



PROCESS SCHEDULER

A DESKTOP APPLICATION TO VISUALIZE OS JOB/PROCESS SCHEDULING ALGORITHMS.

Developed By

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Overview

Process Scheduler is a desktop application to run and visualize the Job/Process Scheduling Algorithms. Users can enter the details of the algorithm and visualize how the algorithm works with the queue diagram animation.

Technical Specifications

Language: Python (with GUI Library - PyQt5)

IDE: VS Code

Goals

1. To solve the job scheduling algorithms for the given inputs.
2. To make users visualize the working of algorithms with queue diagram animation.

Installations Required

Python

Python is an interpreted, high-level and general-purpose programming language in which the whole project is designed and developed.

Follow the commands to install Python.

1. Select the version of Python and download Python Executable Installer from <https://www.python.org/downloads/>
2. Run Executable installer and make sure you select the checkboxes (if any of) '**Install launcher for all users**' and '**Add Python to PATH**'.
3. Verify Python was installed by the following steps:
 - 3.1. Navigate to the directory in which Python was installed on the system. In our case, it is C:\Users\Username\AppData\Local\Programs\Python\Python39 (in last one Python39, the numbers may change according to the version installed).
 - 3.2. Double-click **python.exe**.
 - 3.3. The output should be '**Python version Details**' (version will be like 3.9.3 and details will include time date and system details).
4. Verify Pip was installed by the following steps:

- 4.1. Open Start menu and type '**cmd**'.
- 4.2. Select the Command Prompt application.
- 4.3. Enter > **pip --version** (without '>') in the console.
- 4.4. If pip was installed successfully, output will be '**pip version from location**' (version will be like 21.0.3 and location will be where it is installed).
- 4.5. If pip is not installed follow steps mentioned below:
 - 4.5.1. Go to <https://bootstrap.pypa.io/get-pip.py>. Press right click and select save as and then press enter.
 - 4.5.2. Launch windows command prompt and navigate to the folder where the above file is downloaded.
 - 4.5.3. Type > **python get-pip.py** (without '>') to start pip installation.
 - 4.5.4. Check pip is installed by typing > **pip --version** (without '>') and it should return the current version of the platform.
5. Add Python Path to Environment variable by the following steps (**Optional**):
 - 5.1. Open Start menu and start the run app.
 - 5.2. Type **sysdm.cpl** and click OK. This opens the System Properties window.
 - 5.3. Navigate to the Advanced tab and select Environment Variables.
 - 5.4. Under System Variables, find and select the Path variable.
 - 5.5. Click Edit.
 - 5.6. Click New and paste the path where the python.exe file is located. (Eg: C:\Users\Username\AppData\Local\Programs\Python\Python39)
 - 5.7. Click OK and close all windows.
6. Install virtualEnv (**Optional**):
 - 6.1. Open the Start menu and type '**cmd**'
 - 6.2. Select the Command Prompt application.
 - 6.3. Type the following pip command in the console > **pip install virtualenv** (without '>')

PyQt5

PyQt5 is a comprehensive set of Python bindings for Qt v5. It is implemented as more than 35 extension modules and enables Python to be used as an alternative application development language to C++ **on all supported platforms including iOS and Android**. The GUI of the application is designed using PyQt5 **QtDesigner**.

Follow the commands to install PyQt5.

1. Open '**cmd**'.
2. Run command > **pip install pyqt5** (without '>').
3. Run command > **pip install pyqt5-tools** (without '>').
4. Go to your Python location (Eg: C:\Users\Username\AppData\Local\Programs\Python) and then go to:

Python38\Lib\site-packages\pyqt5_tools\Qt\bin. The whole path looks like:
 C:\Users\Username\AppData\Local\Programs\Python\Python38\Lib\site-packages\pyqt5_tools\Qt\bin (Replace Username with the name on your PC).

5. You can add
 'C:\Users\Username\AppData\Local\Programs\Python\Python38\Lib\site-packages\pyqt5_tools\Qt\bin', this path to your system environment variable to access '**designer**' from any corner of your PC (Replace Username with the name on your PC).
6. After adding to the environment variable, just open cmd and run > **designer** (without '>') to check successful installation.

If you find this error on opening '**designer**': "**PyQt5 Designer is not working: This application failed to start because no Qt platform plugin could be initialized**".

Follow the below steps to fix it:

1. Go to > Python38\Lib\site-packages\PyQt5\Qt\plugins.
2. In plugins, copy the '**platforms**' folder.
3. Now go to > Python38\Lib\site-packages\pyqt5_tools\Qt\bin.
4. Paste the '**platforms**' folder here. Do copy and replace.
5. Open cmd and run > **designer** (without '>') to check successful installation.

Other Required Libraries

There are some other dependencies which have been used to develop the application in order to provide more functionalities with an ease.

Follow the commands to install the additional libraries.

1. Open '**cmd**'.
2. To install a library, type the command > **pip install library-name** (without '>').
3. Replace library-name with the following list of libraries to install all the required libraries.

Libraries: matplotlib, pandas, xlswriter, win32com.

IDE (Optional)

Installation of IDE is not essential to view our project.

However, if you wish to view the code of the project, the following is a link to Visual Studio Code, which is a famous and commonly used IDE.

VS Code: <https://code.visualstudio.com/download>

Download and install the version suitable to your device specifications.

How to run

Follow the commands to run the application.

1. Download the zip file of the Project and extract it on your PC.
2. Open '**cmd**' and navigate into the folder of the project.
3. Run > **py ProcessScheduler.py** (without '>') and the Application Window will appear.

How to use

We have uploaded a working video of the project on Youtube which will give you all the information on how to use the process scheduler application and what all features are there.

Link of the video : YouTube Link

Even though below are the steps listed about how to use this application.

1. Select the **algorithm** in the drop down list.
2. Select the **mode** - preemptive/non-preemptive.
3. Select the **type** - with/without IOBT.
4. Set the **context switch** with the numeric spinbox(if required).
5. Set the **time quantum** with the numeric spinbox(only for RR).
6. Set the **number of jobs** with the numeric spinbox and click on the **Go** button.
7. Fill all the **required input fields** in the job input table and click on the **Solve** button.
8. For filling down the inputs, you can also fill in the excel file **inputs** which is located in the project folder and then import them in the application with the **Import** button.
9. Now you have all the calculated results and the queues are set with the jobs for the visualisation.
10. For type with IOBT algorithms, you can click on the **IO Gantt Chart** button to see the IO Gantt Chart.
11. You can click on the **Generate Graph** button to get the graph of Job vs in CPU time (and Job vs in IO Device time when type is with IOBT).
12. You can click on the **Download** button to get all the information for the given inputs into a **pdf** file which will get saved in the project folder.
13. You can click on the **Help** button to get any kind of help regarding the algorithm or the application.
14. You can play and operate the queue diagram visualization with the **Play/Pause/Next Step/Previous Step** buttons.

15. While the visualization is going on, a **progress bar** at the bottom of the application will indicate the progress of the algorithm in percentage.
16. After you are done with one set of inputs, you can set the algorithm information and reset the input fields with the **Reset** button and if the number of jobs differ, set the number of jobs and click on the **Go** button to start with the next set of inputs.

Specifications

There are total 7 algorithms implemented in this application:

1. First Come First Serve (FCFS)
2. Shortest Job First (SJF)
3. Shortest Remaining Time First (SRTF)
4. Round Robin (RR)
5. Longest Job First (LJF)
6. Longest Remaining Time First (LRTF)
7. Priority

For every algorithm, there are options for mode as preemptive or non-preemptive and type as with IOBT or without IOBT. You can also set the context switch time and time quantum wherever required for every algorithm.

Here is a brief description of all the features of the application which make it more innovative and unique:

Colors

For every job, a unique color is allotted which makes it easier to visualize the animation and study the Gantt Chart.

Import

A normal person is more used to MS Excel than our application. We have kept an excel sheet in the project folder where the table is already prepared, the user just needs to enter all the details over there and with the **import** button, the inputs will be filled in the application window.

Graph

After the inputs are given and the solve button is clicked, the user can click on the **generated graph** button which will display the graph of Job vs in CPU time (and Job vs in IO Device time).

Download

If any algorithm is solved, with the **download** button, all the information like the output table, Gantt chart, etc. will get downloaded in a PDF file into the project folder.

Gantt Chart

For every input when the algorithm is solved, a colorful Gantt chart is displayed at the bottom of the application window which tells at what time which job is in the CPU (or IO Device). If the algorithm is of type with IOBT, the IO Gantt chart is also displayed by clicking on the **IO Gantt chart** button.

Queue Diagram Animation

The bonus feature of the application is a timer based animation of queue diagram which demonstrates which job is present in which state at any time of the algorithm. With the **play** button, the user can start animation and if he/she wants to manually go and examine some particular steps, he/she can pause the animation with **pause** button and traverse to particular step with **next step** and **previous step** button. And the progress of an algorithm is displayed by a **progress bar** at the bottom of the application window.

Future Work

Some more features can be implemented and added to make the application more better and user friendly. Here are those which can be a part of the application in future.

Compare All

Compare All button can be added which will run all the algorithms for the same input and give the statistics of which algorithm will perform the best for the given input. This will also include a single graph with plot for all the algorithms and a PDF download with all the statistical details for why a particular algorithm is better than other for the given inputs.

Univeratility with multiple IOBT

It is not that a job will only go once for IO Device, it can go as many times as it requires. So the input table can be extended with a button for each job to add multiple IOBT inputs.