pywinauto Documentation

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The pywinauto contributors community

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Contents

CHAPTER 1

What is pywinauto

What is it?

pywinauto is a set of python modules to automate the Microsoft Windows GUI. At it's simplest it allows you to send mouse and keyboard actions to windows dialogs and controls.

Installation

- Just run `pip install pywinauto`

Manual installation

- Install the following Python packages
  - pyWin32 (http://sourceforge.net/projects/pywin32/files/pywin32/Build%20220/)
  - comtypes (https://github.com/enthought/comtypes/releases)
  - six (https://pypi.python.org/pypi/six)
  - *(optional)* Pillow (https://pypi.python.org/pypi/Pillow/2.7.0) (to make screenshoots)
- Download latest pywinauto from https://github.com/pywinauto/pywinauto/releases
- Unpack and run `python setup.py install`

To check you have it installed correctly Run Python

```
>>> from pywinauto.application import Application
>>> app = Application(backend="uia").start("notepad.exe")
>>> app.UntitledNotepad.type_keys("%FX")
```

How does it work

The core concept is described in the Getting Started Guide.

A lot is done through attribute access (__getattribute__) for each class. For example when you get the attribute of an Application or Dialog object it looks for a dialog or control (respectively).

```
myapp.Notepad # looks for a Window/Dialog of your app that has a title 'similar'
              # to "Notepad"

myapp.PageSetup.OK # looks first for a dialog with a title like "PageSetup"
                   # then it looks for a control on that dialog with a title
                   # like "OK"
```

This attribute resolution is delayed (with a default timeout) until it succeeds. So for example if you select a menu option and then look for the resulting dialog e.g.

```
app.UntitledNotepad.menu_select("File->SaveAs")
app.SaveAs.ComboBox5.select("UTF-8")
app.SaveAs.edit1.set_text("Example-utf8.txt")
app.SaveAs.Save.click()
```

At the 2nd line the SaveAs dialog might not be open by the time this line is executed. So what happens is that we wait until we have a control to resolve before resolving the dialog. At that point if we can't find a SaveAs dialog with a ComboBox5 control then we wait a very short period of time and try again, this is repeated up to a maximum time (currently 5 seconds!)

This is to avoid having to use time.sleep or a "wait" function explicitly.

If your application performs long time operation, new dialog can appear or disappear later. You can wait for its new state like so

```
app.Open.Open.click() # opening large file
app.Open.wait_not('visible') # make sure "Open" dialog became invisible
# wait for up to 30 seconds until data.txt is loaded
app.window(title='data.txt - Notepad').wait('ready', timeout=30)
```

Some similar tools for comparison

- Python tools
  - PyAutoGui (https://github.com/asweigart/pyautogui) - a popular cross-platform library (has image-based search, no text-based controls manipulation).
  - Lackey (https://github.com/glitchassassin/lackey) - a pure Python replacement for Sikuli (based on image pattern matching).
  - AXUI (https://github.com/xcgspring/AXUI) - one of the wrappers around MS UI Automation API.
  - winGuiAuto (https://github.com/arkottke/winguiauto) - another module using Win32 API.
- Other scripting language tools
  - (Perl) Win32::GuiTest (http://winguitest.sourceforge.net/)
  - (Ruby) Win32-Autogui (https://github.com/robertwahler/win32-autogui) - a wrapper around Win32 API.
  - (Ruby) RAutomation (https://github.com/jarmo/RAutomation) - there are 3 adapters: Win32 API, UIA, AutoIt.

- Other free tools
  - (C#) Winium.Desktop (https://github.com/2gis/Winium.Desktop) - a young but good MS UI Automation based tool.
  - (C#) TestStack.White (https://github.com/TestStack/White) - another good MS UI Automation based library with a long history.
  - AutoIt (http://www.autoitscript.com/) - free tool with its own Basic-like language (Win32 API based, no .NET plans)
  - AutoHotKey (https://github.com/Lexikos/AutoHotkey_L/) - native C++ tool with its own scripting language (.ahk)
  - "Awesome test automation" list (https://github.com/atinfo/awesome-test-automation) on GitHub
  - A big list of open source tools for functional testing (http://www.opensourcetesting.org/category/functional/)
- Commercial tools
  - WinRunner (http://www.mercury.com/us/products/quality-center/functional-testing/winrunner/)
  - SilkTest (http://www.segue.com/products/functional-regressional-testing/silktest.asp)
  - Many Others (http://www.testingfaqs.org/t-gui.html)

Why write yet another automation tool if there are so many out there?

There are loads of reasons :-)

Takes a different approach: Most other tools are not object oriented you end up writing stuff like:

```
window = findwindow(title = "Untitled - Notepad", class = "Notepad")
SendKeys(window, "%OF")  # Format -> Font
fontdialog  = findwindow("title = "Font")
buttonClick(fontdialog, "OK")
```

I was hoping to create something more userfriendly (and pythonic). For example the translation of above would be:

```
win = app.UntitledNotepad
win.menu_select("Format->Font")
app.Font.OK.click()
```

Python makes it easy: Python is a great programming language, but there are no automation tools that were Pythonic (the very few libraries were implemented in Python).

Localization as a main requirement: Mark:

> "I work in the localization industry and GUI automation is used extensively as often all you need to do is ensure that your UI behaves and is correct with respect to the Source UI. This is actually an easier job then for testing the original source UI.
>
> But most automation tools are based off of coordinates or text of the controls and these can change in the localized software. So my goal (though not yet implemented) is to allow scripts to run unchanged between original source language (often English) and the translated software (Japanese, German, etc)."

CHAPTER 2

Getting Started Guide

Once you have installed pywinauto - how do you get going? The very first necessary thing is to determine which accessibility technology (pywinauto's backend) could be used for your application.

The list of supported accessibility technologies on Windows:

- **Win32 API (`backend="win32"`) - a default backend for now**
  - MFC, VB6, VCL, simple WinForms controls and most of the old legacy apps
- **MS UI Automation (`backend="uia"`)**
  - WinForms, WPF, Store apps, Qt5, browsers

  Notes: Chrome requires `--force-renderer-accessibility` cmd flag before starting. Custom properties and controls are not supported because of comtypes Python library restrictions.

Not supported: Java AWT/Swing, GTK+, Tkinter.

AT SPI on Linux and Apple Accessibility API are in the long term plans so far.

GUI Objects Inspection / Spy Tools

If you're still not sure which backend is most appropriate for you then try using object inspection / spy tools that are available for free: download them from GitHub repo gui-inspect-tool (https://github.com/blackrosezy/gui-inspect-tool).

- **Spy++** is included into MS Visual Studio distribution (even Express or Community) and is accessible through Start menu. It uses Win32 API. It means if Spy++ can show all the controls the `"win32"` backend is what you need. *AutoIt Window Info* tool is a kind of Spy++ clone.
- **Inspect.exe** is another great tool created by Microsoft. It's included into Windows SDK so that it can be found in the following location on x64 Windows:

```
C:\Program Files (x86)\Windows Kits\<winver>\bin\x64
```

  Switch Inspect.exe into **UIA mode** (using MS UI Automation). If it can show more controls and their properties than Spy++, probably the `"uia"` backend is your choice.

If some or all controls are not visible to all the inspection tools it's still possible to control the application by generating mouse and keyboard events using basic modules mouse and keyboard.

Entry Points for Automation

So you have an application, you know it supports one of the mentioned accessibility technologies. What's the next?

First you should start your application or connect to an existing app instance. It can be done with an `Application` object. This is not just a clone of `subprocess.Popen`, but an entry point for further automation limiting all the scope by process boundaries. It's useful to control potentially few instances of an application (you work with one instance not bothering another ones).

```
from pywinauto.application import Application
app = Application(backend="uia").start('notepad.exe')

# describe the window inside Notepad.exe process
dlg_spec = app.UntitledNotepad
# wait till the window is really open
actionable_dlg = dlg_spec.wait('visible')
```

If you want to navigate across process boundaries (say Win10 Calculator surprisingly draws its widgets in more than one process) your entry point is a `Desktop` object.

```
from subprocess import Popen
from pywinauto import Desktop

Popen('calc.exe', shell=True)
dlg = Desktop(backend="uia").Calculator
dlg.wait('visible')
```

Application and **Desktop** objects are both backend-specific. No need to use backend name in further actions explicitly.

Window Specification

It's a core concept for the high level pywinauto API. You are able to describe any window or control approximately or in more details even if it doesn't exist yet or already closed. Window specification also keeps information about matching/search algorithm that will be used to get a real window or control.

Let's create a detailed window specification:

```
>>> dlg_spec = app.window(title='Untitled - Notepad')

>>> dlg_spec
<pywinauto.application.WindowSpecification object at 0x0568B790>

>>> dlg_spec.wrapper_object()
<pywinauto.controls.win32_controls.DialogWrapper object at 0x05639B70>
```

Actual window lookup is performed by `wrapper_object()` method. It returns some wrapper for the real existing window/control or raises `ElementNotFoundError`. This wrapper can deal with the window/control by sending actions or retrieving data.

But Python can hide this `wrapper_object()` call so that you have more compact code in production. The following statements do absolutely the same:

```
dlg_spec.wrapper_object().minimize() # while debugging
dlg_spec.minimize() # in production
```

There are many possible criteria for creating window specifications. These are just a few examples.

```
    # can be multi-level
    app.window(title_re='.* - Notepad$').window(class_name='Edit')

    # can combine criteria
    dlg = Desktop(backend="uia").Calculator
    dlg.window(auto_id='num8Button', control_type='Button')
```

The list of possible criteria can be found in the `pywinauto.findwindows.find_elements()` function.

Attribute Resolution Magic

Python simplifies creating window specification by resolving object attributes dynamically. But an attibute name has the same limitations as any variable name: no spaces, commas and other special symbols. But fortunately pywinauto uses "best match" algorithm to make a lookup resistant to typos and small variations.

```
    app.UntitledNotepad
    # is equivalent to
    app.window(best_match='UntitledNotepad')
```

Unicode characters and special symbols usage is possible through an item access in a dictionary like manner.

```
    app['Untitled - Notepad']
    # is the same as
    app.window(best_match='Untitled - Notepad')
```

How to know magic attribute names

There are several principles how "best match" gold names are attached to the controls. So if a window specification is close to one of these names you will have a successful name matching.

1. By title (window text, name): `app.Properties.OK.click()`
2. By title and control type: `app.Properties.OKButton.click()`
3. By control type and number: `app.Properties.Button3.click()` (*Note*: Button0 and Button1 match the same button, Button2 is the next etc.)
4. By top-left label and control type: `app.OpenDialog.FileNameEdit.set_text("")`
5. By control type and item text: `app.Properties.TabControlSharing.select("General")`

Often not all of these matching names are available simultaneously. To check these names for specified dialog you can use `print_control_identifiers()` method. Possible "best_match" names are displayed as a Python list for every control in a tree. More detailed window specification can also be just copied from the method output. Say `app.Properties.child_window(title="Contains:", auto_id="13087", control_type="Edit")`.

```
    >>> app.Properties.print_control_identifiers()

    Control Identifiers:

    Dialog - 'Windows NT Properties'    (L688, T518, R1065, B1006)
    [u'Windows NT PropertiesDialog', u'Dialog', u'Windows NT Properties']
    child_window(title="Windows NT Properties", control_type="Window")
       |
       | Image - ''    (L717, T589, R749, B622)
```

```
       | [u'', u'0', u'Image1', u'Image0', 'Image', u'1']
       | child_window(auto_id="13057", control_type="Image")
       |
       | Image - ''    (L717, T630, R1035, B632)
       | ['Image2', u'2']
       | child_window(auto_id="13095", control_type="Image")
       |
       | Edit - 'Folder name:'    (L790, T596, R1036, B619)
       | [u'3', 'Edit', u'Edit1', u'Edit0']
       | child_window(title="Folder name:", auto_id="13156", control_type="Edit")
       |
       | Static - 'Type:'    (L717, T643, R780, B658)
       | [u'Type:Static', u'Static', u'Static1', u'Static0', u'Type:']
       | child_window(title="Type:", auto_id="13080", control_type="Text")
       |
       | Edit - 'Type:'    (L790, T643, R1036, B666)
       | [u'4', 'Edit2', u'Type:Edit']
       | child_window(title="Type:", auto_id="13059", control_type="Edit")
       |
       | Static - 'Location:'    (L717, T669, R780, B684)
       | [u'Location:Static', u'Location:', u'Static2']
       | child_window(title="Location:", auto_id="13089", control_type="Text")
       |
       | Edit - 'Location:'    (L790, T669, R1036, B692)
       | ['Edit3', u'Location:Edit', u'5']
       | child_window(title="Location:", auto_id="13065", control_type="Edit")
       |
       | Static - 'Size:'    (L717, T695, R780, B710)
       | [u'Size:Static', u'Size:', u'Static3']
       | child_window(title="Size:", auto_id="13081", control_type="Text")
       |
       | Edit - 'Size:'    (L790, T695, R1036, B718)
       | ['Edit4', u'6', u'Size:Edit']
       | child_window(title="Size:", auto_id="13064", control_type="Edit")
       |
       | Static - 'Size on disk:'    (L717, T721, R780, B736)
       | [u'Size on disk:', u'Size on disk:Static', u'Static4']
       | child_window(title="Size on disk:", auto_id="13107", control_type="Text")
       |
       | Edit - 'Size on disk:'    (L790, T721, R1036, B744)
       | ['Edit5', u'7', u'Size on disk:Edit']
       | child_window(title="Size on disk:", auto_id="13106", control_type="Edit")
       |
       | Static - 'Contains:'    (L717, T747, R780, B762)
       | [u'Contains:1', u'Contains:0', u'Contains:Static', u'Static5', u'Contains:']
       | child_window(title="Contains:", auto_id="13088", control_type="Text")
       |
       | Edit - 'Contains:'    (L790, T747, R1036, B770)
       | [u'8', 'Edit6', u'Contains:Edit']
       | child_window(title="Contains:", auto_id="13087", control_type="Edit")
       |
       | Image - 'Contains:'    (L717, T773, R1035, B775)
       | [u'Contains:Image', 'Image3', u'Contains:2']
       | child_window(title="Contains:", auto_id="13096", control_type="Image")
       |
       | Static - 'Created:'    (L717, T786, R780, B801)
       | [u'Created:', u'Created:Static', u'Static6', u'Created:1', u'Created:0']
       | child_window(title="Created:", auto_id="13092", control_type="Text")
```

```
       |
       | Edit - 'Created:'    (L790, T786, R1036, B809)
       | [u'Created:Edit', 'Edit7', u'9']
       | child_window(title="Created:", auto_id="13072", control_type="Edit")
       |
       | Image - 'Created:'    (L717, T812, R1035, B814)
       | [u'Created:Image', 'Image4', u'Created:2']
       | child_window(title="Created:", auto_id="13097", control_type="Image")
       |
       | Static - 'Attributes:'    (L717, T825, R780, B840)
       | [u'Attributes:Static', u'Static7', u'Attributes:']
       | child_window(title="Attributes:", auto_id="13091", control_type="Text")
       |
       | CheckBox - 'Read-only (Only applies to files in folder)'    (L790, T825, R1035, B841)
       | [u'CheckBox0', u'CheckBox1', 'CheckBox', u'Read-only (Only applies to files in folder)Check
       | child_window(title="Read-only (Only applies to files in folder)", auto_id="13075", control_
       |
       | CheckBox - 'Hidden'    (L790, T848, R865, B864)
       | ['CheckBox2', u'HiddenCheckBox', u'Hidden']
       | child_window(title="Hidden", auto_id="13076", control_type="CheckBox")
       |
       | Button - 'Advanced...'    (L930, T845, R1035, B868)
       | [u'Advanced...', u'Advanced...Button', 'Button', u'Button1', u'Button0']
       | child_window(title="Advanced...", auto_id="13154", control_type="Button")
       |
       | Button - 'OK'    (L814, T968, R889, B991)
       | ['Button2', u'OK', u'OKButton']
       | child_window(title="OK", auto_id="1", control_type="Button")
       |
       | Button - 'Cancel'    (L895, T968, R970, B991)
       | ['Button3', u'CancelButton', u'Cancel']
       | child_window(title="Cancel", auto_id="2", control_type="Button")
       |
       | Button - 'Apply'    (L976, T968, R1051, B991)
       | ['Button4', u'ApplyButton', u'Apply']
       | child_window(title="Apply", auto_id="12321", control_type="Button")
       |
       | TabControl - ''    (L702, T556, R1051, B962)
       | [u'10', u'TabControlSharing', u'TabControlPrevious Versions', u'TabControlSecurity', u'TabC
       | child_window(auto_id="12320", control_type="Tab")
       |    |
       |    | TabItem - 'General'    (L704, T558, R753, B576)
       |    | [u'GeneralTabItem', 'TabItem', u'General', u'TabItem0', u'TabItem1']
       |    | child_window(title="General", control_type="TabItem")
       |    |
       |    | TabItem - 'Sharing'    (L753, T558, R801, B576)
       |    | [u'Sharing', u'SharingTabItem', 'TabItem2']
       |    | child_window(title="Sharing", control_type="TabItem")
       |    |
       |    | TabItem - 'Security'    (L801, T558, R851, B576)
       |    | [u'Security', 'TabItem3', u'SecurityTabItem']
       |    | child_window(title="Security", control_type="TabItem")
       |    |
       |    | TabItem - 'Previous Versions'    (L851, T558, R947, B576)
       |    | [u'Previous VersionsTabItem', u'Previous Versions', 'TabItem4']
       |    | child_window(title="Previous Versions", control_type="TabItem")
       |    |
       |    | TabItem - 'Customize'    (L947, T558, R1007, B576)
```

```
        |    | [u'CustomizeTabItem', 'TabItem5', u'Customize']
        |    | child_window(title="Customize", control_type="TabItem")
        |
        | TitleBar - 'None'    (L712, T521, R1057, B549)
        | ['TitleBar', u'11']
        |    |
        |    | Menu - 'System'    (L696, T526, R718, B548)
        |    | [u'System0', u'System', u'System1', u'Menu', u'SystemMenu']
        |    | child_window(title="System", auto_id="MenuBar", control_type="MenuBar")
        |    |    |
        |    |    | MenuItem - 'System'    (L696, T526, R718, B548)
        |    |    | [u'System2', u'MenuItem', u'SystemMenuItem']
        |    |    | child_window(title="System", control_type="MenuItem")
        |    |
        |    | Button - 'Close'    (L1024, T519, R1058, B549)
        |    | [u'CloseButton', u'Close', 'Button5']
        |    | child_window(title="Close", control_type="Button")
```

Look at the examples

The following examples are included: **Note**: Examples are language dependent - they will only work on the language of product that they were programmed for. All examples have been programmed for English Software except where highlighted.

- `mspaint.py` Control MSPaint
- `notepad_fast.py` Use fast timing settings to control Notepad
- `notepad_slow.py` Use slow timing settings to control Notepad
- `notepad_item.py` Use item rather then attribute access to control Notepad.
- `misc_examples.py` Show some exceptions and how to get control identifiers.
- `save_from_internet_explorer.py` Save a Web Page from Internet Explorer.
- `save_from_firefox.py` Save a Web Page from Firefox.
- `get_winrar_info.py` Example of how to do multilingual automation. This is not an ideal example (works on French, Czech and German WinRar)
- `forte_agent_sample.py` Example of dealing with a complex application that is quite dynamic and gives different dialogs often when starting.
- `windowmediaplayer.py` Just another example - deals with check boxes in a ListView.
- `test_sakura.py`, `test_sakura2.py` Two examples of automating a Japanase product.

Automate notepad at the command line

Please find below a sample run

```
      C:\>python
      Python 2.4.2 (#67, Sep 28 2005, 12:41:11) [MSC v.1310 32 bit (Intel)] on win32
      Type "help", "copyright", "credits" or "license" for more information.
(1)   >>> from pywinauto import application
(2)   >>> app = application.Application()
```

```
(3)    >>> app.start("Notepad.exe")
       <pywinauto.application.Application object at 0x00AE0990>
(4)    >>> app.UntitledNotepad.draw_outline()
(5)    >>> app.UntitledNotepad.menu_select("Edit -> Replace")
(6)    >>> app.Replace.print_control_identifiers()
         Control Identifiers:

         Dialog - 'Replace'    (L179, T174, R657, B409)
         ['ReplaceDialog', 'Dialog', 'Replace']
         child_window(title="Replace", class_name="#32770")
             |
             | Static - 'Fi&nd what:'    (L196, T230, R292, B246)
             | ['Fi&nd what:Static', 'Fi&nd what:', 'Static', 'Static0', 'Static1']
             | child_window(title="Fi&nd what:", class_name="Static")
             |
             | Edit - ''    (L296, T226, R524, B250)
             | ['Fi&nd what:Edit', 'Edit', 'Edit0', 'Edit1']
             | child_window(class_name="Edit")
             |
             | Static - 'Re&place with:'    (L196, T264, R292, B280)
             | ['Re&place with:', 'Re&place with:Static', 'Static2']
             | child_window(title="Re&place with:", class_name="Static")
             |
             | Edit - ''    (L296, T260, R524, B284)
             | ['Edit2', 'Re&place with:Edit']
             | child_window(class_name="Edit")
             |
             | CheckBox - 'Match &whole word only'    (L198, T304, R406, B328)
             | ['CheckBox', 'Match &whole word onlyCheckBox', 'Match &whole word only', 'CheckBox0', 'C
             | child_window(title="Match &whole word only", class_name="Button")
             |
             | CheckBox - 'Match &case'    (L198, T336, R316, B360)
             | ['CheckBox2', 'Match &case', 'Match &caseCheckBox']
             | child_window(title="Match &case", class_name="Button")
             |
             | Button - '&Find Next'    (L536, T220, R636, B248)
             | ['&Find Next', '&Find NextButton', 'Button', 'Button0', 'Button1']
             | child_window(title="&Find Next", class_name="Button")
             |
             | Button - '&Replace'    (L536, T254, R636, B282)
             | ['&ReplaceButton', '&Replace', 'Button2']
             | child_window(title="&Replace", class_name="Button")
             |
             | Button - 'Replace &All'    (L536, T288, R636, B316)
             | ['Replace &AllButton', 'Replace &All', 'Button3']
             | child_window(title="Replace &All", class_name="Button")
             |
             | Button - 'Cancel'    (L536, T322, R636, B350)
             | ['CancelButton', 'Cancel', 'Button4']
             | child_window(title="Cancel", class_name="Button")
             |
             | Button - '&Help'    (L536, T362, R636, B390)
             | ['&Help', '&HelpButton', 'Button5']
             | child_window(title="&Help", class_name="Button")
             |
             | Static - ''    (L196, T364, R198, B366)
             | ['ReplaceStatic', 'Static3']
             | child_window(class_name="Static")
```

```
(7)    >>> app.Replace.Cancel.click()
(8)    >>> app.UntitledNotepad.Edit.type_keys("Hi from Python interactive prompt %s" % str(dir()), wit
       <pywinauto.controls.win32_controls.EditWrapper object at 0x00DDC2D0>
(9)    >>> app.UntitledNotepad.menu_select("File -> Exit")
(10)   >>> app.Notepad.DontSave.click()
       >>>
```

1. Import the pywinauto.application module (usually the only module you need to import directly)
2. Create an Application instance. All access to the application is done through this object.
3. We have created an Application instance in step 2 but we did not supply any information on the Windows application it referred to. By using the start() method we execute that application and connect it to the Application instance app.
4. Draw a green rectangle around the Notepad dialog - so that we know we have the correct window.
5. Select the Replace item from the Edit Menu on the Notepad Dialog of the application that app is connected to. This action will make the Replace dialog appear.
6. Print the identifiers for the controls on the Replace dialog, for example the 1st edit control on the Replace dialog can be referred to by any of the following identifiers:

```
app.Replace.Edit
app.Replace.Edit0
app.Replace.Edit1
app.FindwhatEdit
```

   The last is the one that gives the user reading the script aftewards the best idea of what the script does.
7. Close the Replace dialog. (In a script file it is safer to use close_click() rather than click() because close_click() waits a little longer to give windows time to close the dialog.)
8. Let's type some text into the Notepad text area. Without the `with_spaces` argument spaces would not be typed. Please see documentation for SendKeys for this method as it is a thin wrapper around SendKeys.
9. Ask to exit Notepad
10. We will be asked if we want to save - click on the "No" button.

CHAPTER 3

How To's

How to specify a usable Application instance

An `Application()` instance is the point of contact for all work with the application you are automating. So the Application instance needs to be connected to a process. There are two ways of doing this:

```
    start(self, cmd_line, timeout=app_start_timeout)  # instance method:
```

or:

```
    connect(self, **kwargs)  # instance method:
```

`start()` is used when the application is not running and you need to start it. Use it in the following way:

```
    app = Application().start(r"c:\path\to\your\application -a -n -y --arguments")
```

The timeout parameter is optional, it should only be necessary to use if the application takes a long time to start up.

`connect()` is used when the application to be automated is already launched. To specify an already running application you need to specify one of the following:

process the process id of the application, e.g.

```
        app = Application().connect(process=2341)
```

handle The windows handle of a window of the application, e.g.

```
        app = Application().connect(handle=0x010f0c)
```

path The path of the executable of the process (`GetModuleFileNameEx` is used to find the path of each process and compared against the value passed in) e.g.

```
        app = Application().connect(path=r"c:\windows\system32\notepad.exe")
```

or any combination of the parameters that specify a window, these get passed to the `pywinauto.findwindows.find_elements()` function. e.g.

```
    app = Application().connect(title_re=".*Notepad", class_name="Notepad")
```

Note: The application has to be ready before you can use connect*(). There is no timeout or retries like there is when finding the application after start(). So if you start the application outside of pywinauto you need to either sleep or program a wait loop to wait until the application has fully started.

How to specify a dialog of the application

Once the application instance knows what application it is connected to a dialog to work on needs to be specified.

There are many different ways of doing this. The most common will be using item or attribute access to select a dialog based on it's title. e.g

```
dlg = app.Notepad
```

or equivalently

```
dlg = app['Notepad']
```

The next easiest method is to ask for the `top_window()` e.g.

```
dlg = app.top_window()
```

This will return the window that has the highest Z-Order of the top-level windows of the application.

Note: This is currently fairly untested so I am not sure it will return the correct window. It will definitely be a top level window of the application - it just might not be the one highest in the Z-Order.

If this is not enough control then you can use the same parameters as can be passed to `findwindows.find_windows()` e.g.

```
dlg = app.window(title_re="Page Setup", class_name="#32770")
```

Finally to have the most control you can use

```
dialogs = app.windows()
```

this will return a list of all the visible, enabled, top level windows of the application. You can then use some of the methods in `handleprops` module select the dialog you want. Once you have the handle you need then use

```
app.window(handle=win)
```

Note: If the title of the dialog is very long - then attribute access might be very long to type, in those cases it is usually easier to use

```
app.window(title_re=".*Part of Title.*")
```

How to specify a control on a dialog

There are a number of ways to specify a control, the simplest are

```
app.dlg.control
app['dlg']['control']
```

The 2nd is better for non English OS's where you need to pass unicode strings e.g. `app[u'your dlg title'][u'your ctrl title']`

The code builds up multiple identifiers for each control from the following:

- title
- friendly class
- title + friendly class

If the control's title text is empty (after removing non char characters) this text is not used. Instead we look for the closest title text above and to the right of the control. And append the friendly class. So the list becomes

- friendly class
- closest text + friendly class

Once a set of identifiers has been created for all controls in the dialog we disambiguate them.

use the *WindowSpecification.print_control_identifiers()* method

e.g.

```
app.YourDialog.print_control_identifiers()
```

Sample output

```
Button - Paper   (L1075, T394, R1411, B485)
        'PaperGroupBox' 'Paper' 'GroupBox'
Static - Si&ze:   (L1087, T420, R1141, B433)
        'SizeStatic' 'Static' 'Size'
ComboBox -    (L1159, T418, R1399, B439)
        'ComboBox' 'SizeComboBox'
Static - &Source:   (L1087, T454, R1141, B467)
        'Source' 'Static' 'SourceStatic'
ComboBox -    (L1159, T449, R1399, B470)
        'ComboBox' 'SourceComboBox'
Button - Orientation   (L1075, T493, R1171, B584)
        'GroupBox' 'Orientation' 'OrientationGroupBox'
Button - P&ortrait   (L1087, T514, R1165, B534)
        'Portrait' 'RadioButton' 'PortraitRadioButton'
Button - L&andscape   (L1087, T548, R1165, B568)
        'RadioButton' 'LandscapeRadioButton' 'Landscape'
Button - Margins (inches)   (L1183, T493, R1411, B584)
        'Marginsinches' 'MarginsinchesGroupBox' 'GroupBox'
Static - &Left:   (L1195, T519, R1243, B532)
        'LeftStatic' 'Static' 'Left'
Edit -    (L1243, T514, R1285, B534)
        'Edit' 'LeftEdit'
Static - &Right:   (L1309, T519, R1357, B532)
        'Right' 'Static' 'RightStatic'
Edit -    (L1357, T514, R1399, B534)
        'Edit' 'RightEdit'
Static - &Top:   (L1195, T550, R1243, B563)
        'Top' 'Static' 'TopStatic'
Edit -    (L1243, T548, R1285, B568)
        'Edit' 'TopEdit'
Static - &Bottom:   (L1309, T550, R1357, B563)
        'BottomStatic' 'Static' 'Bottom'
Edit -    (L1357, T548, R1399, B568)
        'Edit' 'BottomEdit'
Static - &Header:   (L1075, T600, R1119, B613)
        'Header' 'Static' 'HeaderStatic'
Edit -    (L1147, T599, R1408, B619)
        'Edit' 'TopEdit'
Static - &Footer:   (L1075, T631, R1119, B644)
        'FooterStatic' 'Static' 'Footer'
Edit -    (L1147, T630, R1408, B650)
        'Edit' 'FooterEdit'
Button - OK   (L1348, T664, R1423, B687)
        'Button' 'OK' 'OKButton'
```

```
    Button - Cancel    (L1429, T664, R1504, B687)
             'Cancel' 'Button' 'CancelButton'
    Button - &Printer...    (L1510, T664, R1585, B687)
             'Button' 'Printer' 'PrinterButton'
    Button - Preview    (L1423, T394, R1585, B651)
             'Preview' 'GroupBox' 'PreviewGroupBox'
    Static -     (L1458, T456, R1549, B586)
             'PreviewStatic' 'Static'
    Static -     (L1549, T464, R1557, B594)
             'PreviewStatic' 'Static'
    Static -     (L1466, T586, R1557, B594)
             'Static' 'BottomStatic'
```

This example has been taken from test_application.py

Note The identifiers printed by this method have been run through the process that makes the identifier unique. So if you have two edit boxes, they will both have "Edit" listed in their identifiers. In reality though the first one can be refered to as "Edit", "Edit0", "Edit1" and the 2nd should be refered to as "Edit2"

Note You do not have to be exact!. Say we take an instance from the example above

```
    Button - Margins (inches)    (L1183, T493, R1411, B584)
             'Marginsinches' 'MarginsinchesGroupBox' 'GroupBox'
```

Let's say that you don't like any of these

- `GroupBox` - too generic, it could be any group box
- `Marginsinches` and `MarginsinchesGroupBox` - these just don' look right, it would be nicer to leave out the 'inches' part

Well you CAN! The code does a best match on the identifer you use against all the available identifiers in the dialog.

For example if you break into the debugger you can see how different identifiers can be used

```
    (Pdb) print app.PageSetup.Margins.window_text()
    Margins (inches)
    (Pdb) print app.PageSetup.MarginsGroupBox.window_text()
    Margins (inches)
```

And this will also cater for typos. Though you still have to be careful as if there are 2 similar identifiers in the dialog the typo you have used might be more similar to another control then the one you were thinking of.

How to use pywinauto with application languages other than English

Because Python does not support unicode identifiers in code you cannot use attribute access to reference a control so you would either have to use item access or make an explicit calls to `window()`.

So instead of writing

```
    app.dialog_ident.control_ident.click()
```

You would have to write

```
    app['dialog_ident']['control_ident'].click()
```

Or use `window()` explictly

```
    app.window(title_re="NonAsciiCharacters").window(title="MoreNonAsciiCharacters").click()
```

To see an example of this check `examples\misc_examples.py get_info()`

How to deal with controls that do not respond as expected (e.g. OwnerDraw Controls)

Some controls (especially Ownerdrawn controls) do not respond to events as expected. For example if you look at any HLP file and go to the Index Tab (click 'Search' button) you will see a listbox. Running Spy or Winspector on this will show you that it is indeed a list box - but it is ownerdrawn. This means that the developer has told Windows that they will override how items are displayed and do it themselves. And in this case they have made it so that strings cannot be retrieved :-(.

So what problems does this cause?

```
    app.HelpTopics.ListBox.texts()                  # 1
    app.HelpTopics.ListBox.select("ItemInList")     # 2
```

1. Will return a list of empty strings, all this means is that pywinauto has not been able to get the strings in the listbox
2. This will fail with an IndexError because the select(string) method of a ListBox looks for the item in the Texts to know the index of the item that it should select.

The following workaround will work on this control

```
    app.HelpTopics.ListBox.select(1)
```

This will select the 2nd item in the listbox, because it is not a string lookup it works correctly.

Unfortunately not even this will always work. The developer can make it so that the control does not respond to standard events like Select. In this case the only way you can select items in the listbox is by using the keyboard simulation of TypeKeys().

This allows you to send any keystrokes to a control. So to select the 3rd item you would use

```
    app.Helptopics.ListBox1.type_keys("{HOME}{DOWN 2}{ENTER}")
```

- `{HOME}` will make sure that the first item is highlighted.
- `{DOWN 2}` will then move the highlight down two items
- `{ENTER}` will select the highlighted item

If your application made an extensive use of a similar control type then you could make using it easier by deriving a new class from ListBox, that could use extra knowledge about your particular application. For example in the WinHelp example every time an item is highlighted in the list view, its text is inserted into the Edit control above the list, and you CAN get the text of the item from there e.g.

```
    # print the text of the item currently selected in the list box
    # (as long as you are not typing into the Edit control!)
    print app.HelpTopics.Edit.texts()[1]
```

How to Access the System Tray (aka SysTray, aka 'Notification Area')

Near the clock there are icons representing running applications, this area is normally referred to as the "System Tray". In fact, there are many different windows/controls in this area. The control that contains the icons is actually a toolbar. It is a child of Pager control within a window with a class TrayNotifyWnd, which is inside another window with a class Shell_TrayWnd and all these windows are part of the running Explorer instance. Thankfully you don't need to remember all that :-).

The thing that is important to remember is that you are looking for a window in the "Explorer.exe" application with the class "Shell_TrayWnd" that has Toolbar control with a title "Notification Area".

One way to get this is to do the following

```
import pywinauto.application
app = pywinauto.application.Application().connect(path="explorer")
systray_icons = app.ShellTrayWnd.NotificationAreaToolbar
```

The taskbar module provides very preliminary access to the System Tray.

It defines the following variables:

explorer_app defines an Application() object connected to the running explorer. You probably don't need to use it directly very much.

TaskBar The handle to the task bar (the bar containing Start Button, the QuickLaunch icons, running tasks, etc

StartButton "Start me up" :-) I think you might know what this is!

QuickLaunch The Toolbar with the quick launch icons

SystemTray The window that contains the Clock and System Tray Icons

Clock The clock

SystemTrayIcons The toolbar representing the system tray icons

RunningApplications The toolbar representing the running applications

I have also provided two functions in the module that can be used to click on system tray icons:

`ClickSystemTrayIcon(button)` You can use this to left click a visible icon in the system tray. I had to specifically say visible icon as there may be many invisible icons that obviously cannot be clicked. Button can be any integer. If you specify 3 then it will find and click the 3rd visible button. (Almost no error checking is performed now here but this method will more than likely be moved/renamed in the future.)

`RightClickSystemTrayIcon(button)` Similar to `ClickSytemTrayIcon` but performs a right click.

Often, when you click/right click on an icon, you get a popup menu. The thing to remember at this point is that the popup menu is a part of the application being automated not part of explorer.

e.g.

```
# connect to outlook
outlook = Application.connect(path='outlook.exe')

# click on Outlook's icon
taskbar.ClickSystemTrayIcon("Microsoft Outlook")

# Select an item in the popup menu
outlook.PopupMenu.Menu().get_menu_path("Cancel Server Request")[0].click()
```

CHAPTER 4

Waiting for Long Operations

A GUI application behaviour is often unstable and your script needs waiting until a new window appears or an existing window is closed/hidden. pywinauto can wait for a dialog initialization implicitly (with the default timeout). There are few methods/functions that could help you to make your code easier and more reliable.

Application methods

- wait_cpu_usage_lower (new in pywinauto 0.5.2, renamed in 0.6.0)

This method is useful for multi-threaded interfaces that allow a lazy initialization in another thread while GUI is responsive and all controls already exist and ready to use. So waiting for a specific window existence/state is useless. In such case the CPU usage for the whole process indicates that a task calculation is not finished yet.

Example:

```
app.wait_cpu_usage_lower(threshold=5) # wait until CPU usage is lower than 5%
```

WindowSpecification methods

These methods are available to all controls.

- wait
- wait_not

There is an example containing long waits: install script for 7zip 9.20 x64 (https://gist.github.com/vasily-v-ryabov/7a04717af4584cbb840f).

A `WindowSpecification` object isn't necessarily related to an existing window/control. It's just a description namely a couple of criteria to search the window. The `wait` method (if no any exception is raised) can guarantee that the target control exists or even visible, enabled and/or active.

Functions in `timings` module

There are also low-level methods useful for any Python code.

- wait_until
- wait_until_passes

Decorators *pywinauto.timings.always_wait_until()* and *pywinauto.timings.always_wait_until_passes(* can also be used if every function call should have timing control.

```
# call ensure_text_changed(ctrl) every 2 sec until it's passed or timeout (4 sec) is expired

@always_wait_until_passes(4, 2)
def ensure_text_changed(ctrl):
    if previous_text == ctrl.window_text():
        raise ValueError('The ctrl text remains the same while change is expected')
```

Identify controls

The methods to help you to find a needed control.

- print_control_identifiers
- draw_outline

How To‘s

- *How To’s*

Methods available to each different control type

Windows have many controls, buttons, lists, etc

All Controls

These functions are aviailable to all controls.

- capture_as_image
- click
- click_input
- close
- close_click
- debug_message
- double_click
- double_click_input
- drag_mouse
- draw_outline
- get_focus
- get_show_state
- maximize
- menu_select
- minimize
- move_mouse
- move_window
- notify_menu_select
- notify_parent
- press_mouse
- press_mouse_input
- release_mouse

- release_mouse_input
- restore
- right_click
- right_click_input
- send_message
- send_message_timeout
- set_focus
- set_window_text
- type_keys
- Children
- Class
- ClientRect
- ClientRects
- ContextHelpID
- ControlID
- ExStyle
- Font
- Fonts
- FriendlyClassName
- GetProperties
- HasExStyle
- HasStyle
- IsChild
- IsDialog
- IsEnabled
- IsUnicode
- IsVisible
- Menu
- MenuItem
- MenuItems
- Owner
- Parent
- PopupWindow
- ProcessID
- Rectangle
- Style

- Texts
- TopLevelParent
- UserData
- VerifyActionable
- VerifyEnabled
- VerifyVisible
- WindowText

Button, CheckBox, RadioButton, GroupBox

- ButtonWrapper.Check
- ButtonWrapper.GetCheckState
- ButtonWrapper.SetCheckIndeterminate
- ButtonWrapper.UnCheck

ComboBox

- ComboBoxWrapper.DroppedRect
- ComboBoxWrapper.ItemCount
- ComboBoxWrapper.ItemData
- ComboBoxWrapper.ItemTexts
- ComboBoxWrapper.Select
- ComboBoxWrapper.SelectedIndex

Dialog

- DialogWrapper.ClientAreaRect
- DialogWrapper.RunTests
- DialogWrapper.WriteToXML

Edit

- EditWrapper.GetLine
- EditWrapper.LineCount
- EditWrapper.LineLength
- EditWrapper.Select
- EditWrapper.SelectionIndices

- EditWrapper.SetEditText
- EditWrapper.set_window_text
- EditWrapper.TextBlock

Header

- HeaderWrapper.GetColumnRectangle
- HeaderWrapper.GetColumnText
- HeaderWrapper.ItemCount

ListBox

- ListBoxWrapper.GetItemFocus
- ListBoxWrapper.ItemCount
- ListBoxWrapper.ItemData
- ListBoxWrapper.ItemTexts
- ListBoxWrapper.Select
- ListBoxWrapper.SelectedIndices
- ListBoxWrapper.SetItemFocus

ListView

- ListViewWrapper.Check
- ListViewWrapper.ColumnCount
- ListViewWrapper.Columns
- ListViewWrapper.ColumnWidths
- ListViewWrapper.GetColumn
- ListViewWrapper.GetHeaderControl
- ListViewWrapper.GetItem
- ListViewWrapper.GetSelectedCount
- ListViewWrapper.IsChecked
- ListViewWrapper.IsFocused
- ListViewWrapper.IsSelected
- ListViewWrapper.ItemCount
- ListViewWrapper.Items
- ListViewWrapper.Select
- ListViewWrapper.Deselect

- ListViewWrapper.UnCheck

PopupMenu

(no extra visible methods)

ReBar

- ReBarWrapper.BandCount
- ReBarWrapper.GetBand
- ReBarWrapper.GetToolTipsControl

Static

(no extra visible methods)

StatusBar

- StatusBarWrapper.BorderWidths
- StatusBarWrapper.GetPartRect
- StatusBarWrapper.GetPartText
- StatusBarWrapper.PartCount
- StatusBarWrapper.PartRightEdges

TabControl

- TabControlWrapper.GetSelectedTab
- TabControlWrapper.GetTabRect
- TabControlWrapper.GetTabState
- TabControlWrapper.GetTabText
- TabControlWrapper.RowCount
- TabControlWrapper.Select
- TabControlWrapper.TabCount
- TabControlWrapper.TabStates

Toolbar

- ToolbarWrapper.Button
- ToolbarWrapper.ButtonCount
- ToolbarWrapper.GetButton
- ToolbarWrapper.GetButtonRect
- ToolbarWrapper.GetToolTipsControl
- ToolbarWrapper.PressButton

  ToolbarButton (returned by `Button()`)

  - ToolbarButton.Rectangle
  - ToolbarButton.Style
  - ToolbarButton.click_input
  - ToolbarButton.Click
  - ToolbarButton.IsCheckable
  - ToolbarButton.IsChecked
  - ToolbarButton.IsEnabled
  - ToolbarButton.IsPressable
  - ToolbarButton.IsPressed
  - ToolbarButton.State

ToolTips

- ToolTipsWrapper.GetTip
- ToolTipsWrapper.GetTipText
- ToolTipsWrapper.ToolCount

TreeView

- TreeViewWrapper.EnsureVisible
- TreeViewWrapper.GetItem
- TreeViewWrapper.GetProperties
- TreeViewWrapper.IsSelected
- TreeViewWrapper.ItemCount
- TreeViewWrapper.Root
- TreeViewWrapper.Select

  TreeViewElement (returned by `GetItem()` and `Root()`)

  - TreeViewElement.Children

- TreeViewElement.Item
- TreeViewElement.Next
- TreeViewElement.Rectangle
- TreeViewElement.State
- TreeViewElement.SubElements
- TreeViewElement.Text

UpDown

- UpDownWrapper.GetBase
- UpDownWrapper.GetBuddyControl
- UpDownWrapper.GetRange
- UpDownWrapper.GetValue
- UpDownWrapper.SetValue
- UpDownWrapper.Increment
- UpDownWrapper.Decrement

CHAPTER 6

Credits

(listed in reverse chronological order)

Vasily Ryabov, Valentin Kroupkin, Alexander Rumyantsev - MS UI Automation backend implementation

Ivan Magazinnik - mouse/keyboard input emulation on Linux

Maxim Samokhvalov - initial implementation of hooks.py module

Intel Corporation - Vasily Ryabov revived and maintained the project during his work at Intel (pywinauto 0.5.x)

Valentin Kroupkin (airelil) - continuous integration (AppVeyor), many unit tests improvements (pywinauto 0.5.x)

Michael Herrmann - bug fixes, project maintenance (0.4.x)

Raghav - idea with using metaclass for finding wrapper

Daisuke Yamashita - Bugs/suggestions for 2.5 that MenuWrapper.GetProperties() returns a list rather then a dict

Dalius Dobravolskas - Help on the forums and prompted major improvements on the wait* functionality

Jeff Winkler - Early encouragement, creation of screencasts

Stefaan Himpe - Lots of speed and stability improvements early on

CHAPTER 7

Dev Notes

FILE LAYOUT

used by just about everything (and considered a block!) win32defines.py win32functions.py win32structures.py

Find windows and their attributes findwindows.py handleprops.py

wrap windows, get extra info for particular controls # set the friendly class name controlscommon_controls.py controlscontrolactions.py controlshwndwrapper.py controlswin32_controls.py

currently depends on the Friendly class name # probably needs to be refactored to make it independent of controls! # maybe move that stuff to _application_? findbestmatch.py # currently depends on controls!

controlactions.py

testsallcontrols.py testsasianhotkey.py testscomboboxdroppedheight.py testscomparetoreffont.py testsleadtrailspaces.py testsmiscvalues.py testsmissalignment.py testsmissingextrastring.py testsoverlapping.py testsrepeatedhotkey.py teststranslation.py teststruncation.py

controlproperties.py

xml_helpers.py

FindDialog.py PyDlgCheckerWrapper.py

application.py test_application.py

Best matching

difflib provides this support For menu's it is simple we match against the text of the menu item. For controls the story is more complicated because we want to match against the following:

- Control text if it exists
- Friendly Class name
- Control text + Friendly class name (if control text exists)
- (Possibly) closest static + FriendlyClassName

e.g. FindWhatCombo, ComboBox1,

or Text, TextRiadio, RadioButton2

1. the control itself knows what it should be referred to

2. Need to disambiguate across all controls in the dialog
3. then we need to match

ATTRIBUTE RESOLUTION

Thinking again... app.dlg.control

TWO LEVELS

- **application.member (Python resolves)** an attribute of application object
- **application.dialog** a dialog reference

THREE LEVELS

- **application.member.attr (Python resolves)** another attribute of the previous member
- **application.dialog.member** a member of the dialog object
- **application.dialog.control** a control on the dialog

FOUR LEVELS (leaving out Python resolved)

- application.dialog.member.member
- application.dialog.control.member

DELAYED RESOLUTION FOR SUCCESS Taking the example

```
app.dlg.control.action()
```

If we leave out syntax and programming errors there are still a number of reasons why it could fail.

dlg might not be found control might not be found either dlg or control may be disabled

dialog and control may be found but on the wrong dialog (e.g. in Notepad you can bring up 2 "Page Setup" dialogs both with an OK button)

One solution would just be to add a "sleep" before trying to find each new dialog (to ensure that it is there and ready) - but this will mean lots of unnecessary waiting.

So the solution I have tried is:

- perform the complete attribute access resolution at the latest possible time
- if it fails then wait and try again
- after a specified timeout fail raising the original exception.

This means that in the normal case you don't have unnecessary waits - and in the failure case - you still get an exception with the error.

Also waiting to do resolution as late as possible stops errors where an earlier part of the path succeedes - but finds the wrong item.

So for example if finds the page setup dialog in Notepad # open the Printer setup dialog (which has "Page Setup" as title) app.PageSetup.Printer.Click()

if this runs too quickly it actually finds the current page setup dialog # before the next dialog opens, but that dialog does not have a Properties # button - so an error is raised. # because we re-run the resolution from the start we find the new pagesetup dialog. app.PageSetup.Properties.Click()

WRITING TO DIALOGS

We need a way of making sure that the dialog is active without having to access a control on it. e.g.

```
app.MainWin.MenuSelect("Something That->Loads a Dialog")
app.Dlg._write("dlg.xml")
```

or a harder problem:

```
app.PageSetup.Printer.Click()
app.PageSetup._write("pagesetup.xml")
```

In this second example it is very hard to be sure that the correct Page Setup dialog is shown.

The only way to be realy sure is to check for the existance of certain control(s) (ID, Class, text, whatever) - but it would be nice to not have to deal with those :-(

Another less declarative (more magic?) is to scan the list of available windows/controls and if they haven't changed then accept that the correct one is shown.

When testing and having XML files then we should use those to make sure that we have the correct dialog up (by using Class/ID)

CHAPTER 8

PYWINAUTO TODO's

- Make sure to add documentation strings for all undocumented methods/functions
- Check coverage of the tests and work to increase it.
- Add tests for SendInput click methods
- Implement findbestmatch using FuzzyDict.
- Find a way of doing application data in a better way. Currently if someone even adds a call to print_control_identifiers() it will break the matching algorithm!
- Need to move the checking if a control is a Ownerdrawn/bitmap control out of __init__ methods and into it's own method something like IsNormallyRendered() (Why?)
- Give example how to work with Tray Window
- Fix ToolbarWrapper.PressButton() which doesn't seem to work (found wile working on IE example script)
- Maybe supply an option so that scripts can be run by using:

```
pywinauto.exe yourscript.py
```

  This would work by creating a Py2exe wrapper that would import the script (and optionally call a particular function?)

  This way pywinauto could be made available to people without python installed (whether this is a big requirement or not I don't know because the automation language is python anyway!.

- Message traps - how to handle unwanted message boxes popping up?
  1. Wait for an Exception then handle it there
  2. set a trap waiting for a specific dialog
  3. on calls to window specification, if we fail to find our window then we can run quickly through the available specified traps to see if any of them apply - then if they do we can run the associated actions - then try our original dialog again
- Handle adding reference controls (in that they should be the controls used for finding windows)
- Find the reference name of a variable e.g so that in Dialog._write() we can know the variable name that called the _write on (this we don't have to repeat the XML file name!)
- If we remove the delay after a button click in controlactions then trying to close two dialogs in a row might fail because the first dialog hasn't closed yet and the 2nd may have similar title and same closing button e.g PageSetup.OK.Click(), PageSetup2.OK.Click(). A possible solution to this might be to keep a cache of windows in the application and no two different dialog identifiers (PageSetup and PageSetup2 in this case) can have the

same handle - so returning the handle of PageSetup when we call PageSetup2 would fail (and we would do our usual waiting until it succeeds or times out).

- Investigate using any of the following
  - BringWindowToTop: probably necessary before image capture
  - GetTopWindow: maybe to re-set top window after capture?
  - EnumThreadWindows
  - GetGUIThreadInfo
- Make it easy to work with context(right click) menu's
- Further support .NET controls and download/create a test .NET application
- Look at supporting the Sytem Tray (e.g. right click on an icon)
- supply SystemTray class (singleton probably)
- Look at clicking and text input - maybe use SendInput
- Support Up-Down controls and other common controls
- Find out whether control.item.action() or control.action(item) is better
- Create a Recorder to visually create tests

LOW PRIORITY

- Create a class that makes it easy to deal with a single window (e.g. no application)
- Allow apps to be started in a different thread so we don't lock up
  - this is being done already - the problem is that some messages cannot be sent across processes if they have pointers (so we need to send a synchronous message which waits for the other process to respond before returning)
  - But I guess it would be possible to create a thread for sending those messages?
- Liberate the code from HwndWrapper - there is very little this add's beyond what is available in handleprops. The main reason this is required is for the FriendlyClassName. So I need to look to see if this can be moved elsewhere.

  Doing this might flatten the heirarchy quite a bit and reduce the dependencies on the various packages
- Need to make Menu items into classes so instead of Dlg.MenuSelect we should be doing

```
dlg.Menu("blah->blah").Select()
```

or even

```
dlg.Menu.Blah.Blah.Select()
```

To do this we need to change how menu's are retrieved - rather than get all menuitems at the start - then we just get the requested level.

This would also enable things like

```
dlg.Menu.Blah.Blah.IsChecked()  IsEnabled(), etc
```

CLOSED (in some way or the other)

- Allow delay after click to be removed. The main reason that this is needed at the moment is because if you close a dialog and then try an action on the parent immediately it may not yet be active - so the delay is needed to allow it to become active. To fix this we may need to add more magic around calling actions on dialogs e.g. on an attribute access for an ActionDialog do the following:
  - Check if it is an Action
  - If it is not enabled then wait a little bit
  - If it is then wait a little bit and try again
  - repeat that until success or timeout

  The main thing that needs to be resolved is that you don't want two of these waits happening at once (so a wait in a function at 1 level, and another wait in a function called by the other one - because this would mean there would be a VERY long delay while the timeout of the nested function was reached the number of times the calling func tried to succeed!)
- Add referencing by closest static (or surrounding group box?)
- Need to modularize the methods of the common_controls because at the moment they are much too monolithic.
- Finish example of saving a page from IE
- Document that I have not been able to figure out how to reliably check if a menu item is enabled or not before selecting it. (Probably FIXED NOW!)

  For Example in Media Player if you try and click the View->Choose Columns menu item when it is not enabled it crashes Media Player. Theoretically MF_DISABLED and MF_GRAYED should be used - but I found that these are not updated (at least for Media Player) until they are dropped down.
- Implement an opional timing/config module so that all timing can be customized

CHAPTER 9

Change Log

0.6.5 Handling Privileges, AutomationID for Win32 etc.

30-July-2018

Enhancements:

- Check admin privileges for both target app and Python process. This allows detecting cases when window messages won't work.
- Add `automation_id` and `control_type` properties for "win32" backend (the most useful for WinForms). Correct child_window() keywords are `auto_id` and `control_type`.
- Switch pypiwin32 dependency to pywin32 which became official again.
- New generators `iter_children()` and `iter_descendants()`.
- Add method `is_checked()` to "win32" check box.

Bug Fixes:

- Method `Application().connect(...)` works better with `timeout` argument.
- Fix `.set_focus()` for "uia" backend including minimized window case (issue #443).
- `maximize()/minimize()` methods can be chained now.
- Fix passing keyword arguments to a function for decorators `@always_wait_until_passes` and `@always_wait_until`.
- Use correct types conversion for WaitGuiThreadIdle (issue #497).
- Fix reporting code coverage on Linux.
- Use .format() for logging BaseWrapper actions (issue #471).
- Print warning in case binary type is not determined (issue #387).

0.6.4 NULL pointer access fix and enhancements

21-January-2018

Bug Fixes:

- Final fix for `ValueError: NULL COM pointer access`.

Enhancements:

- Multi-threading mode (MTA) for comtypes is enabled by default, if it's not initialized by another library before importing pywinauto.
- Method `get_value()` has been added to EditWrapper in UIA backend.
- Method `scroll()` has been added for all UIA controls which have ScrollPattern implemented.
- Added methods `is_minimized/is_maximized/is_normal/get_show_state` for UIAWrapper.
- Added handling in-place controls inside ListView control and (row, column) indexing in a grid-like table mode. Examples:

```
auto_detected_ctrl = list_view.get_item(0).inplace_control()

combo = list_view.get_item(1,1).inplace_control("ComboBox")
combo.select("Item name")

edit = list_view.get_item(3,4).inplace_control("Edit")
edit.type_keys("some text{ENTER}", set_foreground=False)

dt_picker = list_view.get_item(2,0).inplace_control("DateTimePicker")
```

0.6.3 A lot of improvements and some optimizations

03-July-2017

- Improved string representation for all wrapper objects. Thanks airelil (https://github.com/airelil)!
- Fixed several sporadic crashes for `backend="uia"`.
- Fixed several bugs in `wait/wait_not` methods:
  - Method `wait('exists')` doesn't work for `backend="uia"`. Thanks maollm (https://github.com/maollm)!
  - Methods `wait/wait_not` take ~ default time (5 sec.) instead of customized timeout like 1 sec.
- `depth` param can used in a `WindowSpecification` now. `depth=1` means this control, `depth=2` means immediate children only and so on (aligned with `print_control_identifiers` method). Thanks dmitrykazanbaev (https://github.com/dmitrykazanbaev)!
- Significantly improved sending keys to an inactive window silently. Special thanks for antonlarin (https://github.com/antonlarin)! Now 2 methods are available:
  - `send_chars` is supposed to send character input (this includes `{Enter}`, `{Tab}`, `{Backspace}`) without Alt/Shift/Ctrl modifiers.
  - `send_keystrokes` is for key input (including key combinations with Alt/Shift/Ctrl modifiers).
- Method `Application().connect(path='your.exe')` uses default timeout `Timings.app_connect_timeout`. It can accept `timeout` and `retry_interval` keyword arguments. Thanks daniil-kukushkin (https://github.com/daniil-kukushkin)!
- Method `print_control_identifiers` is more consistent and minimum 2x faster now! Thanks cetygamer (https://github.com/cetygamer)!
- Fixed subclassing `Application` with your own methods. Thanks efremovd (https://github.com/efremovd)!
- Param `work_dir` can be used in `Application().start(...)`. Thanks efremovd (https://github.com/efremovd)!

- Class `Application` has been enriched with methods `is_process_running()` and `wait_for_process_exit()`. Thanks efremovd (https://github.com/efremovd)!
- Module `timings` uses `time.clock()` for Python 2.x and `time.perf_counter()` for Python 3.x so that accident system time change can't affect on your script behavior. Thanks airelil (https://github.com/airelil)!
- Added WireShark example. Thanks ViktorRoy94 (https://github.com/ViktorRoy94)!
- Now `print_control_identifiers()` can dump UI elements tree to a file. Thanks sovrasov (https://github.com/sovrasov)!
- Improved logging actions for `backend="uia"`, extended example for MS Paint. Thanks ArtemSkrebkov (https://github.com/ArtemSkrebkov)!
- Extended `CalendarWrapper` for `backend="win32"` with these methods: `get_month_delta`, `set_month_delta` and `get_month_range`. Thanks Nikita-K (https://github.com/Nikita-K)!
- Added method `legacy_properties()` to `UIAWrapper`. Thanks AsyaPronina (https://github.com/AsyaPronina)!
- Improved VB6 ListView detection for `backend="win32"`. Thanks KirillMoizik (https://github.com/KirillMoizik)!
- Fixed 64-bit specific bug in `TreeViewWrapper` for `backend="win32"` (`argument 4: <type 'exceptions.OverflowError'>: long int too long to convert`).

0.6.2 More bug fixes

28-February-2017

- Several bugs were fixed:
  - Maximized window is always resized (restored) when calling `set_focus()`.
  - AttributeError: type object '_CustomLogger' has no attribute 'disable'.
  - `print_control_identifiers()` gets bytes string on Python 3.x.
  - Importing pywinauto causes debug messages to appear twice.
- Improved click methods behaviour for Win32 ListView and TreeView: `ensure_visible()` is called inside before the click.
- Made `taskbar.SystemTrayIcons` localization friendly.

0.6.1 Bug fixes and optimizations for UI Automation and beyond

08-February-2017

- `win32_hooks` module is well tested and more reliable now. See detailed example (https://github.com/pywinauto/pywinauto/blob/master/examples/hook_and_listen.py).
- Fixed several bugs and crashes here and there.
  - Crash when ctrl.window_text() becomes None at the right moment. Thanks mborus (https://github.com/mborus)!
  - `HwndWrapper.set_focus()` fails when used via interpreter. Thanks Matthew Kennerly (https://github.com/mtkennerly)!

  - Fix LoadLibrary call error on just released Python 2.7.13. Thanks Kirill Moizik (https://github.com/KirillMoizik)!
  - AttributeError: WindowSpecification class has no 'CPUUsage' method.
  - `comtypes` prints a lot of warnings at `import pywinauto`.
  - Methods `is_dialog()` and `restore()` are missed for UIA backend.
  - Method `print_control_identifiers()` crashes on some applications with Unicode symbols.
  - Installation by `python setup.py install` may fail if pyWin32 dependency was installed manually.
  - Bug in resolving attributes: 'UIAWrapper' object has no attribute 'Menu' for `dlg = app.Custom.Menu`
  - Method `send_chars()` can now send `{ENTER}` to some applications. Thanks Max Bolingbroke (https://github.com/batterseapower)!
- Searching UI elements is faster now especially if you use `control_type` or `auto_id` in a WindowSpecification. Method `Application.kill()` is also optimized in many cases.
- Added an example for Win10 Calculator (https://github.com/pywinauto/pywinauto/blob/master/examples/win10_calculator.p

0.6.0 Introduce MS UI Automation support and many more improvements

30-October-2016

- This big release introduces MS UI Automation (UIA) support:
  - Just start from `app = Application(backend='uia').start('your_app.exe')`.
  - Supported controls: Menu, Button/CheckBox/RadioButton, ComboBox, Edit, Tab control, List (ListView), DataGrid, Tree, Toolbar, Tooltip, Slider.
- Documentation is built continuously now on ReadTheDocs. See also improved Getting Started Guide.
- New multi-backend architecture makes implementation of new platforms support easier in the future. The minimal set for new backend includes its name and two classes inherited from *`element_info.ElementInfo`* and from *`pywinauto.base_wrapper.BaseWrapper`*. New backend must be registered by function *`pywinauto.backend.register()`*.
- Code style is much closer to PEP8: i.e. `click_input` should be used instead of `ClickInput`.
- Initial implementation of the `hooks` module. Keyboard and mouse event handlers can be registered in the system. It was inspired by pyHook, pyhk, pyhooked and similar modules, but re-written from scratch. Thanks for Max Samokhvalov! The fork of the `hooks` module is used in pyhooked 0.8 by Ethan Smith.
- A lot of small improvements are not counted here.

0.5.4 Bug fixes and partial MFC Menu Bar support

30-October-2015

- Fix bugs and inconsistencies:
  - Add *where="check"* possible value to the ListViewWrapper.Click/ClickInput' methods.

  - Add *CheckByClickInput* and *UncheckByClickInput* methods for a plain check box.
  - Fix crash while waiting for the window start.
- Add partial MFC Menu Bar support. The menu bar can be interpreted as a toolbar. Items are clickable by index through experimental *MenuBarClickInput* method of the *ToolbarWrapper*.
- Python 3.5 is supported.

0.5.3 Better Unicode support for SetEditText/TypeKeys and menu items

25-September-2015

- Better backward compatibility with pywinauto 0.4.2:
  - support Unicode symbols in the `TypeKeys` method again;
  - allow `SetEditText/TypeKeys` methods to take non-string arguments;
  - fix taking Unicode parameters in `SetEditText/TypeKeys`.
- Fix bug in `Wait("active")`, raise a SyntaxError when waiting for an incorrect state.
- Re-consider some timings, update docs for the default values etc.
- Fix several issues with an owner-drawn menu.
- `MenuItem` method `Click` is renamed to `ClickInput` while `Click = Select` now.
- New `SetTransparency` method can make a window transparent in a specified degree.

0.5.2 Improve ListView, new methods for CPU usage, DPI awareness

07-September-2015

- New Application methods: `CPUUsage` returns CPU usage as a percent (float number), `WaitCPUUsageLower` waits until the connected process' CPU usage is lower than a specified value (2.5% by default).
- A new class `_listview_item`. It is very similar to `_treeview_element`.
- Add DPI awareness API support (Win8+). It allows correct work when all fonts are scaled at 125%, 150% etc (globally or per monitor).
- "Tools overview" section in docs.
- Fix number of bugs:
  - `TreeViewWrapper.Select` doesn't work when the control is not in focus.
  - `TabControlWrapper.Select` doesn't work in case of TCS_BUTTONS style set.
  - `ListViewWrapper` methods `Check/UnCheck` are fixed.
  - Toolbar button: incorrect access by a tooltip text.
  - Warning "Cannot retrieve text length for handle" uses print() instead of actionlogger.
  - `ClientToScreen` method doesn't return a value (modifying mutable argument is not good practice).

0.5.1 Several fixes, more tests

13-July-2015

- Resolve pip issues
- Warn user about mismatched Python/application bitness (64-bit Python should be used for 64-bit application and 32-bit Python is for 32-bit app)
- Add "TCheckBox" class name to ButtonWrapper detection list
- Fix `DebugMessage` method
- Disable logging (actionlogger.py) by default, provide shortcuts: `actionlogger.enable()` and `actionlogger.disable()`. For those who are familiar with standard `logging` module there's method `actionlogger.set_level(level)`

0.5.0 64-bit Py2/Py3 compatibility

30-June-2015

- 64-bit Python and 64-bit apps support (but 32-bit Python is recommended for 32-bit apps)
- Python 2.x/3.x compatibility
- Added pyWin32 dependency (silent install by pip for 2.7 and 3.1+)
- Improvements for Toolbar, TreeView, UpDown and DateTimePicker wrappers
- Improved `best_match` algorithm allows names like `ToolbarFile`
- Clicks can be performed with pressed Ctrl or Shift
- Drag-n-drop and scrolling methods (DragMouse, DragMouseInput, MouseWheelInput)
- Improved menu support: handling OWNERDRAW menu items; access by command_id (like `$23453`)
- Resolved issues with py2exe and cx_freeze
- `RemoteMemoryBlock` can now detect memory corruption by checking guard signature
- Upgraded `taskbar` module
- `sysinfo` module for checking 32-bit or 64-bit OS and Python
- `set_foreground` flag in `TypeKeys` method for typing into in-place controls
- flags `create_new_console` and `wait_for_idle` in `Application.start` method

0.4.0 Various cleanup and bug fixes

03-April-2010

- Gracefully Handle dir() calls on Application or WindowSpecification objects (which used hang for a while as these classes would search for windows matching __members__, __methods__ and __bases__). The code now checks for any attribute that starts with '__' and ends with '__' and raises AttributeError immediately. Thanks to Sebastian Haase for raising this.
- Removed the reference to an Application object in WindowSpecification. It was not used in the class and made the class harder to use. WindowSpecification is now more useful as a utility class.

- Add imports of application.WindowSpecification and application.Application to pywinauto.__init__.py so that these classes can be used more easily (without having to directly import pywinauto.application). Thanks again to Sebastian Haase.
- Added a function to empty the clipboard (thanks to Tocer on Sourceforge)
- Use 'SendMessageTimeout' to get the text of a window. (SendMessage will hang if the application is not processing messages)
- Fixed references to PIL.ImageGrab. PIL add's it's module directly to the module path, so it should just be referenced by ImageGrab and not PIL.ImageGrab.
- Use AttachThreadInput + PostMessage rather than SendMessageTimeout to send mouse clicks.
- Fix how timeout retry times are calculated in timings.WaitUntil() and timings.Wait
- Fixed some issues with application.Kill_() method, highlighted due to the changes in the HwndWrapper.Close() method.
- Fix writing images to XML. It was broken with updates to PIL that I had not followed. Changed the method of knowing if it is an image by checking for various attributes.
- Renamed WindowSpecification.(Ww)indow() to ChildWindow() and added deprecation messages for the other functions.
- Improved the tests (fixed test failures which were not pywinauto issues)

0.3.9 Experimental! New Sendkeys, and various fixes

27-November-2009

- Major change this release is that Sendkeys is no longer a requirement! A replacement that supports Unicode is included with pywinauto. (hopefully soon to be released as a standalone module). Please note - this is still quite untested so this release should be treated with some care..
- Made sure that default for WindowSpecification.Window_() was to look for non top level windows. The defaults in find_windows() had been changed previously and it now needed to be explicitly overridden.
- Fixed a missing reference to 'win32defines' when referencing WAIT_TIMEOUT another typo of false (changed to False)
- Removed the restriction to only get the active windows for the process, now it will be possible to get the active windows, even if a process is not specified. From http://msdn.microsoft.com/en-us/library/ms633506%28VS.85%29.aspx it gets the active window for the foreground thread.
- Hopefully improved Delphi TreeView and ListView handling (added window class names as supported window classes to the appropriate classes).
- Added support for running UI tests with reference controls. (requried for some localization tests)
- Various PyLint and PEP8 fixes made.

0.3.8 Collecting improvements from last 2 years

10-March-2009

- Fixed toolbar button pressing - This required for HwndWrapper.NotifyParent() to be updated (to accept a new ID parameter)
- Fixed a bug wherea listview without a column control would make pywinauto fail to capture the dialog.

- Converted documenation from Pudge generated to Sphinx Generated
- Added some baic support for Pager and Progress controls (no tests yet)
- Added some more VB 'edit' window classes
- Added some more VB 'listbox' window classes
- Added some more VB 'button' window classes
- Ensured that return value from ComboBoxWrapper.SelectedIndices is always a tuple (there was a bug where it would sometimes be a ctypes array)
- Changed default for finding windows to find disabled windows as well as enabled ones (previous was to find enabled windows only) (note this may impact scripts that relied on the previous setting i.e. in cases where two dialogs have the same title!)
- Much better handling of InvalidWindowHandle during automation runs. This could be raised when a closing window is still available when the automation was called, but is gone half way through whatever function was called.
- Made clicking more robust by adding a tiny wait between each SendMessageTimeout in _perform_click().
- Added attributes `can_be_label` and `has_title` to `HwndWrapper` and subclasses to specify whether a control can act as a label for other controls, and whether the title should be used for identifying the control. If you have created your own HwndWrapper subclasses you may need to override the defaults.
- Added a `control_id` parameter to find_windows which allows finding windows based off of their control id's
- Added a FriendlyClassName method to MenuItem
- Split up the functions for button truncation data
- Commented out code to get a new font if the font could not be recovered
- Moved code to get the control font from Truncation test to handleprops
- Added a function to get the string representation of the bug. (need to refactor PrintBugs at some point).
- Fixed a variable name (from fname -> font_attrib as fname was not a defined variable!)
- Forced some return values from MissingExtraString test to be Unicode
- Fixed the MiscValues test (converted to Unicode and removed some extraneous characters)
- Updated the path for all unittests
- Made two unit tests sligthly more robust and less dependent on computer/app settings
- Updated timing settings for unit tests
- Updated the examples to work in dev environment.

0.3.7 Merge of Wait changes and various bug fixes/improvements

10-April-2007

- Added Timings.WaitUntil() and Timings.WaitUntilPasses() which handle the various wait until something in the code. Also refactored existing waits to use these two methods.
- Fixed a major Handle leak in RemoteMemorBlock class (which is used extensively for 'Common' controls. I was using OpenHandle to open the process handle, but was not calling CloseHandle() for each corresponding OpenHandle().

- Added an active_() method to Application class to return the active window of the application.
- Added an 'active' option to WindowSpecification.Wait() and WaitNot().
- Some cleanup of the clipboard module. GetFormatName() was improved and GetData() made a little more robust.
- Added an option to findwindows.find_windows() to find only active windows (e.g. active_only = True). Default is False.
- Fixed a bug in the timings.Timings class - timing values are Now accessed through the class (Timings) and not through the intance (self).
- Updated ElementTree import in XMLHelpers so that it would work on Python 2.5 (where elementtree is a standard module) as well as other versions where ElementTree is a separate module.
- Enhanced Item selection for ListViews, TreeViews - it is now possible to pass strings and they will be searched for. More documentation is required though.
- Greatly enhanced Toolbar button clicking, selection, etc. Though more documentation is required.
- Added option to ClickInput() to allow mouse wheel movements to be made.
- menuwrapper.Menu.GetProperties() now returns a dict like all other GetProperties() methods. This dict for now only has one key 'MenuItems' which contains the list of menuitems (which had been the previous return value).

0.3.6b Changes not documented in 0.3.6 history

31-July-2006

- Fixed a bug in how findbestmatch.FindBestMatches was working. It would match against text when it should not!
- Updated how timings.Timings.Slow() worked, if any time setting was less then .2 after 'slowing' then set it to .2

0.3.6 Scrolling and Treview Item Clicking added

28-July-2006

- Added parameter to `_treeview_item.Rectangle()` to have an option to get the Text rectangle of the item. And defaulted to this.
- Added `_treeview_item.Click()` method to make it easy to click on tree view items.
- Fixed a bug in `TreeView.GetItem()` that was expanding items when it shouldn't.
- Added `HwndWrapper.Scroll()` method to allow scrolling. This is a very minimal implementation - and if the scrollbars are implemented as separate controls (rather then a property of a control - this will probably not work for you!). It works for Notepad and Paint - that is all I have tried so far.
- Added a call to `HwndWrapper.SetFocus()` in `_perform_click_input()` so that calls to `HwndWrapper.ClickInput()` will make sure to click on the correct window.

0.3.5 Moved to Metaclass control wrapping

24-May-2006

- Moved to a metaclass implementation of control finding. This removes some cyclic importing that had to be worked around and other then metaclass magic makes the code a bit simpler.
- Some of the sample files would not run - so I updated them so they would (Thanks to Stefaan Himpe for pointing this out)
- Disabled saving application data (it was still being saved in Application.RecordMatch() even if the rest of the application data code is disabled. This was causing what appeared to be a memory leak where pywinauto would keep grabbing more and more memory (especially for controls that contain a lot of information). Thanks to Frank Martinez for leading me to this).
- Added ListViewWrapper.GetItemRect() to enable retrieving the rectangle for a particular item in the listview.
- Removed references to _ctrl() method within pywinauto as it was raising a DeprecationWarning internally even if the user was not using it.

0.3.4 Fixed issue with latest ctypes, speed gains, other changes

25-Apr-2006

- The latest version of ctypes (0.9.9.6) removed the code generator I was using some generated code in win32functions.py (stdcall). I was not using those functions so I just commented them out.
- Started the process of renaming methods of the `Application` and `WindowSpecification` classes. I will be converting names to `UppercaseNames_()`. The trailing _ is to disambiguate the method names from potential Window titles.
- Updated how print_control_identifiers works so that it now always prints the disambiguated control name. (even for single controls)
- Added __hash__ to HwndWrapper so that controls could be dictionary keys.
- Caching various information at various points. For example I cache how well two pieces of text match. For short scripts this has little impact - but for larger script it could well have a major impact. Also caching information for controls that cannot change e.g. TopLeveParent, Parent, etc

0.3.3 Added some methods, and fixed some small bugs

19-Apr-2006

- Added a wait for the control to be active and configurable sleeps after 'modifying' actions (e.g. Select, Deselect, etc)
- Fixed Timings.Slow() and Timings.Fast() - they could in certain circumstances do the opposite! If you had already set a timing slower or faster then they would set it then they would blindly ignore that and set their own times. I added functionality that they will take either the slowest or fastest of the new/current setting rather then blindly setting to the new value.
- Fixed some hidden bugs with HwndWrapper.CloseClick()
- Fixed a bug in setup.py that would raise an error when no argument was specified
- Added an argument to HwndWrapper.SendMessageTimeout so that the wait options could be passed in.
- Added HwndWrapper.Close(), Maximize(), Minimize(), Restore() and GetShowState().
- Commented out all deprecated methods (will be removed completely in some future release).

- Added Application.kill_() method - which closes all windows and kills the application. If the application is asking if you want to save your changes - you will not be able to click yes or no and the application will be killed anyway!.

0.3.2 Fixed setup.py and some typos

31-Mar-2006

- Fixed the spelling of Stefaan Himpe's name
- Fixed setup.py which was working for creating a distribution but not for installing it (again thanks to Stefaan for pointing it out!)

0.3.1 Performance tune-ups

30-Mar-2006

- Change calculation of distance in findbestmatch.GetNonTextControlName() so that it does not need to square or get the square root to find the real distance - as we only need to compare values - not have the actual distance. (Thanks to Stefaan Himpe)
- Compiled regular expression patterns before doing the match to avoid compiling the regular expression for window that is being tested (Thanks to Stefaan Himpe)
- Made it easier to add your own control tests by adding a file extra_tests.py which needs to export a ModifyRegisteredTests() method. Also cleaned up the code a little.
- Updated notepad_fast.py to make it easier to profile (adde a method)
- Changed WrapHandle to use a cache for classes it has matched - this is to avoid having to match against all classes constantly.
- Changed default timeout in SendMessageTimeout to .001 seconds from .4 seconds this results in a significant speedup. Will need to make this value modifiable via the timing module/routine.
- WaitNot was raising an error if the control was not found - it should have returned (i.e. success - control is not in any particular state because it does not exist!).
- Added ListViewWrapper.Deselect() per Chistophe Keller's suggestion. While I was at it I added a check on the item value passed in and added a call to WaitGuiIdle(self) so that the control has a chance to process the message.
- Changed doc templates and moved dependencies into pywinauto subversion to ensure that all files were availabe at www.openqa.org and that they are not broken when viewed there.
- Moved all timing information into the timings.Timings class. There are some simple methods for changing the timings.

0.3.0 Added Application data - now useful for localization testing

20-Mar-2006

- Added automatic Application data collection which can be used when running the same test on a different spoken language version. Support is still preliminary and is expected to change. Please treat as early Alpha.

If you have a different language version of Windows then you can try this out by running the notepad_fast.py example with the langauge argument e.g.

```
examples\notepad_fast.py language
```

This will load the application data from the supplied file notepad_fast.pkl and use it for finding the right menu items and controls to select.

- Test implementation to make it easier to start using an application. Previously you needed to write code like

```
app = Application().connect_(title = 'Find')
app.Find.Close.Click()
app.NotePad.MenuSelect("File->Exit")
```

1st change was to implement static methods `start()` and `connect()`. These methods return a new Application instance so the above code becomes:

```
app = Application.connect(title = 'Find')
app.Find.Close.Click()
app.NotePad.MenuSelect("File->Exit")
```

I also wanted to make it easier to start working with a simple application - that may or may not have only one dialog. To make this situation easier I made `window_()` not throw if the application has not been `start()ed` or `connect()ed` first. This leads to simpler code like:

```
app = Application()
app.Find.Close.Click()
app.NotePad.MenuSelect("File->Exit")
```

What happens here is that when you execute any of Application.window_(), Application.__getattr__() or Application.__getitem__() when the application hasn't been connected or started. It looks for the window that best matches your specification and connects the application to that process.

This is extra functionality - existing connect_() and start_() methods still exist

- Fixed HwndWrapper.SetFocus() so that it would work even if the window was not in the foreground. (it now makes the window foreground as well as giving it focus). This overcomes a restriction in Windows where you can only change the foreground window if you own the foreground window.
- Changed some 2.4'isms that an anonymous commenter left on my blog :-) with these changes pywinauto should run on Python 2.3 (though I haven't done extensive testing).
- Commented out controls.common_controls.TabControlWrapper.GetTabState() and TabStates() as these did not seem to be returning valid values anyway.
- Fixed documentation issues were parts of the documentation were not getting generated to the HTML files.
- Fixed issue where MenuSelect would sometimes not work as expected. Some Menu actions require that the window that owns the menu be active. Added a call to SetFocus() before selecting a menu item to ensure that the window was active.
- Fixed Bug 1452832 where clipboard was not closed in clipboard.GetData()
- Added more unit tests now up to 248 from 207

0.2.5 More refactoring, more tests

07-Mar-2006

- Added wrapper classes for Menus and MenuItems this enabled cleaner interaction with Menu's. It also gives more functionality - you can now programmatically Click() on menus, and query if a menu item is checked or not.
- Added application.WindowSpecification.Wait() and WaitNot() methods. These methods allow you to wait for a control to exist, be visible, be enabled, be ready (both enabled and visible!) or to wait for the control to not be in any of these states. WaitReady(), WaitNotEnabled(), WaitNotVisible() now use these methods. I was able to also add the missing methods WaitNotReady(), WaitEnabled(), WaitVisible(), WaitExists(), WaitnotExists(). Please use Wait() and WaitNot() as I have Deprecated these Wait* methods.
- Slightly modified timeout waits for control resolution so that a timed function more accurately follows the timeout value specified.
- Added application.Application.start() and connect() static methods. These methods are factory methods in that they will return an initialized Application instance. They work exactly the same as start_() and connect() as they are implemented in terms of those.

  from pywinauto.application import Application notepad = Application.start("notepad") same_notepad = Application.connect(path = "notepad")
- Updated the examples to follow changes to the code - and to make them a little more robust.
- Added a new Controls Overview document page which lists all the actions on all controls.
- Added more unit tests now up to 207 from 134 (added 68 tests)

0.2.1 Small Release number - big changes

17-Feb-2006

- Quick release to get many changes out there - but this release has been less tested then I would like for a .3 release.
- Allow access to non text controls using the closest Text control. This closest text control will normally be the static/label associated with the control. For example in Notepad, Format->Font dialog, the 1st combobox can be refered to as "FontComboBox" rather than "ComboBox1"
- Added a new control wrapper - `PopupMenuWrapper` for context menu's You can now work easily with context menu's e.g.

```
app.Notepad.Edit.RightClick()
# need to use MenuClick rather then MenuSelect
app.PopupMenu.MenuClick("Select All")
app.Notepad.Edit.RightClick()
app.PopupMenu.MenuClick("Copy")
```

  I could think of merging the `RightClick()` and `MenuSelect()` into one method `ContextMenuSelect()` if that makes sense to most people.
- Added Support for Up-Down controls
- Not all top level windows now have a FriendlyClassName of "Dialog". I changed this because it made it hard to get windows of a particular class. For example the main Notepad window has a class name of "Notepad".

  This was primarily implemented due to work I did getting the System Tray.
- Renamed `StatusBarWrapper.PartWidths()` to `PartRightEdges()` as this is more correct for what it returns.

- Changed HwndWrapper.Text() and SetText() to WindowText() and SetWindowText() respectively to try and make it clearer that it is the text returned by GetWindowText and not the text that is visible on the control. This change also suggested that EditWrapper.SetText() be changed to SetEditText() (though this is not a hard requirement EditWrapper.SetText() still exists - but may be deprecated.
- Added ClickInput, DoubleClickInput, RightClickInput, PressMouseInput ReleaseMouseInput to HwndWrapper - these use SendInput rather then WM_LBUTTONDOWN, WM_RBUTTONUP, etc used by Click, DoubleClick etc.

  I also added a MenuClick method that allows you to click on menu items. This means you can now 'physically' drop menus down.
- Some further working with tooltips that need to be cleaned up.
- Fixed a bug where coordinates passed to any of the Click operations had the X and Y coordinates swapped.
- Added new MenuItem and Menu classes that are to the most part hidden but you can get a menu item by doing

```
app.Notepad.MenuItem("View")
app.Notepad.MenuItem("View->Status Bar")
```

  MenuItems have various actions so for example you can use `MenuItem.IsChecked()` to check if the menu item is checked. Among other methods there are `Click()` and `Enabled()`.
- Modified the 'best match' algorithm for finding controls. It now searches a couple of times, and tries to find the best fit for the text passed to it. The idea here is to make it more "Select what I want - not that other thing that looks a bit like what I want!". It is possible this change could mean you need to use new identifiers in scripts - but in general very little modification should be necessary.

  There was also a change to the algorithm that looked for the closest text control. It missed some obvious controls in the previous implementation. It also had a bug for controls above the control rather than to the left.
- Added a new example scripts SaveFromInternetExplorer.py and SaveFromFirefox.py which show automating downloading of a page from either of these browsers.
- Added yet more unit tests, there are now a total of 134 tests.

0.2.0 Significant refactoring

06-Feb-2006

- Changed how windows are searched for (from application) This chage should not be a significant change for users
- Started adding unit tests (and the have already uncovered bugs that been fixed). They also point to areas of missing functionality that will be addded with future updates
- Changed from property access to Control attributes to function access If your code was accessing properties of controls then this might be a significant change! The main reasons for doing this were due to the inheritability of properties (or lack there-of!) and the additional scafolding that was required to define them all.
- Updated the `DialogWrapper.MenuSelect()` method to notify the parent that it needs to initialize the menu's before it retrieves the items
- Added functionality to associate 'non-text' controls with the 'text' control closest to them. This allows controls to be referenced by:

```
app.dlg.<Nearby_text><Window_class>
```

  e.g. to reference the "Footer" edit control in the Page Setup dialog you could use:

```
app.PageSetup.FooterEdit
```

- Added a MoveWindow method to HwndWrapper
- Did some more cleanup (fixing pylint warnings) but still not finished
- Added some better support for .NET controls (not to be considered final)

0.1.3 Many changes, few visible

15-Jan-2006

- Wrote doc strings for all modules, classes and functions
- Ran pychecker and pylint and fixed some errors/warning
- changed

```
_connect, _start, _window, _control, _write
```

  respectively to

```
connect_, start_, window_, connect_, write_
```

  If you forget to change `_window`, `_connect` and `_start` then you will probably get the following error.

```
TypeError: '_DynamicAttributes' object is not callable
```

- pywinauto is now a package name - you need to import it or its modules
- Changes to the code to deal with pywinauto package name
- Fixed searching for windows if a Parent is passed in
- Added Index to retrieved MenuItem dictionary
- Added a check to ensure that a windows Handle is a valid window
- Refactored some of the methods in common_controls
- Refactored how FriendlyClassName is discovered (and still not really happy!

0.1.2 Add Readme and rollup various changes

15-Jan-2006

- Updated Readme (original readme was incorrect)
- Added clipboard module
- Fixed DrawOutline part of tests.__init__.print_bugs
- Added a NotifyParent to HwndWrapper
- Make sure that HwndWrapper.ref is initialized to None
- Refactored some methods of ComboBox and ListBox
- Updated Combo/ListBox selection methods
- Removed hardcoded paths from test_application.py

- Added section to save the document as UTF-8 in MinimalNotepadTest
- Fixed EscapeSpecials and UnEscapeSpecials in XMLHelpers
- Made sure that overly large bitmaps do not break XML writing

0.1.1 Minor bug fix release

12-Jan-2006

- Fixed some minor bugs discovered after release

0.1.0 Initial Release

6-Jan-2006

CHAPTER 10

Source code reference

Basic User Input Modules

pywinauto.mouse

Cross-platform module to emulate mouse events like a real user

`pywinauto.mouse.`**`click`**(*button='left', coords=(0, 0)*)
Click at the specified coordinates

`pywinauto.mouse.`**`double_click`**(*button='left', coords=(0, 0)*)
Double click at the specified coordinates

`pywinauto.mouse.`**`move`**(*coords=(0, 0)*)
Move the mouse

`pywinauto.mouse.`**`press`**(*button='left', coords=(0, 0)*)
Press the mouse button

`pywinauto.mouse.`**`release`**(*button='left', coords=(0, 0)*)
Release the mouse button

`pywinauto.mouse.`**`right_click`**(*coords=(0, 0)*)
Right click at the specified coords

`pywinauto.mouse.`**`scroll`**(*coords=(0, 0), wheel_dist=1*)
Do mouse wheel

`pywinauto.mouse.`**`wheel_click`**(*coords=(0, 0)*)
Middle mouse button click at the specified coords

pywinauto.keyboard

Keyboard input emulation module

Automate typing keys to an active window by calling `SendKeys` method. You can use any Unicode characters (on Windows) and some special keys listed below. The module is also available on Linux.

Available key codes:

```
{SCROLLLOCK}, {VK_SPACE}, {VK_LSHIFT}, {VK_PAUSE}, {VK_MODECHANGE},
{BACK}, {VK_HOME}, {F23}, {F22}, {F21}, {F20}, {VK_HANGEUL}, {VK_KANJI},
{VK_RIGHT}, {BS}, {HOME}, {VK_F4}, {VK_ACCEPT}, {VK_F18}, {VK_SNAPSHOT},
{VK_PA1}, {VK_NONAME}, {VK_LCONTROL}, {ZOOM}, {VK_ATTN}, {VK_F10}, {VK_F22},
```

```
{VK_F23}, {VK_F20}, {VK_F21}, {VK_SCROLL}, {TAB}, {VK_F11}, {VK_END},
{LEFT}, {VK_UP}, {NUMLOCK}, {VK_APPS}, {PGUP}, {VK_F8}, {VK_CONTROL},
{VK_LEFT}, {PRTSC}, {VK_NUMPAD4}, {CAPSLOCK}, {VK_CONVERT}, {VK_PROCESSKEY},
{ENTER}, {VK_SEPARATOR}, {VK_RWIN}, {VK_LMENU}, {VK_NEXT}, {F1}, {F2},
{F3}, {F4}, {F5}, {F6}, {F7}, {F8}, {F9}, {VK_ADD}, {VK_RCONTROL},
{VK_RETURN}, {BREAK}, {VK_NUMPAD9}, {VK_NUMPAD8}, {RWIN}, {VK_KANA},
{PGDN}, {VK_NUMPAD3}, {DEL}, {VK_NUMPAD1}, {VK_NUMPAD0}, {VK_NUMPAD7},
{VK_NUMPAD6}, {VK_NUMPAD5}, {DELETE}, {VK_PRIOR}, {VK_SUBTRACT}, {HELP},
{VK_PRINT}, {VK_BACK}, {CAP}, {VK_RBUTTON}, {VK_RSHIFT}, {VK_LWIN}, {DOWN},
{VK_HELP}, {VK_NONCONVERT}, {BACKSPACE}, {VK_SELECT}, {VK_TAB}, {VK_HANJA},
{VK_NUMPAD2}, {INSERT}, {VK_F9}, {VK_DECIMAL}, {VK_FINAL}, {VK_EXSEL},
{RMENU}, {VK_F3}, {VK_F2}, {VK_F1}, {VK_F7}, {VK_F6}, {VK_F5}, {VK_CRSEL},
{VK_SHIFT}, {VK_EREOF}, {VK_CANCEL}, {VK_DELETE}, {VK_HANGUL}, {VK_MBUTTON},
{VK_NUMLOCK}, {VK_CLEAR}, {END}, {VK_MENU}, {SPACE}, {BKSP}, {VK_INSERT},
{F18}, {F19}, {ESC}, {VK_MULTIPLY}, {F12}, {F13}, {F10}, {F11}, {F16},
{F17}, {F14}, {F15}, {F24}, {RIGHT}, {VK_F24}, {VK_CAPITAL}, {VK_LBUTTON},
{VK_OEM_CLEAR}, {VK_ESCAPE}, {UP}, {VK_DIVIDE}, {INS}, {VK_JUNJA},
{VK_F19}, {VK_EXECUTE}, {VK_PLAY}, {VK_RMENU}, {VK_F13}, {VK_F12}, {LWIN},
{VK_DOWN}, {VK_F17}, {VK_F16}, {VK_F15}, {VK_F14}
```

Modifiers:

- `'+'`: `{VK_SHIFT}`
- `'^'`: `{VK_CONTROL}`
- `'%'`: `{VK_MENU}` a.k.a. Alt key

Example how to use modifiers:

```
SendKeys('^a^c') # select all (Ctrl+A) and copy to clipboard (Ctrl+C)
SendKeys('+{INS}') # insert from clipboard (Shift+Ins)
SendKeys('%{F4}') # close an active window with Alt+F4
```

Repetition count can be specified for special keys. `{ENTER 2}` says to press Enter twice.

Main User Modules

pywinauto.application module

pywinauto.findbestmatch

Module to find the closest match of a string in a list

exception `pywinauto.findbestmatch.`**`MatchError`**(*items=None*, *tofind=''*)
A suitable match could not be found

class `pywinauto.findbestmatch.`**`UniqueDict`**
A dictionary subclass that handles making its keys unique

`find_best_matches`(*search_text*, *clean=False*, *ignore_case=False*)
Return the best matches for search_text in the items
- **search_text** the text to look for
- **clean** whether to clean non text characters out of the strings
- **ignore_case** compare strings case insensitively

`pywinauto.findbestmatch.`**`build_unique_dict`**(*controls*)
Build the disambiguated list of controls

Separated out to a different function so that we can get the control identifiers for printing.

pywinauto.findbestmatch.**find_best_control_matches**(*search_text*, *controls*)
Returns the control that is the the best match to search_text

This is slightly differnt from find_best_match in that it builds up the list of text items to search through using information from each control. So for example for there is an OK, Button then the following are all added to the search list: "OK", "Button", "OKButton"

But if there is a ListView (which do not have visible 'text') then it will just add "ListView".

pywinauto.findbestmatch.**find_best_match**(*search_text*, *item_texts*, *items*, *limit_ratio=0.5*)
Return the item that best matches the search_text

- **search_text** The text to search for
- **item_texts** The list of texts to search through
- **items** The list of items corresponding (1 to 1) to the list of texts to search through.
- **limit_ratio** How well the text has to match the best match. If the best match matches lower then this then it is not considered a match and a MatchError is raised, (default = .5)

pywinauto.findbestmatch.**get_control_names**(*control*, *allcontrols*, *textcontrols*)
Returns a list of names for this control

pywinauto.findbestmatch.**get_non_text_control_name**(*ctrl*, *controls*, *text_ctrls*)
return the name for this control by finding the closest text control above and to its left

pywinauto.findbestmatch.**is_above_or_to_left**(*ref_control*, *other_ctrl*)
Return true if the other_ctrl is above or to the left of ref_control

pywinauto.findwindows

pywinauto.timings

Timing settings for all of pywinauto

This module has one object that should be used for all timing adjustments timings.Timings

There are a couple of predefined settings

timings.Timings.Fast() timings.Timings.Defaults() timings.Timings.Slow()

The Following are the individual timing settings that can be adjusted:

- window_find_timeout (default 5)
- window_find_retry (default .09)
- app_start_timeout (default 10)
- app_start_retry (default .90)
- app_connect_timeout (default 5.)
- app_connect_retry (default .1)
- cpu_usage_interval (default .5)

- cpu_usage_wait_timeout (default 20)
- exists_timeout (default .5)
- exists_retry (default .3)
- after_click_wait (default .09)
- after_clickinput_wait (default .09)
- after_menu_wait (default .1)
- after_sendkeys_key_wait (default .01)
- after_button_click_wait (default 0)
- before_closeclick_wait (default .1)
- closeclick_retry (default .05)
- closeclick_dialog_close_wait (default 2)
- after_closeclick_wait (default .2)
- after_windowclose_timeout (default 2)
- after_windowclose_retry (default .5)
- after_setfocus_wait (default .06)
- setfocus_timeout (default 2)
- setfocus_retry (default .1)
- after_setcursorpos_wait (default .01)
- sendmessagetimeout_timeout (default .01)
- after_tabselect_wait (default .05)
- after_listviewselect_wait (default .01)
- after_listviewcheck_wait default(.001)
- listviewitemcontrol_timeout default(1.5)
- after_treeviewselect_wait default(.1)
- after_toobarpressbutton_wait default(.01)
- after_updownchange_wait default(.1)
- after_movewindow_wait default(0)
- after_buttoncheck_wait default(0)
- after_comboboxselect_wait default(.001)
- after_listboxselect_wait default(0)
- after_listboxfocuschange_wait default(0)
- after_editsetedittext_wait default(0)
- after_editselect_wait default(.02)
- drag_n_drop_move_mouse_wait default(.1)
- before_drag_wait default(.2)
- before_drop_wait default(.1)

- after_drag_n_drop_wait default(.1)
- scroll_step_wait default(.1)

class pywinauto.timings.**TimeConfig**
Central storage and manipulation of timing values

Defaults()
Set all timings to the default time

Fast()
Set fast timing values

Currently this changes the timing in the following ways: timeouts = 1 second waits = 0 seconds retries = .001 seconds (minimum!)

(if existing times are faster then keep existing times)

Slow()
Set slow timing values

Currently this changes the timing in the following ways: timeouts = default timeouts * 10 waits = default waits * 3 retries = default retries * 3

(if existing times are slower then keep existing times)

exception pywinauto.timings.**TimeoutError**

pywinauto.timings.**always_wait_until**(*timeout*, *retry_interval*, *value=True*, *op=<built-in function eq>*)
Decorator to call wait_until(...) every time for a decorated function/method

pywinauto.timings.**always_wait_until_passes**(*timeout*, *retry_interval*, *exceptions=<class 'Exception'>*)
Decorator to call wait_until_passes(...) every time for a decorated function/method

pywinauto.timings.**timestamp**()
Get a precise timestamp

pywinauto.timings.**wait_until**(*timeout*, *retry_interval*, *func*, *value=True*, *op=<built-in function eq>*, **args*, ***kwargs*)
Wait until `op(function(*args, **kwargs), value)` is True or until timeout expires

- **timeout** how long the function will try the function
- **retry_interval** how long to wait between retries
- **func** the function that will be executed
- **value** the value to be compared against (defaults to True)
- **op** the comparison function (defaults to equality)
- **args** optional arguments to be passed to func when called
- **kwargs** optional keyword arguments to be passed to func when called

Returns the return value of the function If the operation times out then the return value of the the function is in the 'function_value' attribute of the raised exception.

e.g.

```
try:
    # wait a maximum of 10.5 seconds for the
    # the objects item_count() method to return 10
    # in increments of .5 of a second
    wait_until(10.5, .5, self.item_count, 10)
```

```
        except TimeoutError as e:
            print("timed out")
```

pywinauto.timings.**wait_until_passes**(*timeout*, *retry_interval*, *func*, *exceptions=<class 'Exception'>*, **args*, ***kwargs*)

Wait until `func(*args, **kwargs)` does not raise one of the exceptions

- **timeout** how long the function will try the function
- **retry_interval** how long to wait between retries
- **func** the function that will be executed
- **exceptions** list of exceptions to test against (default: Exception)
- **args** optional arguments to be passed to func when called
- **kwargs** optional keyword arguments to be passed to func when called

Returns the return value of the function If the operation times out then the original exception raised is in the 'original_exception' attribute of the raised exception.

e.g.

```
        try:
            # wait a maximum of 10.5 seconds for the
            # window to be found in increments of .5 of a second.
            # P.int a message and re-raise the original exception if never found.
            wait_until_passes(10.5, .5, self.Exists, (ElementNotFoundError))
        except TimeoutError as e:
            print("timed out")
            raise e.
```

Specific Functionality

pywinauto.clipboard

Some clipboard wrapping functions - more to be added later

pywinauto.clipboard.**EmptyClipboard**()

pywinauto.clipboard.**GetClipboardFormats**()

Get a list of the formats currently in the clipboard

pywinauto.clipboard.**GetData**(*format_id=<MagicMock name='mock.CF_UNICODETEXT' id='140150256156968'>*)

Return the data from the clipboard in the requested format

pywinauto.clipboard.**GetFormatName**(*format_id*)

Get the string name for a format value

Controls Reference

pywinauto.base_wrapper

Base class for all wrappers in all backends

class pywinauto.base_wrapper.**BaseMeta**
Abstract metaclass for Wrapper objects

static find_wrapper(*element*)
Abstract static method to find an appropriate wrapper

class pywinauto.base_wrapper.**BaseWrapper**(*element_info*, *active_backend*)
Abstract wrapper for elements.

All other wrappers are derived from this.

can_be_label = False

capture_as_image(*rect=None*)
Return a PIL image of the control.

See PIL documentation to know what you can do with the resulting image.

children(***kwargs*)
Return the children of this element as a list

It returns a list of BaseWrapper (or subclass) instances. An empty list is returned if there are no children.

class_name()
Return the class name of the elenemt

click_input(*button='left'*, *coords=(None*, *None)*, *button_down=True*, *button_up=True*, *double=False*, *wheel_dist=0*, *use_log=True*, *pressed=''*, *absolute=False*, *key_down=True*, *key_up=True*)
Click at the specified coordinates

- **button** The mouse button to click. One of 'left', 'right', 'middle' or 'x' (Default: 'left', 'move' is a special case)
- **coords** The coordinates to click at.(Default: the center of the control)
- **double** Whether to perform a double click or not (Default: False)
- **wheel_dist** The distance to move the mouse wheel (default: 0)

NOTES: This is different from click method in that it requires the control to be visible on the screen but performs a more realistic 'click' simulation.

This method is also vulnerable if the mouse is moved by the user as that could easily move the mouse off the control before the click_input has finished.

client_to_screen(*client_point*)
Maps point from client to screen coordinates

control_count()
Return the number of children of this control

control_id()
Return the ID of the element

Only controls have a valid ID - dialogs usually have no ID assigned.

The ID usually identified the control in the window - but there can be duplicate ID's for example lables in a dialog may have duplicate ID's.

descendants(***kwargs*)
Return the descendants of this element as a list

It returns a list of BaseWrapper (or subclass) instances. An empty list is returned if there are no descendants.

double_click_input(*button='left'*, *coords=(None*, *None)*)
Double click at the specified coordinates

drag_mouse_input(*dst=(0*, *0)*, *src=None*, *button='left'*, *pressed=''*, *absolute=True*)
Click on **src**, drag it and drop on **dst**

- **dst** is a destination wrapper object or just coordinates.
- **src** is a source wrapper object or coordinates. If **src** is None the self is used as a source object.
- **button** is a mouse button to hold during the drag. It can be "left", "right", "middle" or "x"
- **pressed** is a key on the keyboard to press during the drag.
- **absolute** specifies whether to use absolute coordinates for the mouse pointer locations

draw_outline(*colour='green'*, *thickness=2*, *fill=<MagicMock name='mock.win32defines.BS_NULL' id='140150259993568'>*, *rect=None*)
Draw an outline around the window.

- **colour** can be either an integer or one of 'red', 'green', 'blue' (default 'green')
- **thickness** thickness of rectangle (default 2)
- **fill** how to fill in the rectangle (default BS_NULL)
- **rect** the coordinates of the rectangle to draw (defaults to the rectangle of the control)

element_info
Read-only property to get **ElementInfo** object

friendly_class_name()
Return the friendly class name for the control

This differs from the class of the control in some cases. class_name() is the actual 'Registered' element class of the control while friendly_class_name() is hopefully something that will make more sense to the user.

For example Checkboxes are implemented as Buttons - so the class of a CheckBox is "Button" - but the friendly class is "CheckBox"

friendlyclassname = None

get_properties()
Return the properties of the control as a dictionary.

has_title = True

is_child(*parent*)
Return True if this element is a child of 'parent'.

An element is a child of another element when it is a direct of the other element. An element is a direct descendant of a given element if the parent element is the the chain of parent elements for the child element.

is_dialog()
Return true if the control is a top level window

is_enabled()
Whether the element is enabled or not

Checks that both the top level parent (probably dialog) that owns this element and the element itself are both enabled.

If you want to wait for an element to become enabled (or wait for it to become disabled) use `Application.wait('visible')` or `Application.wait_not('visible')`.

If you want to raise an exception immediately if an element is not enabled then you can use the BaseWrapper.verify_enabled(). BaseWrapper.VerifyReady() raises if the window is not both visible and enabled.

is_visible()
Whether the element is visible or not

Checks that both the top level parent (probably dialog) that owns this element and the element itself are both visible.

If you want to wait for an element to become visible (or wait for it to become hidden) use `Application.wait('visible')` or `Application.wait_not('visible')`.

If you want to raise an exception immediately if an element is not visible then you can use the BaseWrapper.verify_visible(). BaseWrapper.verify_actionable() raises if the element is not both visible and enabled.

iter_children(***kwargs*)
Iterate over the children of this element

It returns a generator of BaseWrapper (or subclass) instances.

iter_descendants(***kwargs*)
Iterate over the descendants of this element

It returns a generator of BaseWrapper (or subclass) instances.

move_mouse_input(*coords=(0, 0)*, *pressed=''*, *absolute=True*)
Move the mouse

parent()
Return the parent of this element

Note that the parent of a control is not necesarily a dialog or other main window. A group box may be the parent of some radio buttons for example.

To get the main (or top level) window then use BaseWrapper.top_level_parent().

press_mouse_input(*button='left'*, *coords=(None, None)*, *pressed=''*, *absolute=True*, *key_down=True*, *key_up=True*)
Press a mouse button using SendInput

process_id()
Return the ID of process that owns this window

rectangle()
Return the rectangle of element

The rectangle() is the rectangle of the element on the screen. Coordinates are given from the top left of the screen.

This method returns a RECT structure, Which has attributes - top, left, right, bottom. and has methods width() and height(). See win32structures.RECT for more information.

release_mouse_input(*button='left'*, *coords=(None, None)*, *pressed=''*, *absolute=True*, *key_down=True*, *key_up=True*)
Release the mouse button

right_click_input(*coords=(None, None)*)
Right click at the specified coords

root()
Return wrapper for root element (desktop)

set_focus()
Set the focus to this element

texts()
Return the text for each item of this control

It is a list of strings for the control. It is frequently overridden to extract all strings from a control with multiple items.

It is always a list with one or more strings:
- The first element is the window text of the control
- Subsequent elements contain the text of any items of the control (e.g. items in a listbox/combobox, tabs in a tabcontrol)

top_level_parent()
Return the top level window of this control

The TopLevel parent is different from the parent in that the parent is the element that owns this element - but it may not be a dialog/main window. For example most Comboboxes have an Edit. The ComboBox is the parent of the Edit control.

This will always return a valid window element (if the control has no top level parent then the control itself is returned - as it is a top level window already!)

type_keys(*keys*, *pause=None*, *with_spaces=False*, *with_tabs=False*, *with_newlines=False*, *turn_off_numlock=True*, *set_foreground=True*)
Type keys to the element using keyboard.SendKeys

This uses the re-written keyboard python module where you can find documentation on what to use for the **keys**.

verify_actionable()
Verify that the element is both visible and enabled

Raise either ElementNotEnalbed or ElementNotVisible if not enabled or visible respectively.

verify_enabled()
Verify that the element is enabled

Check first if the element's parent is enabled (skip if no parent), then check if element itself is enabled.

verify_visible()
Verify that the element is visible

Check first if the element's parent is visible. (skip if no parent), then check if element itself is visible.

wait_for_idle()
Backend specific function to wait for idle state of a thread or a window

was_maximized()
Indicate whether the window was maximized before minimizing or not

wheel_mouse_input(*coords=(None*, *None)*, *wheel_dist=1*, *pressed=''*)
Do mouse wheel

window_text()
Window text of the element

Quite a few contorls have other text that is visible, for example Edit controls usually have an empty string for window_text but still have text displayed in the edit window.

windowclasses = []

writable_props
Build the list of the default properties to be written.

Derived classes may override or extend this list depending on how much control they need.

exception pywinauto.base_wrapper.**ElementNotEnabled**
Raised when an element is not enabled

exception pywinauto.base_wrapper.**ElementNotVisible**
Raised when an element is not visible

exception pywinauto.base_wrapper.**InvalidElement**
Raises when an invalid element is passed

pywinauto.base_wrapper.**remove_non_alphanumeric_symbols**(*s*)
Make text usable for attribute name

pywinauto.controls.hwndwrapper

pywinauto.controls.menuwrapper

pywinauto.controls.common_controls

pywinauto.controls.win32_controls

pywinauto.controls.uiawrapper

Basic wrapping of UI Automation elements

class pywinauto.controls.uiawrapper.**LazyProperty**(*fget*)
Bases: object

A lazy evaluation of an object attribute.

The property should represent immutable data, as it replaces itself. Provided by: http://stackoverflow.com/a/6849299/1260742

class pywinauto.controls.uiawrapper.**UIAWrapper**(*element_info*)
Bases: *pywinauto.base_wrapper.BaseWrapper*

Default wrapper for User Interface Automation (UIA) controls.

All other UIA wrappers are derived from this.

This class wraps a lot of functionality of underlying UIA features for working with windows.

Most of the methods apply to every single element type. For example you can click() on any element.

automation_id()
Return the Automation ID of the control

can_select_multiple()
An interface to CanSelectMultiple of the SelectionProvider pattern

Indicates whether the UI Automation provider allows more than one child element to be selected concurrently.

children_texts()
Get texts of the control's children

close()
Close the window

Only a control supporting Window pattern should answer. If it doesn't (menu shadows, tooltips,...), try to send "Esc" key

collapse()
Displays all child nodes, controls, or content of the control

An interface to Collapse method of the ExpandCollapse control pattern.

expand()
Displays all child nodes, controls, or content of the control

An interface to Expand method of the ExpandCollapse control pattern.

friendly_class_name()
Return the friendly class name for the control

This differs from the class of the control in some cases. class_name() is the actual 'Registered' window class of the control while friendly_class_name() is hopefully something that will make more sense to the user.

For example Checkboxes are implemented as Buttons - so the class of a CheckBox is "Button" - but the friendly class is "CheckBox"

get_expand_state()
Indicates the state of the control: expanded or collapsed.

An interface to CurrentExpandCollapseState property of the ExpandCollapse control pattern. Values for enumeration as defined in uia_defines module: expand_state_collapsed = 0 expand_state_expanded = 1 expand_state_partially = 2 expand_state_leaf_node = 3

get_selection()
An interface to GetSelection of the SelectionProvider pattern

Retrieves a UI Automation provider for each child element that is selected. Builds a list of UIAElementInfo elements from all retrieved providers.

get_show_state()
Get the show state and Maximized/minimzed/restored state

Returns values as following

window_visual_state_normal = 0 window_visual_state_maximized = 1 window_visual_state_minimized = 2

has_keyboard_focus()
Return True if the element is focused with keyboard

iface_expand_collapse = None

iface_grid = None

iface_grid_item = None

iface_invoke = None

iface_item_container = None

iface_range_value = None

iface_scroll = None

iface_scroll_item = None

iface_selection = None

iface_selection_item = None

iface_table = None

iface_table_item = None

iface_text = None

iface_toggle = None

iface_transform = None

iface_transformV2 = None

iface_value = None

iface_virtualized_item = None

iface_window = None

invoke()
An interface to the Invoke method of the Invoke control pattern

is_active()
Whether the window is active or not

is_collapsed()
Test if the control is collapsed

is_dialog()
Return true if the control is a dialog window (WindowPattern interface is available)

is_expanded()
Test if the control is expanded

is_keyboard_focusable()
Return True if the element can be focused with keyboard

is_maximized()
Indicate whether the window is maximized or not

is_minimized()
Indicate whether the window is minimized or not

is_normal()
Indicate whether the window is normal (i.e. not minimized and not maximized)

is_selected()
Indicate that the item is selected or not.

Only items supporting SelectionItem pattern should answer. Raise NoPatternInterfaceError if the pattern is not supported

Usually applied for controls like: a radio button, a tree view item, a list item.

is_selection_required()
An interface to IsSelectionRequired property of the SelectionProvider pattern.

This property can be dynamic. For example, the initial state of a control might not have any items selected by default, meaning that IsSelectionRequired is FALSE. However, after an item is selected the control must always have at least one item selected.

legacy_properties()
Get the element's LegacyIAccessible control pattern interface properties

maximize()
Maximize the window

Only controls supporting Window pattern should answer

menu_select(*path*, *exact=False*)
Select a menu item specified in the path

The full path syntax is specified in: `pywinauto.menuwrapper.Menu.get_menu_path()`

There are usually at least two menu bars: "System" and "Application" System menu bar is a standard window menu with items like: 'Restore', 'Move', 'Size', 'Minimize', e.t.c. This menu bar usually has a "Title Bar" control as a parent. Application menu bar is often what we look for. In most cases, its parent is the dialog itself so it should be found among the direct children of the dialog. Notice that we don't use "Application" string as a title criteria because it couldn't work on applications with a non-english localization. If there is no menu bar has been found we fall back to look up for Menu control. We try to find the control through all descendants of the dialog

minimize()
Minimize the window

Only controls supporting Window pattern should answer

restore()
Restore the window to normal size

Only controls supporting Window pattern should answer

scroll(*direction*, *amount*, *count=1*, *retry_interval=0.1*)
Ask the control to scroll itself

direction can be any of "up", "down", "left", "right" **amount** can be only "line" or "page" **count** (optional) the number of times to scroll **retry_interval** (optional) interval between scroll actions

select()
Select the item

Only items supporting SelectionItem pattern should answer. Raise NoPatternInterfaceError if the pattern is not supported

Usually applied for controls like: a radio button, a tree view item or a list item.

selected_item_index()
Return the index of a selected item

set_focus()
Set the focus to this element

writable_props
Extend default properties list.

class pywinauto.controls.uiawrapper.**UiaMeta**(*name*, *bases*, *attrs*)
Bases: *pywinauto.base_wrapper.BaseMeta*

Metaclass for UiaWrapper objects

static find_wrapper(*element*)
Find the correct wrapper for this UIA element

pywinauto.controls.uiawrapper.**lazy_property**
alias of *LazyProperty*

pywinauto.controls.uia_controls

Wrap various UIA windows controls

class pywinauto.controls.uia_controls.**ButtonWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap a UIA-compatible Button, CheckBox or RadioButton control

click()
Click the Button control by using Invoke pattern

get_toggle_state()
Get a toggle state of a check box control.

The toggle state is represented by an integer 0 - unchecked 1 - checked 2 - indeterminate

The following constants are defined in the uia_defines module toggle_state_off = 0 toggle_state_on = 1 toggle_state_inderteminate = 2

is_dialog()
Buttons are never dialogs so return False

toggle()
An interface to Toggle method of the Toggle control pattern.

Control supporting the Toggle pattern cycles through its toggle states in the following order: ToggleState_On, ToggleState_Off and, if supported, ToggleState_Indeterminate

Usually applied for the check box control.

The radio button control does not implement IToggleProvider, because it is not capable of cycling through its valid states. Toggle a state of a check box control. (Use 'select' method instead) Notice, a radio button control isn't supported by UIA. https://msdn.microsoft.com/en-us/library/windows/desktop/ee671290(v=vs.85).aspx

class pywinauto.controls.uia_controls.**ComboBoxWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap a UIA CoboBox control

item_count()
Return the number of items in the combobox

The interface is kept mostly for a backward compatibility with the native ComboBox interface

select(*item*)
Select the ComboBox item

The item can be either a 0 based index of the item to select or it can be the string that you want to select

selected_index()
Return the selected index

selected_text()
Return the selected text or None

Notice, that in case of multi-select it will be only the text from a first selected item

texts()
Return the text of the items in the combobox

class pywinauto.controls.uia_controls.**EditWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Edit control

get_line(*line_index*)
Return the line specified

get_value()
Return the current value of the element

has_title = False

line_count()
Return how many lines there are in the Edit

line_length(*line_index*)
Return how many characters there are in the line

select(*start=0*, *end=None*)
Set the edit selection of the edit control

selection_indices()
The start and end indices of the current selection

set_edit_text(*text*, *pos_start=None*, *pos_end=None*)
Set the text of the edit control

set_text(*text*, *pos_start=None*, *pos_end=None*)
Set the text of the edit control

set_window_text(*text*, *append=False*)
Override set_window_text for edit controls because it should not be used for Edit controls.

Edit Controls should either use set_edit_text() or type_keys() to modify the contents of the edit control.

text_block()
Get the text of the edit control

texts()
Get the text of the edit control

writable_props
Extend default properties list.

class pywinauto.controls.uia_controls.**HeaderItemWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Header Item control

class pywinauto.controls.uia_controls.**HeaderWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Header control

class pywinauto.controls.uia_controls.**ListItemWrapper**(*elem*, *container=None*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible ListViewItem control

is_checked()
Return True if the ListItem is checked

Only items supporting Toggle pattern should answer. Raise NoPatternInterfaceError if the pattern is not supported

texts()
Return a list of item texts

class pywinauto.controls.uia_controls.**ListViewWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible ListView control

cell(*row*, *column*)
Return a cell in the ListView control

Only for controls with Grid pattern support
- **row** is an index of a row in the list.
- **column** is an index of a column in the specified row.

The returned cell can be of different control types. Mostly: TextBlock, ImageControl, EditControl, DataItem or even another layer of data items (Group, DataGrid)

column_count()
Return the number of columns

columns()
Get the information on the columns of the ListView

get_column(*col_index*)
Get the information for a column of the ListView

get_header_control()
Return Header control associated with the ListView

get_item(*row*)
Return an item of the ListView control
- **row** can be either an index of the row or a string with the text of a cell in the row you want returned.

get_item_rect(*item_index*)
Return the bounding rectangle of the list view item

The method is kept mostly for a backward compatibility with the native ListViewWrapper interface

get_items()
Return all items of the ListView control

get_selected_count()
Return a number of selected items

The call can be quite expensieve as we retrieve all the selected items in order to count them

item(*row*)
Return an item of the ListView control
- **row** can be either an index of the row or a string with the text of a cell in the row you want returned.

item_count()
A number of items in the ListView

items()
Return all items of the ListView control

texts()
Return a list of item texts

writable_props
Extend default properties list.

class pywinauto.controls.uia_controls.**MenuItemWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible MenuItem control

items()
Find all items of the menu item

select()
Apply Select pattern

class pywinauto.controls.uia_controls.**MenuWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible MenuBar or Menu control

item_by_index(*idx*)
Find a menu item specified by the index

item_by_path(*path*, *exact=False*)
Find a menu item specified by the path

The full path syntax is specified in: controls.menuwrapper.Menu.get_menu_path()

Note: $ - specifier is not supported

items()
Find all menu items

class pywinauto.controls.uia_controls.**SliderWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Slider control

has_title = False

large_change()
Get a large change of slider's thumb

This change is achieved by pressing PgUp and PgDown keys when slider's thumb has keyboard focus.

max_value()
Get the maximum value of the Slider

min_value()
Get the minimum value of the Slider

set_value(*value*)
Set position of slider's thumb

small_change()
Get a small change of slider's thumb

This change is achieved by pressing left and right arrows when slider's thumb has keyboard focus.

value()
Get a current position of slider's thumb

class pywinauto.controls.uia_controls.**TabControlWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Tab control

get_selected_tab()
Return an index of a selected tab

select(*item*)
Select a tab by index or by name

tab_count()
Return a number of tabs

texts()
Tabs texts

class pywinauto.controls.uia_controls.**ToolbarWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible ToolBar control

The control's children usually are: Buttons, SplitButton, MenuItems, ThumbControls, TextControls, Separators, CheckBoxes. Notice that ToolTip controls are children of the top window and not of the toolbar.

button(*button_identifier*, *exact=True*)
Return a button by the specified identifier
- **button_identifier** can be either an index of a button or a string with the text of the button.
- **exact** flag specifies if the exact match for the text look up has to be applied.

button_count()
Return a number of buttons on the ToolBar

check_button(*button_identifier*, *make_checked*, *exact=True*)
Find where the button is and toggle it
- **button_identifier** can be either an index of the button or a string with the text on the button.
- **make_checked** specifies the required toggled state of the button. If the button is already in the specified state the state isn't changed.
- **exact** flag specifies if the exact match for the text look up has to be applied

texts()
Return texts of the Toolbar

writable_props
Extend default properties list.

class pywinauto.controls.uia_controls.**TooltipWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Tooltip control

class pywinauto.controls.uia_controls.**TreeItemWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible TreeItem control

In addition to the provided methods of the wrapper additional inherited methods can be especially helpful: select(), extend(), collapse(), is_extended(), is_collapsed(), click_input(), rectangle() and many others

ensure_visible()
Make sure that the TreeView item is visible

get_child(*child_spec*, *exact=False*)
Return the child item of this item

Accepts either a string or an index. If a string is passed then it returns the child item with the best match for the string.

is_checked()
Return True if the TreeItem is checked

Only items supporting Toggle pattern should answer. Raise NoPatternInterfaceError if the pattern is not supported

sub_elements()
Return a list of all visible sub-items of this control

class pywinauto.controls.uia_controls.**TreeViewWrapper**(*elem*)
Bases: *pywinauto.controls.uiawrapper.UIAWrapper*

Wrap an UIA-compatible Tree control

get_item(*path*, *exact=False*)
Read a TreeView item

- **path** a path to the item to return. This can be one of the following:
  - A string separated by \ characters. The first character must be \. This string is split on the \ characters and each of these is used to find the specific child at each level. The \ represents the root item - so you don't need to specify the root itself.
  - A list/tuple of strings - The first item should be the root element.
  - A list/tuple of integers - The first item the index which root to select. Indexing always starts from zero: get_item((0, 2, 3))
- **exact** a flag to request exact match of strings in the path or apply a fuzzy logic of best_match thus allowing non-exact path specifiers

item_count()
Return a number of items in TreeView

print_items()
Print all items with line indents

roots()
Return root elements of TreeView

writable_props
Extend default properties list.

Pre-supplied Tests

pywinauto.tests.allcontrols

Get All Controls Test

What is checked This test does no actual testing it just returns each control.

How is it checked A loop over all the controls in the dialog is made and each control added to the list of bugs

When is a bug reported For each control.

Bug Extra Information There is no extra information associated with this bug type

Is Reference dialog needed No,but if available the reference control will be returned with the localised control.

False positive bug reports Not possible

Test Identifier The identifier for this test/bug is "AllControls"

`pywinauto.tests.allcontrols.`**`AllControlsTest`**(*windows*)
Returns just one bug for each control

pywinauto.tests.asianhotkey

Asian Hotkey Format Test

What is checked

This test checks whether the format for shortcuts/hotkeys follows the standards for localised Windows applications. This format is {localised text}({uppercase hotkey}) so for example if the English control is "&Help" the localised control for Asian languages should be "LocHelp(H)"

How is it checked

After checking whether this control displays hotkeys it examines the 1st string of the control to make sure that the format is correct. If the reference control is available then it also makes sure that the hotkey character is the same as the reference. Controls with a title of less than 4 characters are ignored. This has been done to avoid false positive bug reports for strings like "&X:".

When is a bug reported

A bug is reported when a control has a hotkey and it is not in the correct format. Also if the reference control is available a bug will be reported if the hotkey character is not the same as used in the reference

Bug Extra Information

This test produces 2 different types of bug: BugType: "AsianHotkeyFormat" There is no extra information associated with this bug type

BugType: "AsianHotkeyDiffRef"

There is no extra information associated with this bug type

Is Reference dialog needed

The reference dialog is not needed. If it is unavailable then only bugs of type "AsianHotkeyFormat" will be reported, bug of type "AsianHotkeyDiffRef" will not be found.

False positive bug reports

There should be very few false positive bug reports when testing Asian software. If a string is very short (eg "&Y:") but is padded with spaces then it will get reported.

Test Identifier

The identifier for this test/bug is "AsianHotkeyTests"

pywinauto.tests.asianhotkey.**AsianHotkeyTest**(*windows*)
Return the repeated hotkey errors

pywinauto.tests.comboboxdroppedheight

ComboBox dropped height Test

What is checked It is ensured that the height of the list displayed when the combobox is dropped down is not less than the height of the reference.

How is it checked The value for the dropped rectangle can be retrieved from windows. The height of this rectangle is calculated and compared against the reference height.

When is a bug reported If the height of the dropped rectangle for the combobox being checked is less than the height of the reference one then a bug is reported.

Bug Extra Information There is no extra information associated with this bug type

Is Reference dialog needed The reference dialog is necessary for this test.

False positive bug reports No false bugs should be reported. If the font of the localised control has a smaller height than the reference then it is possible that the dropped rectangle could be of a different size.

Test Identifier The identifier for this test/bug is "ComboBoxDroppedHeight"

pywinauto.tests.comboboxdroppedheight.**ComboBoxDroppedHeightTest**(*windows*)
Check if each combobox height is the same as the reference

pywinauto.tests.comparetoreffont

Compare against reference font test

What is checked This test checks all the parameters of the font for the control against the font for the reference control. If any value is different then this is reported as a bug. Here is a list of all the possible values that are tested: lfFaceName The name of the font lfHeight The height of the font lfWidth Average width of characters lfEscapement Angle of text lfOrientation Another angle for the text! lfWeight How bold the text is lfItalic If the font is italic lfUnderline If the font is underlined lfStrikeOut If the font is struck out lfCharSet The character set of the font lfOutPrecision The output precision lfClipPrecision The clipping precision lfQuality The output quality lfPitchAndFamily The pitch and family

How is it checked Each property of the font for the control being tested is compared against the equivalent property of the reference control font for equality.

When is a bug reported For each property of the font that is not identical to the reference font a bug is reported. So for example if the Font Face has changed and the text is bold then (at least) 2 bugs will be reported.

Bug Extra Information The bug contains the following extra information Name Description ValueType What value is incorrect (see above), String Ref The reference value converted to a string, String Loc The localised value converted to a string, String

Is Reference dialog needed This test will not run if the reference controls are not available.

False positive bug reports Running this test for Asian languages will result in LOTS and LOTS of false positives, because the font HAS to change for the localised text to display properly.

Test Identifier The identifier for this test/bug is "CompareToRefFont"

pywinauto.tests.comparetoreffont.**CompareToRefFontTest**(*windows*)
Compare the font to the font of the reference control

pywinauto.tests.leadtrailspaces

Different Leading and Trailing Spaces Test

What is checked Checks that the same space characters (<space>, <tab>, <enter>, <vertical tab>) are before and after all non space characters in the title of the control when compared to the reference control.

How is it checked Find the 1st non-space character, and the characters of the title up to that are the leading spaces. Find the last non-space character, and the characters of the title after that are the trailing spaces. These are then compared to the lead and trail spaces from the reference control and if they are not exactly the then a bug is reported.

When is a bug reported When either the leading or trailing spaces of the control being tested does not match the equivalent spaces of the reference control exactly.

Bug Extra Information The bug contains the following extra information

- **Lead-Trail** Whether this bug report is for the leading or trailing spaces of the control, String

  This will be either:

  - "Leading" bug relating to leading spaces
  - "Trailing" bug relating to trailing spaces
- **Ref** The leading or trailings spaces of the reference string (depending on Lead-Trail value), String
- **Loc** The leading or trailings spaces of the local string (depending on Lead-Trail value), String

Is Reference dialog needed This test will not run if the reference controls are not available.

False positive bug reports This is usually not a very important test, so if it generates many false positives then we should consider removing it.

Test Identifier The identifier for this test/bug is "LeadTrailSpaces"

pywinauto.tests.leadtrailspaces.**GetLeadSpaces**(*title*)
Return the leading spaces of the string

pywinauto.tests.leadtrailspaces.**GetTrailSpaces**(*title*)
Return the trailing spaces of the string

pywinauto.tests.leadtrailspaces.**LeadTrailSpacesTest**(*windows*)
Return the leading/trailing space bugs for the windows

pywinauto.tests.miscvalues

Miscellaneous Control properties Test

What is checked This checks various values related to a control in windows. The values tested are class_name The class type of the control style The Style of the control (GetWindowLong) exstyle The Extended Style of the control (GetWindowLong) help_id The Help ID of the control (GetWindowLong) control_id The Control ID of the control (GetWindowLong) user_data The User Data of the control (GetWindowLong) Visibility Whether the control is visible or not

How is it checked After retrieving the information for the control we compare it to the same information from the reference control.

When is a bug reported If the information does not match then a bug is reported.

Bug Extra Information The bug contains the following extra information Name Description ValueType What value is incorrect (see above), String Ref The reference value converted to a string, String Loc The localised value converted to a string, String

Is Reference dialog needed This test will not run if the reference controls are not available.

False positive bug reports Some values can change easily without any bug being caused, for example User Data is actually meant for programmers to store information for the control and this can change every time the software is run.

Test Identifier The identifier for this test/bug is "MiscValues"

pywinauto.tests.miscvalues.**MiscValuesTest**(*windows*)
Return the bugs from checking miscelaneous values of a control

pywinauto.tests.missalignment

Missalignment Test

What is checked This test checks that if a set of controls were aligned on a particular axis in the reference dialog that they are all aligned on the same axis.

How is it checked A list of all the reference controls that are aligned is created (ie more than one control with the same Top, Left, Bottom or Right coordinates). These controls are then analysed in the localised dialog to make sure that they are all aligned on the same axis.

When is a bug reported A bug is reported when any of the controls that were aligned in the reference dialog are no longer aligned in the localised control.

Bug Extra Information The bug contains the following extra information Name Description AlignmentType This is either LEFT, TOP, RIGHT or BOTTOM. It tells you how the controls were aligned in the reference dialog. String AlignmentRect Gives the smallest rectangle that surrounds ALL the controls concerned in the bug, rectangle

Is Reference dialog needed This test cannot be performed without the reference control. It is required to see which controls should be aligned.

False positive bug reports It is quite possible that this test reports false positives: 1. Where the controls only just happen to be aligned in the reference dialog (by coincidence) 2. Where the control does not have a clear boundary (for example static labels or checkboxes) they may be miss-aligned but it is not noticeable that they are not.

Test Identifier The identifier for this test/bug is "Missalignment"

pywinauto.tests.missalignment.**MissalignmentTest**(*windows*)
Run the test on the windows passed in

pywinauto.tests.missingextrastring

Different number of special character sequences Test

What is checked This test checks to make sure that certain special character sequences appear the in the localised if they appear in the reference title strings. These strings usually mean something to the user but the software internally does not care if they exist or not. The list that is currently checked is: ">>", ">", "<<", "<", ":"(colon), "...", "&&", "&", ""

How is it checked For each of the string to check for we make sure that if it appears in the reference that it also appears in the localised title.

When is a bug reported

- If the reference has one of the text strings but the localised does not a bug is reported.
- If the localised has one of the text strings but the reference does not a bug is reported.

Bug Extra Information The bug contains the following extra information

MissingOrExtra Whether the characters are missing or extra from the controls being check as compared to the reference, (String with following possible values)

- "MissingCharacters" The characters are in the reference but not in the localised.
- "ExtraCharacters" The characters are not in the reference but are in the localised.

MissingOrExtraText What character string is missing or added, String

Is Reference dialog needed This test will not run if the reference controls are not available.

False positive bug reports Currently this test is at a beta stage filtering of the results is probably necessary at the moment.

Test Identifier The identifier for this test/bug is "MissingExtraString"

`pywinauto.tests.missingextrastring.`**`MissingExtraStringTest`**(*windows*)
Return the errors from running the test

pywinauto.tests.overlapping

Overlapping Test

What is checked The overlapping test checks for controls that occupy the same space as some other control in the dialog.

- If the reference controls are available check for each pair of controls:
  - If controls are exactly the same size and position in reference then make sure that they are also in the localised.
  - If a reference control is wholly contained in another make sure that the same happens for the controls being tested.
- If the reference controls are not available only the following check can be done
  - If controls are overlapped in localised report a bug (if reference is available it is used just to say if this overlapping happens in reference also)

How is it checked Various tests are performed on each pair of controls to see if any of the above conditions are met. The most specific tests that can be performed are done 1st so that the bugs reported are as specific as possible. I.e. we report that 2 controls are not exactly overlapped when they should be rather than jut reporting that they are overlapped which contains less information.

When is a bug reported A bug is reported when:

- controls are overlapped (but not contained wholly, and not exactly overlapped)
- reference controls are exactly overlapped but they are not in tested dialog
- one reference control is wholly contained in another but not in tested dialog

Bug Extra Information This test produces 3 different types of bug: BugType: "Overlapping" Name Description OverlappedRect <What this info is>, rectangle

BugType - "NotContainedOverlap" There is no extra information associated with this bug type

BugType - "NotExactOverlap" There is no extra information associated with this bug type

Is Reference dialog needed For checking whether controls should be exactly overlapped and whether they should be wholly contained the reference controls are necessary. If the reference controls are not available then only simple overlapping of controls will be checked.

False positive bug reports If there are controls in the dialog that are not visible or are moved dynamically it may cause bugs to be reported that do not need to be logged. If necessary filter out bugs with hidden controls.

Test Identifier The identifier for this test is "Overlapping"

class pywinauto.tests.overlapping.**OptRect**

pywinauto.tests.overlapping.**OverlappingTest**(*windows*)
Return the repeated hotkey errors

pywinauto.tests.repeatedhotkey

Repeated Hotkeys Test

What is checked This test checks all the controls in a dialog to see if there are controls that use the same hotkey character.

How is it checked A list of all the hotkeys (converted to uppercase) used in the dialog is created. Then this list is examined to see if any hotkeys are used more than once. If any are used more than once a list of all the controls that use this hotkey are compiled to be used in the bug report.

When is a bug reported If more than one control has the same hotkey then a bug is reported.

Bug Extra Information The bug contains the following extra information Name Description RepeatedHotkey This is the hotkey that is repeated between the 2 controls converted to uppercase, String CharsUsedInDialog This is a list of all the hotkeys used in the dialog, String AllCharsInDialog This is a list of all the characters in the dialog for controls that have a hotkeys, String AvailableInControlS A list of the available characters for each control. Any of the characters in this list could be used as the new hotkey without conflicting with any existing hotkey.

Is Reference dialog needed The reference dialog does not need to be available. If it is available then for each bug discovered it is checked to see if it is a problem in the reference dialog. NOTE: Checking the reference dialog is not so exact here! Only when the equivalent controls in the reference dialog all have the hotkeys will it be reported as being in the reference also. I.e. if there are 3 controls with the same hotkey in the Localised software then those same controls in the reference dialog must have the same hotkey for it to be reported as existing in the reference also.

False positive bug reports There should be very few false positives from this test. Sometimes a control only has one or 2 characters eg "X:" and it is impossible to avoid a hotkey clash. Also for Asian languages hotkeys should be the same as the US software so probably this test should be run on those languages.

Test Identifier The identifier for this test/bug is "RepeatedHotkey"

pywinauto.tests.repeatedhotkey.**GetHotkey**(*text*)
Return the position and character of the hotkey

pywinauto.tests.repeatedhotkey.**ImplementsHotkey**(*win*)
checks whether a control interprets & character to be a hotkey

pywinauto.tests.repeatedhotkey.**RepeatedHotkeyTest**(*windows*)
Return the repeated hotkey errors

pywinauto.tests.translation

Translation Test

What is checked This checks for controls which appear not to be translated.

How is it checked It compares the text of the localised and reference controls.

If there are more than string in the control then each item is searched for in the US list of titles (so checking is not order dependent). The indices for the untranslated strings are returned in a comma separated string. Also the untranslated strings themselves are returned (all as one string). These strings are not escaped and are delimited as "string1","string2",..."stringN".

When is a bug reported

If the text of the localised control is identical to the reference control (in case, spacing i.e. a binary compare) then it will be flagged as untranslated. Otherwise the control is treated as translated.

Note: This is the method to return the least number of bugs. If there are differences in any part of the string (e.g. a path or variable name) but the rest of the string is untranslated then a bug will not be highlighted

Bug Extra Information The bug contains the following extra information Name Description Strings The list of the untranslated strings as explained above StringIndices The list of indices (0 based) that are untranslated. This will usually be 0 but if there are many strings in the control untranslated it will report ALL the strings e.g. 0,2,5,19,23

Is Reference dialog needed The reference dialog is always necessary.

False positive bug reports False positive bugs will be reported in the following cases. - The title of the control stays the same as the US because the translation is the same as the English text(e.g. Name: in German) - The title of the control is not displayed (and not translated). This can sometimes happen if the programmer displays something else on the control after the dialog is created.

Test Identifier The identifier for this test/bug is "Translation"

pywinauto.tests.translation.**TranslationTest**(*windows*)
Returns just one bug for each control

pywinauto.tests.truncation

Truncation Test

What is checked Checks for controls where the text does not fit in the space provided by the control.

How is it checked There is a function in windows (DrawText) that allows us to find the size that certain text will need. We use this function with correct fonts and other relevant information for the control to be as accurate as possible.

When is a bug reported When the calculated required size for the text is greater than the size of the space available for displaying the text.

Bug Extra Information The bug contains the following extra information Name Description Strings The list of the truncated strings as explained above StringIndices The list of indices (0 based) that are truncated. This will often just be 0 but if there are many strings in the control untranslated it will report ALL the strings e.g. 0,2,5,19,23

Is Reference dialog needed The reference dialog does not need to be available. If it is available then for each bug discovered it is checked to see if it is a problem in the reference dialog.

False positive bug reports Certain controls do not display the text that is the title of the control, if this is not handled in a standard manner by the software then DLGCheck will report that the string is truncated.

Test Identifier The identifier for this test/bug is "Truncation"

pywinauto.tests.truncation.**TruncationTest**(*windows*)
Actually do the test

Backend Internal Implementation modules

pywinauto.backend

Back-end components storage (links to platform-specific things)

class pywinauto.backend.**BackEnd**(*name*, *element_info_class*, *generic_wrapper_class*)
Minimal back-end description (name & 2 required base classes)

class pywinauto.backend.**BackendsRegistry**
Registry pattern class for the list of available back-ends

element_class
Return *element_info.ElementInfo*'s subclass of the active backend

name
Name of the active backend

wrapper_class
BaseWrapper's subclass of the active backend

pywinauto.backend.**activate**(*name*)
Set active backend by name

Possible values of **name** are "win32", "uia" or other name registered by the *register()* function.

pywinauto.backend.**element_class**()
Return *element_info.ElementInfo*'s subclass of the active backend

pywinauto.backend.**name**()
Return name of the active backend

pywinauto.backend.**register**(*name*, *element_info_class*, *generic_wrapper_class*)
Register a new backend

pywinauto.backend.**wrapper_class**()
Return BaseWrapper's subclass of the active backend

pywinauto.element_info

Interface for classes which should deal with different backend elements

class pywinauto.element_info.**ElementInfo**
Abstract wrapper for an element

children(***kwargs*)
Return children of the element

class_name
Return the class name of the element

control_id
Return the ID of the control

descendants(**kwargs)
Return descendants of the element

dump_window()
Dump an element to a set of properties

enabled
Return True if the element is enabled

static filter_with_depth(*elements*, *root*, *depth*)
Return filtered elements with particular depth level relative to the root

framework_id
Return the framework of the element

handle
Return the handle of the element

has_depth(*root*, *depth*)
Return True if element has particular depth level relative to the root

iter_children(**kwargs)
Iterate over children of element

iter_descendants(**kwargs)
Iterate over descendants of the element

name
Return the name of the element

parent
Return the parent of the element

process_id
Return the ID of process that controls this element

rectangle
Return rectangle of element

rich_text
Return the text of the element

set_cache_strategy(*cached*)
Set a cache strategy for frequently used attributes of the element

visible
Return True if the element is visible

pywinauto.win32_element_info

pywinauto.uia_element_info

Implementation of the class to deal with an UI element (based on UI Automation API)

class pywinauto.uia_element_info.**UIAElementInfo**(*handle_or_elem=None*, *cache_enable=False*)

UI element wrapper for IUIAutomation API

automation_id
Return AutomationId of the element

children(***kwargs*)
Return a list of only immediate children of the element
- **kwargs** is a criteria to reduce a list by process, class_name, control_type, content_only and/or title.

class_name
Return class name of the element

control_id
Return ControlId of the element if it has a handle

control_type
Return control type of element

descendants(***kwargs*)
Return a list of all descendant children of the element
- **kwargs** is a criteria to reduce a list by process, class_name, control_type, content_only and/or title.

dump_window()
Dump window to a set of properties

element
Return AutomationElement's instance

enabled
Check if the element is enabled

framework_id
Return FrameworkId of the element

handle
Return handle of the element

iter_children(***kwargs*)
Return a generator of only immediate children of the element
- **kwargs** is a criteria to reduce a list by process, class_name, control_type, content_only and/or title.

name
Return name of the element

parent
Return parent of the element

process_id
Return ProcessId of the element

rectangle
Return rectangle of the element

rich_text
Return rich_text of the element

runtime_id
Return Runtime ID (hashable value but may be different from run to run)

set_cache_strategy(*cached=None*)
Setup a cache strategy for frequently used attributes

visible
Check if the element is visible

pywinauto.uia_element_info.**elements_from_uia_array**(*ptrs*, *cache_enable=False*)
Build a list of UIAElementInfo elements from IUIAutomationElementArray

pywinauto.uia_defines

Common UIA definitions and helper functions

class pywinauto.uia_defines.**IUIA**
Singleton class to store global COM objects from UIAutomationCore.dll

build_condition(*process=None*, *class_name=None*, *title=None*, *control_type=None*, *content_only=None*)
Build UIA filtering conditions

exception pywinauto.uia_defines.**NoPatternInterfaceError**
There is no such interface for the specified pattern

pywinauto.uia_defines.**get_elem_interface**(*element_info*, *pattern_name*)
A helper to retrieve an element interface by the specified pattern name

TODO: handle a wrong pattern name

pywinauto.hooks

Internal Modules

pywinauto.controlproperties

Wrap

class pywinauto.controlproperties.**ControlProps**(**args*, ***kwargs*)
Wrap controls read from a file to resemble hwnd controls

HasExStyle(*exstyle*)

HasStyle(*style*)

WindowText(**args*, ***kwargs*)

window_text()

class pywinauto.controlproperties.**FuncWrapper**(*value*)
Little class to allow attribute access to return a callable object

pywinauto.controlproperties.**GetMenuBlocks**(*ctrls*)

pywinauto.controlproperties.**MenuBlockAsControls**(*menuItems*, *parentage=None*)

pywinauto.controlproperties.**MenuItemAsControl**(*menuItem*)
Make a menu item look like a control for tests

pywinauto.controlproperties.**SetReferenceControls**(*controls*, *refControls*)
Set the reference controls for the controls passed in

This does some minor checking as following:

- test that there are the same number of reference controls as controls - fails with an exception if there are not
- test if all the ID's are the same or not

pywinauto.handleprops

Functions to retrieve properties from a window handle

These are implemented in a procedural way so as to to be useful to other modules with the least conceptual overhead

pywinauto.handleprops.**children**(*handle*)
Return a list of handles to the children of this window

pywinauto.handleprops.**classname**(*handle*)
Return the class name of the window

pywinauto.handleprops.**clientrect**(*handle*)
Return the client rectangle of the control

pywinauto.handleprops.**contexthelpid**(*handle*)
Return the context help id of the window

pywinauto.handleprops.**controlid**(*handle*)
Return the ID of the control

pywinauto.handleprops.**dumpwindow**(*handle*)
Dump a window to a set of properties

pywinauto.handleprops.**exstyle**(*handle*)
Return the extended style of the window

pywinauto.handleprops.**font**(*handle*)
Return the font as a LOGFONTW of the window

pywinauto.handleprops.**has_enough_privileges**(*process_id*)
Check if target process has enough rights to query GUI actions

pywinauto.handleprops.**has_exstyle**(*handle*, *tocheck*)
Return True if the control has extended style tocheck

pywinauto.handleprops.**has_style**(*handle*, *tocheck*)
Return True if the control has style tocheck

pywinauto.handleprops.**is64bitbinary**(*filename*)
Check if the file is 64-bit binary

pywinauto.handleprops.**is64bitprocess**(*process_id*)
Return True if the specified process is a 64-bit process on x64

Return False if it is only a 32-bit process running under Wow64. Always return False for x86.

pywinauto.handleprops.**is_toplevel_window**(*handle*)
Return whether the window is a top level window or not

pywinauto.handleprops.**isenabled**(*handle*)
Return True if the window is enabled

pywinauto.handleprops.**isunicode**(*handle*)
Return True if the window is a Unicode window

pywinauto.handleprops.**isvisible**(*handle*)
Return True if the window is visible

pywinauto.handleprops.**iswindow**(*handle*)
Return True if the handle is a window

pywinauto.handleprops.**parent**(*handle*)
Return the handle of the parent of the window

pywinauto.handleprops.**processid**(*handle*)
Return the ID of process that controls this window

pywinauto.handleprops.**rectangle**(*handle*)
Return the rectangle of the window

pywinauto.handleprops.**style**(*handle*)
Return the style of the window

pywinauto.handleprops.**text**(*handle*)
Return the text of the window

pywinauto.handleprops.**userdata**(*handle*)
Return the value of any user data associated with the window

pywinauto.xml_helpers

pywinauto.fuzzydict

Match items in a dictionary using fuzzy matching

Implemented for pywinauto.

This class uses difflib to match strings. This class uses a linear search to find the items as it HAS to iterate over every item in the dictionary (otherwise it would not be possible to know which is the 'best' match).

If the exact item is in the dictionary (no fuzzy matching needed - then it doesn't do the linear search and speed should be similar to standard Python dictionaries.

```
>>> fuzzywuzzy = FuzzyDict({"hello" : "World", "Hiya" : 2, "Here you are" : 3})
>>> fuzzywuzzy['Me again'] = [1,2,3]
>>>
>>> fuzzywuzzy['Hi']
2
>>>
>>>
>>> # next one doesn't match well enough - so a key error is raised
...
>>> fuzzywuzzy['There']
Traceback (most recent call last):
  File "<stdin>", line 1, in ?
  File "pywinauto
```

```
    uzzydict.py", line 125, in __getitem__
        raise KeyError(
    KeyError: "'There'. closest match: 'hello' with ratio 0.400"
    >>>
    >>> fuzzywuzzy['you are']
    3
    >>> fuzzywuzzy['again']
    [1, 2, 3]
    >>>
```

class pywinauto.fuzzydict.**FuzzyDict**(*items=None*, *cutoff=0.6*)
Provides a dictionary that performs fuzzy lookup

pywinauto.actionlogger

pywinauto.actionlogger.**ActionLogger**
alias of _StandardLogger

pywinauto.actionlogger.**disable**()
Disable pywinauto logging actions

pywinauto.actionlogger.**enable**()
Enable pywinauto logging actions

pywinauto.actionlogger.**reset_level**()
Reset a logging level to a default

pywinauto.actionlogger.**set_level**(*level*)
Set a logging level for the pywinauto logger.

pywinauto.sysinfo

Simple module for checking whether Python and Windows are 32-bit or 64-bit

pywinauto.sysinfo.**is_x64_OS**()

pywinauto.sysinfo.**is_x64_Python**()

pywinauto.sysinfo.**os_arch**()

pywinauto.sysinfo.**python_bitness**()

pywinauto.remote_memory_block

Module containing wrapper around VirtualAllocEx/VirtualFreeEx Win32 API functions to perform custom marshalling

exception pywinauto.remote_memory_block.**AccessDenied**
Raised when we cannot allocate memory in the control's process

class pywinauto.remote_memory_block.**RemoteMemoryBlock**(*ctrl*, *size=4096*)
Class that enables reading and writing memory in a different process

Address()
Return the address of the memory block

CheckGuardSignature()
read guard signature at the end of memory block

CleanUp()
Free Memory and the process handle

Read(*data*, *address=None*, *size=None*)
Read data from the memory block

Write(*data*, *address=None*, *size=None*)
Write data into the memory block

CHAPTER 11

Indices and tables

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