Milestone 5 Documentation

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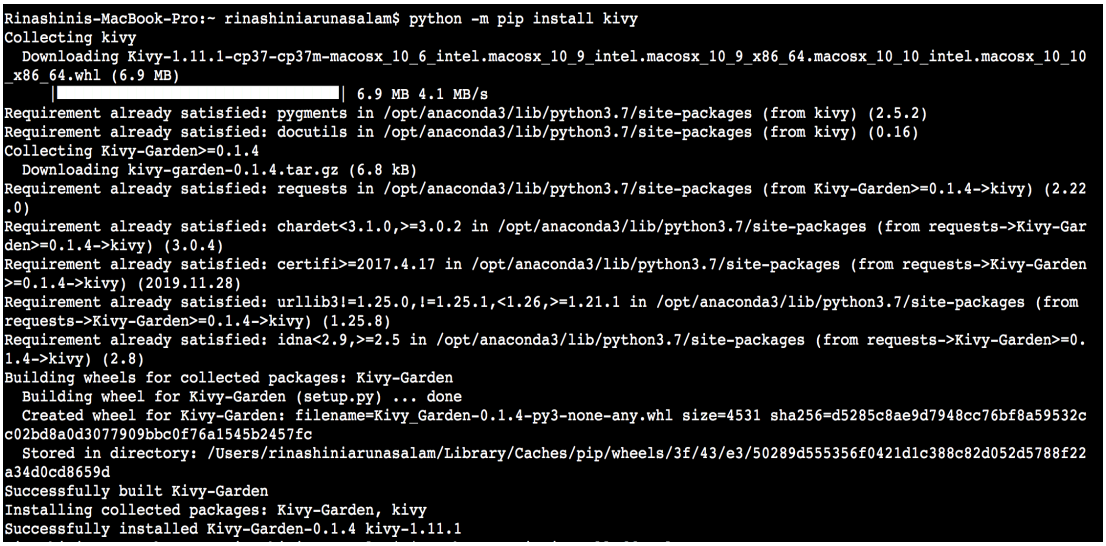
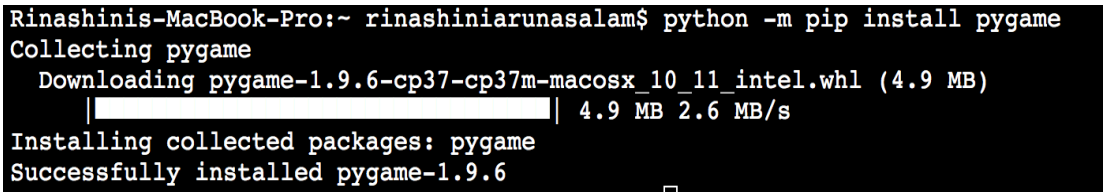
Github Link : https://github.com/RinashiniA/WQD7005-Group

Part A: Installing Kivy and its packages

1) Installing Kivy using pip install kivy as guided in the kivy website.



2) Installing pygame which is a Python wrapper module for the SDL multimedia library that contains python functions and classes that allow for keyboard and mouse inputs.



3) Upgrading pip wheel setuptools to ensure that we have the latest pip and wheel.

```
Rinashinis-MacBook-Pro:~ rinashiniarunasalam$ python -m pip install --upgrade pip wheel setuptools
Collecting pip
  Downloading pip-20.1.1-py2.py3-none-any.whl (1.5 MB)
     |████████████████████████████████| 1.5 MB 1.2 MB/s
Requirement already up-to-date: wheel in /opt/anaconda3/lib/python3.7/site-packages (0.34.2)
Collecting setuptools
  Downloading setuptools-47.3.1-py3-none-any.whl (582 kB)
     |████████████████████████████████| 582 kB 577 kB/s
Installing collected packages: pip, setuptools
  Attempting uninstall: pip
    Found existing installation: pip 20.0.2
    Uninstalling pip-20.0.2:
      Successfully uninstalled pip-20.0.2
  Attempting uninstall: setuptools
    Found existing installation: setuptools 46.0.0.post20200309
    Uninstalling setuptools-46.0.0.post20200309:
      Successfully uninstalled setuptools-46.0.0.post20200309
Successfully installed pip-20.1.1 setuptools-47.3.1
```

4) Installing graph from the garden package which will be used when computing and displaying of graphs.

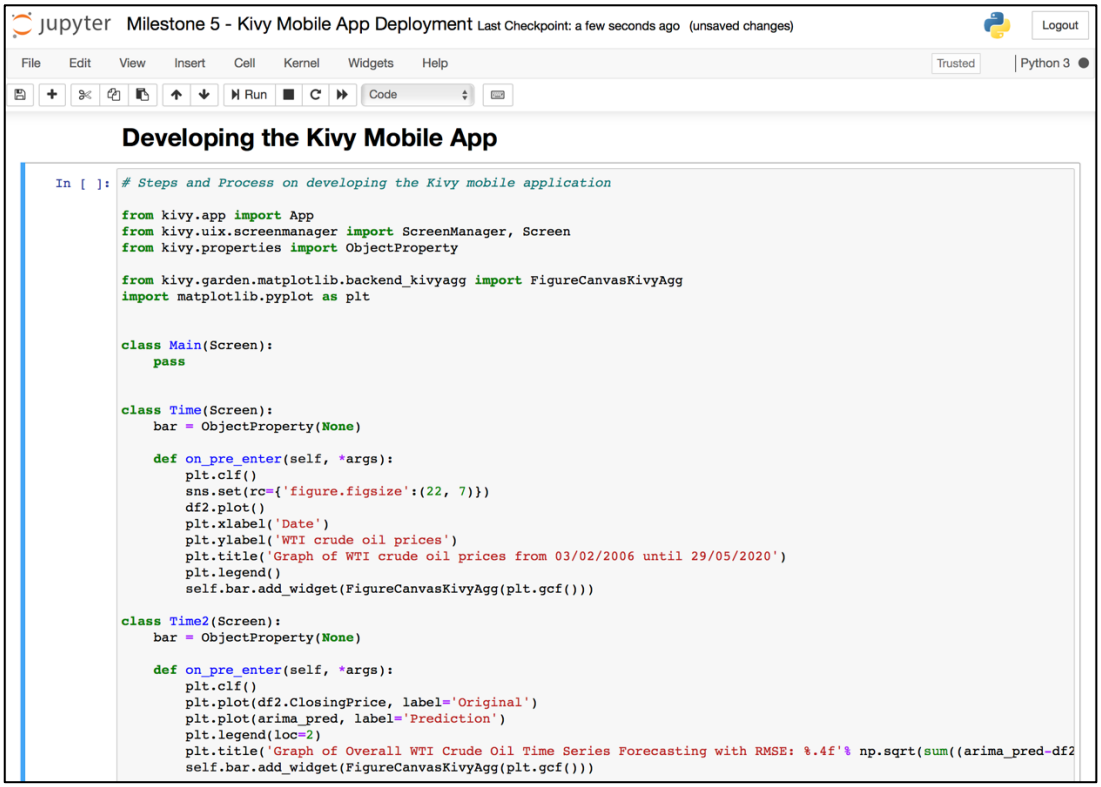
```
(base) Rinashinis-MacBook-Pro:~ rinashiniarunasalam$ garden install graph
[INFO    ] [Logger      ] Record log in /Users/rinashiniarunasalam/.kivy/logs/kivy_20-06-17_19.txt
[INFO    ] [Kivy        ] v2.0.0rc3, git-Unknown, 20200617
[INFO    ] [Kivy        ] Installed at "/opt/anaconda3/lib/python3.7/site-packages/kivy/__init__.py"
[INFO    ] [Python      ] v3.7.6 (default, Jan  8 2020, 13:42:34)
[Clang 4.0.1 (tags/RELEASE_401/final)]
[INFO    ] [Python      ] Interpreter at "/opt/anaconda3/bin/python"
Downloading http://github.com/kivy-garden/garden.graph/archive/master.zip ...
Progression 1024 |
Progression 2048 /
Progression 3072 -
Progression 4096 \
Progression 5120 |
Progression 6144 /
Progression 7168 -
Progression 8192 \
Progression 9216 |
Progression 10240 /
Progression 11264 -
Progression 12288 \
Progression 13312 |
Progression 14336 /
Progression 15360 -
Progression 16384 \
Progression 17408 |
Progression 18432 /
Progression 19456 -
Progression 20480 \
Progression 21504 |
Progression 22528 /
Progression 23552 -
Progression 24576 \
Progression 25600 |
Progression 26624 /
Progression 27648 -
Progression 28672 \
Progression 29696 |
Progression 30720 /
Progression 31744 -
```

5) Installing matplotlib from the garden package.

```
(base) Rinashinis-MacBook-Pro:~ rinashiniarunasalam$ garden install matplotlib
[INFO    ] [Logger      ] Record log in /Users/rinashiniarunasalam/.kivy/logs/kivy_20-06-17_22.txt
[INFO    ] [Kivy        ] v2.0.0rc3, git-Unknown, 20200617
[INFO    ] [Kivy        ] Installed at "/opt/anaconda3/lib/python3.7/site-packages/kivy/__init__.py"
[INFO    ] [Python      ] v3.7.6 (default, Jan  8 2020, 13:42:34)
[Clang 4.0.1 (tags/RELEASE_401/final)]
[INFO    ] [Python      ] Interpreter at "/opt/anaconda3/bin/python"
Downloading http://github.com/kivy-garden/garden.matplotlib/archive/master.zip ...
Progression 1024 |
Progression 2048 /
Progression 3072 -
Progression 4096 \
Progression 5120 |
Progression 6144 /
Progression 7168 -
Progression 8192 \
Progression 9216 |
Progression 10240 /
Progression 11264 -
Progression 12288 \
Progression 13312 |
Progression 14336 /
Progression 15360 -
Progression 16384 \
Progression 17408 |
Progression 18432 /
Progression 19456 -
Progression 20480 \
Progression 21300 |
Download done (21300 downloaded)
Extracting...
Installing new version...
Done! garden.matplotlib is installed at: /Users/rinashiniarunasalam/.kivy/garden/garden.matplotlib
Cleaning...
(base) Rinashinis-MacBook-Pro:~ rinashiniarunasalam$
```

Part B: Kivy App Jupyter Notebook and .kv file (as zipped)

1) Jupyter Notebook on codes to develop the Kivy Mobile App. The entire ipynb is as zipped.



2) The .kv file that helped to create the interface of the Kivy Mobile App. The entire .kv file is as zipped.

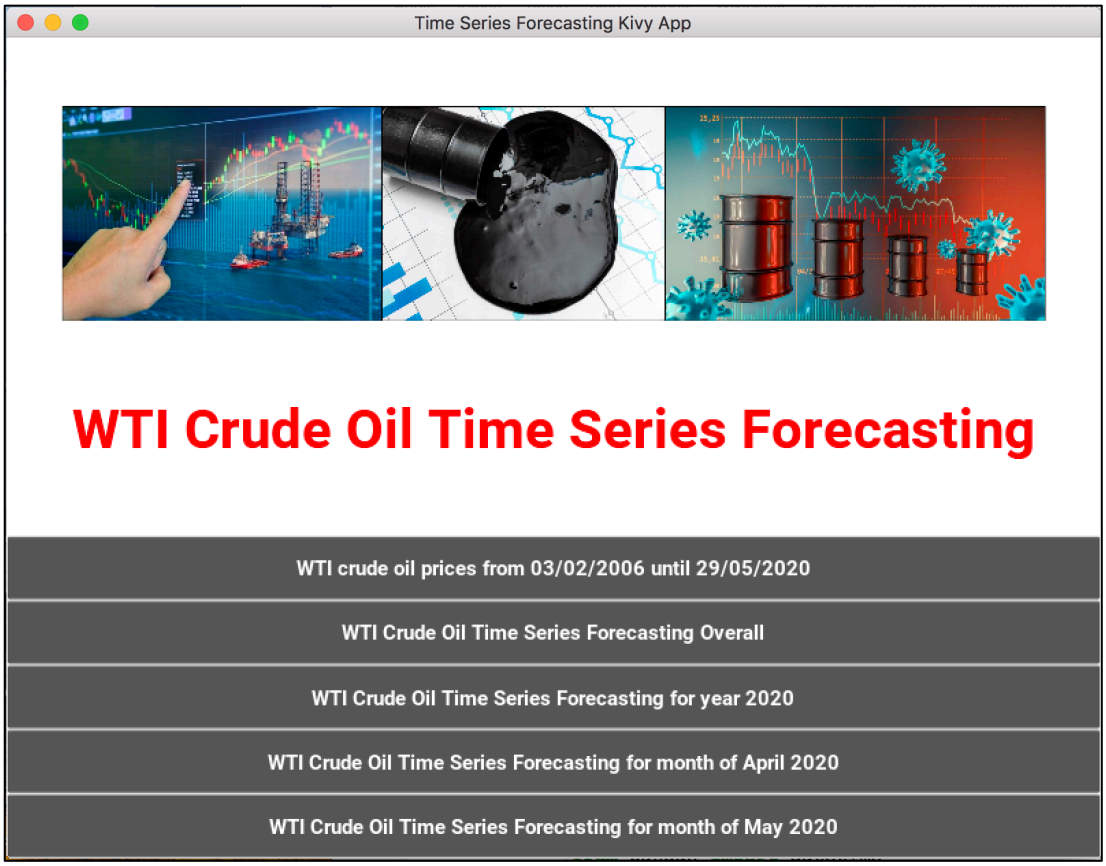
jupyter timeseries.kv ✔ an hour ago

File Edit View Language

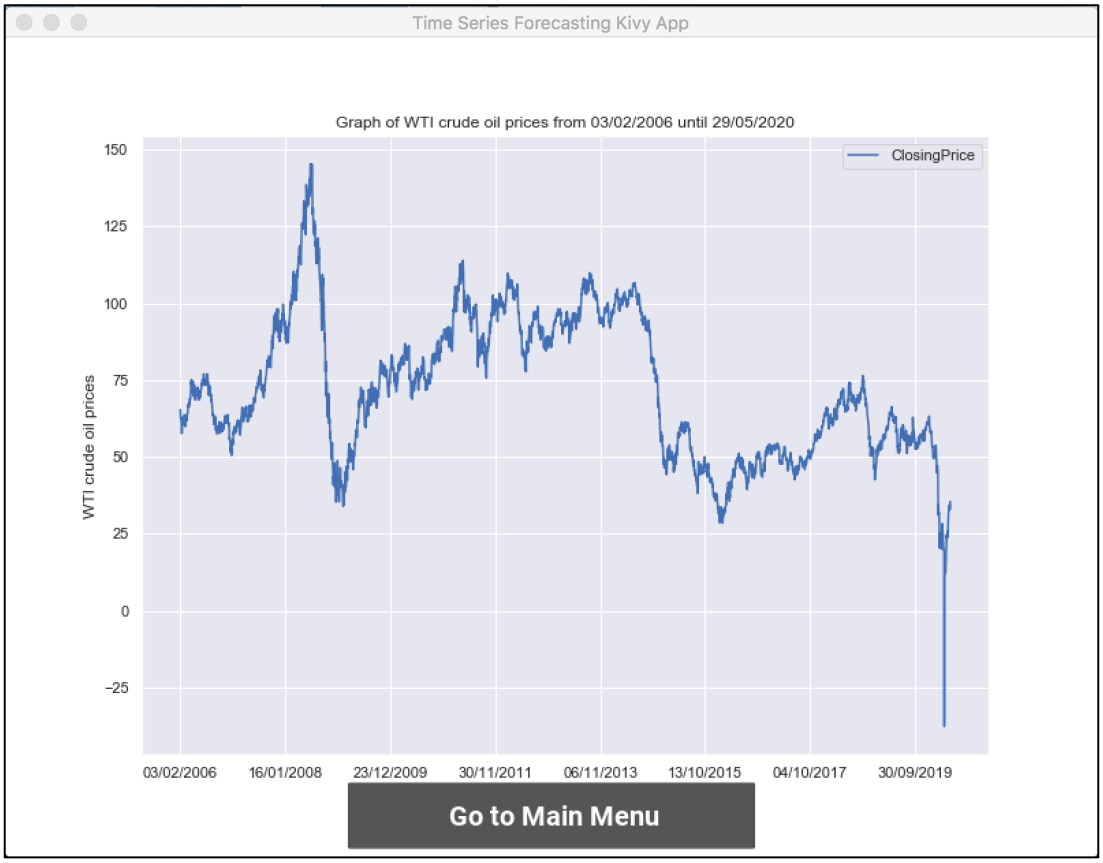
```
#:kivy 1.11.0
#:import SlideTransition kivy.uix.screenmanager.SlideTransition

<Manager>:
    transition: SlideTransition()

    Main:
        name: 'Main'

    Time:
        name: 'Time'

    Time2:
        name: 'Time2'

    Time3:
        name: 'Time3'

    Time4:
        name: 'Time4'

    Time5:
        name: 'Time5'

<Main>:

    BoxLayout:
        canvas.before:
            Color:
                rgba: 1, 1, 1, 1
            Rectangle:
                size: self.size
        orientation: 'vertical'
        padding: 0,50,0,0

        Image:
            source: 'CrudeOil2.png'
            size: self.texture_size

        Label:
            text: 'WTI Crude Oil Time Series Forecasting'
```

Part C: Kivy App Deployment Result

1) Main page (slide) which contains the buttons that will link to the graphs of WTI Crude Oil Prices over the years as well as the WTI Crude Oil Time Series forecasting models when clicked.

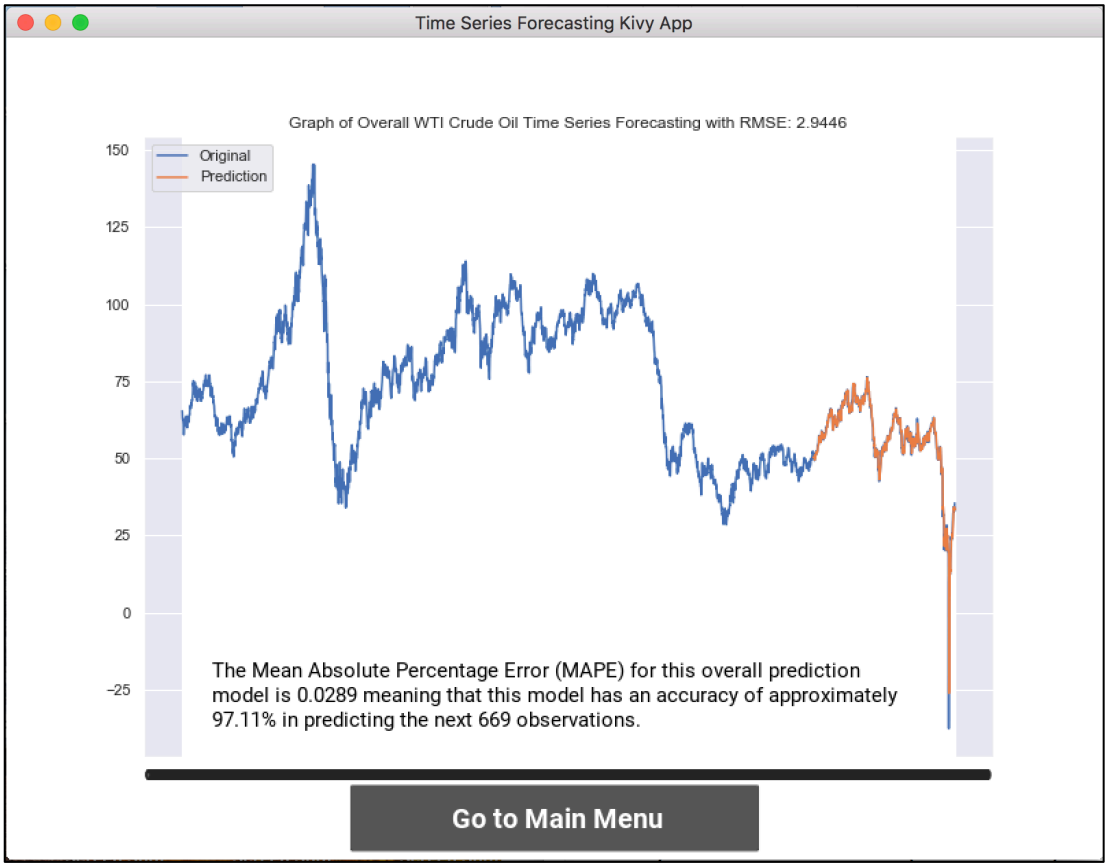


2) The first button (when clicked) will move to the next page (slide) that displays the graph of WTI Crude Oil closing prices from the year 2006 until May 2020.



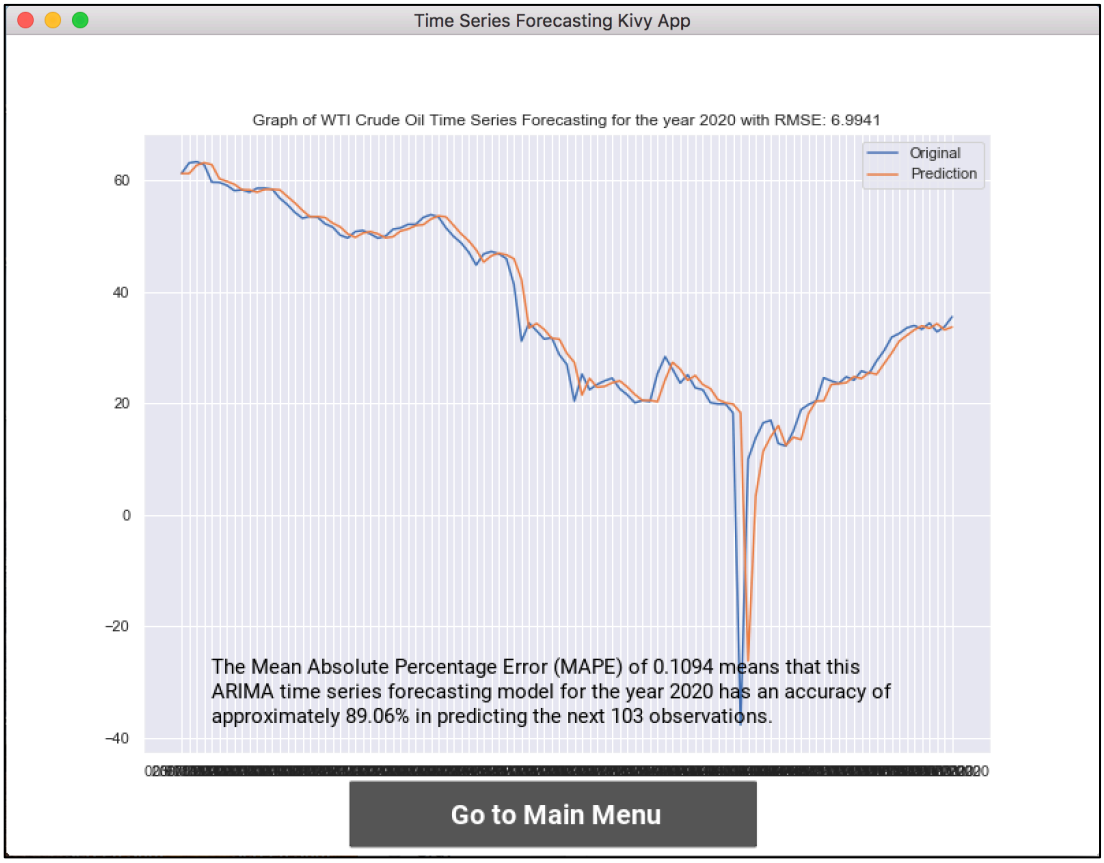
3) To move over to the second button from the main page, the “Go to Main Menu” button has to be clicked. It will then take us to the main screen to which the second button that will display the overall WTI Time Series Forecasting can be clicked.

This graph shows the Overall WTI Crude Oil Time Series Forecasting Model for 669 observations where it has a Mean Absolute Percentage Error (MAPE) of 0.0289 which gives the model an accuracy level of 97.11%.



4) After clicking on to the “Go to Main Menu” button, next we will look at the WTI Crude Oil Forecasting Model for the year 2020 where we will predict the closing prices for the year 2020.

This graph shows the WTI Crude Oil Time Series Forecasting Model for the year 2020 with 103 observations where it has a Mean Absolute Percentage Error (MAPE) of 0.1094 which gives the model an accuracy level of 89.06%.

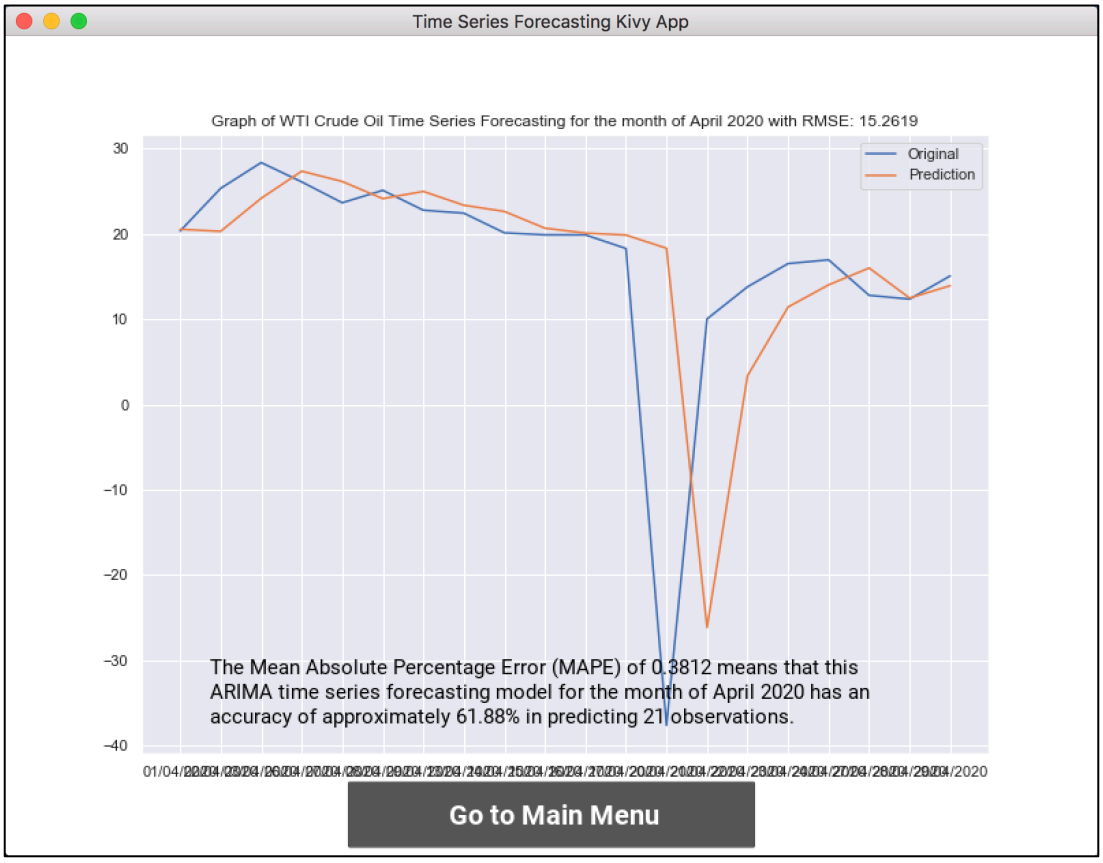


5) Looking further into the WTI Crude Oil Time Series Forecasting Model, in the next button when clicked will display the graph of WTI Crude Oil Forecasting Model for the month of April 2020.

This graph shows the WTI Crude Oil Time Series Forecasting Model for the month of April 2020 with 21 observations where it has a Mean Absolute Percentage Error (MAPE) of 0.3812 which gives the model an accuracy level of 61.88%.

A lower accuracy in forecasting was observed with 61.88% as compared to the accuracy level of the overall prediction model with 97.11% due to the sudden sharp collapse in oil demand in mid-April 2020 leaving the global market oversupplied with more than enough crude oil. The lack of oil demand is due to most countries experiencing lockdowns to overcome the Covid-19 outbreak. This then caused the price of the WTI crude oil to drop to levels of negative as shown in the plot as above.

At such, it was difficult to correctly predict the closing price of the WTI Crude Oil due to unforeseen circumstances. While if there isn't sudden external factors affecting the WTI Crude Oil price, the forecasting would've been easier and will have a higher accuracy level.



6) And the last button when clicked will display the WTI Crude Oil Forecasting Model for the month of May 2020 with 21 observations where it has a Mean Absolute Percentage Error (MAPE) of 0.0464 which gives the model an accuracy level of 95.36%.

While in the month of May 2020, we can observe a more stable increase in the price of WTI crude oil per barrel as countries are moving from tighter lockdowns to looser lockdowns due to most countries having reduced rise in the number of daily Covid-19 cases. Hence, the prediction of WTI crude oil price for the month of May 2020 is more stable with 95.36% accuracy as there isn't sudden external parameters impacting the price of WTI crude oil severely.