

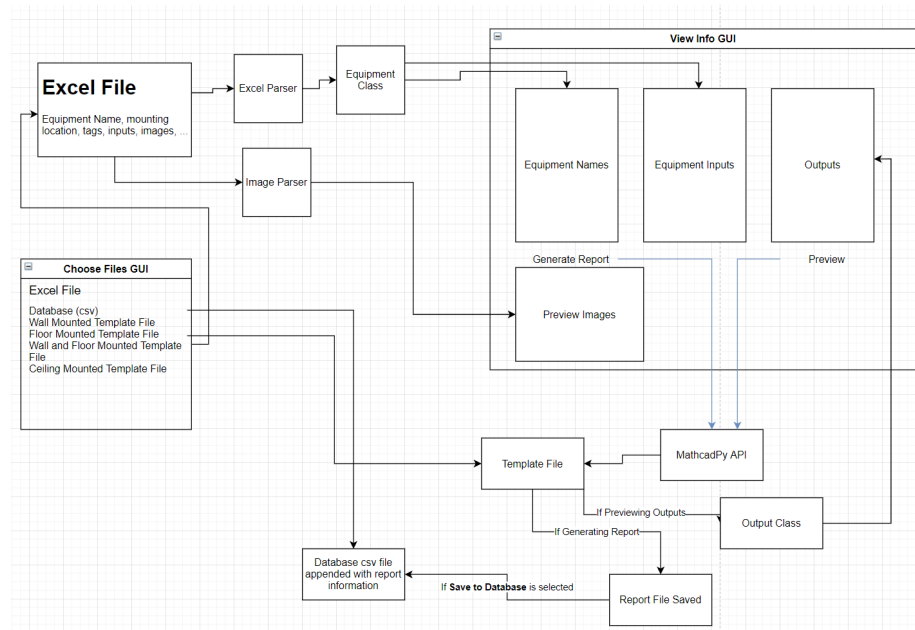
# Mathcad Anchorage Automation Software Developer's Documentation

Note: This is the developer documentation file. Use this as a reference to how the program is constructed.

## Technologies Used:

1. Python is the programming language of choice
2. PySimpleGUI : used to render the graphical user interface. Documentation
3. MathcadPy : wrapper written in python used to access the Mathcad api. Documentation
4. Openpyxl : used to interface with the excel documents. Documentation
5. Nuitka : used to package the application as an executable. Documentation
6. Look in `~/dist/requirements.txt` to view all the dependencies
7. Look in `~/dist/info.txt` for more information on how to package the application and how to re-create the python virtual environment.

## Flowchart:



## Outline:

1. Datatypes and storage of data
2. Connection between Excel document and Mathcad
3. Rendering to the GUI

## Documentation:

**Datatypes and Storage of Data** Equipment Class: (stores all the equipment from the excel file)

Class variables:

- **self.items** = list()
- **self.cur\_index** = 0
- **self.length** = 0
- **self.fields** = list()
- **self.names** = list()
- **self.inputs** = list()

Class methods:

- **append(self, to\_append:dict)** Takes in a dict as an argument
- **next\_index(self)** No arguments  
Increments the value of self.cur\_index
- **prev\_index(self)** No arguments  
Decriments the value of self.cur\_index

Outputs Class: (stores the values of the outputs when the user decides to preview the output variables from the Mathcad file)

Class variables:

- **self.items** = list()

Class methods:

- **append(self, to\_append)** Takes tuple or list argument
- **clear(self)**
- **display(self)->list** No arguments

**Excel and Mathcad** The MathcadPy library is used as a wrapper that allows you to access all of the mathcad api endpoints from the comfort of Python. You can read more about the Mathcad API here. The API allows you to modify and change Mathcad Prime files. Despite PTC's documenation, you cannot print documents.

The function **get\_eqpt\_from\_xl(filepath:str)->Equipment** takes in the filepath of the input excel file and returns the Equipment object. This function is executed right after the choose files window is closed.

The excel table looks like the one below:

eqpt_name	mounting_location	tags	w_p_input(lb)	s_ds_input
Anesthesia Machine	Wall, Floor	Medical, ICU, something	335	1.121

eqpt_name	mounting_location	tags	w_p_input(lb)	s_ds_input
Warming Cabinet	Floor	Medical	137	1.121
Surgical Scrub Sink	Wall	Medical	295	1.121
Retractable Ceiling Column	Ceiling	Medical	800	1.121

The function **pre\_generate\_report(equipment:Equipment, files, generating\_multiple\_reports = False)** acts as a pre-flight test. It checks if the proper template is given for the equipment and passes the equipment and a uniquely generated filename to the **generate\_report** function. The function **generate\_report(cur\_eqpt, equipment:Equipment, file\_name:str, template\_file:str, files, debug = False)->bool** connects to the Mathcad API, opens the template file specific to the mounting location, updates the input values specific to the equipment, and then saves the document. If generating multiple reports, multithreading is used to speed up the process. Currently 4 threads are being used, but feel free to increase this number if the workflow demands more throughput. This variable is called **num\_threads** in the event **generate\_report\_for\_all**.

The function **mathcad\_calculate(eqpt, files, debug = False)** allows the user to preview the Mathcad calculation output. It duplicates the template file into a temp file, takes the inputs and waits for the outputs to generate. It then deletes the temp file when finished. It returns a dictionary with the output values. The debug variable changes if Mathcad will display the windows being edited or not. When debug = False, no window is shown, when debug = True, windows are shown.

**Rendering to the GUI** Choose equipment: Once the user has input the excel file they want to read from, the program extracts all information in the **get\_eqpt\_from\_xl** function and places all the equipment names in the Choose Equipment column.

Inputs: Once we get the Equipment from the **get\_eqpt\_from\_xl** function, we can then render it to the input fields in the GUI.

Outputs: If the user clicks the **Preview Calculation Outputs** button, the inputs from the current equipment being used is sent to the template corresponding to the correct mounting location and the output fields are gathered via the **mathcad\_calculate** function. The outputs are saved in the Outputs class and the information is displayed in the GUI.

Preview Images: The user has the option to include preview images that correspond to the mounting locations. The images must be included in the excel document. Use the **example\_sheet.xlsx** as a template. Images must be .png or .jpg or .jpeg. The images are gathered from the excel sheet using the **get\_images\_from\_xl(self, num\_images:int)** function. Images are stored as binaries. When the user views a different equipment, the image corresponding

to the mounting location is loaded into the Image Preview section of the GUI. Use `./dist/img_to_b64.py` to convert images from `.png/.jpg` to binaries. It provides a python file called `output.py` with the binaries stored in variables. Preview images are automatically converted to binaries in `get_images_from_xl`.

**Saving to the Database** Saving to Database: The database is a `.csv` file which holds some important information about generated reports. The function `save_to_csv` is used. When the user decides to save the report to the database, they are saving the equipment name, mounting location, tags, and the generated report's unique filename. The user can choose a specific database to save to, or it will save to the default database located in the `mathcad_automation_output` folder.

The table looks like the one below:

Date	Tags	Name	Mounting Location	File Name
2021-06-30	MEDICAL	RETRACTABLE CEILING COLUMN	CEILING	test.mcdx
2021-06-30	MEDICAL	RETRACTABLE CEILING COLUMN	CEILING	Retractable_
2021-06-30	MEDICAL	SURGICAL SCRUB SINK	WALL	Surgical_Scr
2021-06-30	MEDICAL, ICU	ANESTHESIA MACHINE	WALL, FLOOR	Anesthesia_M
2021-06-30	MEDICAL	WARMING CABINET	FLOOR	Warming_Ca
2021-07-01	MEDICAL	RETRACTABLE CEILING COLUMN	CEILING	testing.mcdx