Moayad Rajjoub
ELECTRONIC ENGINEER

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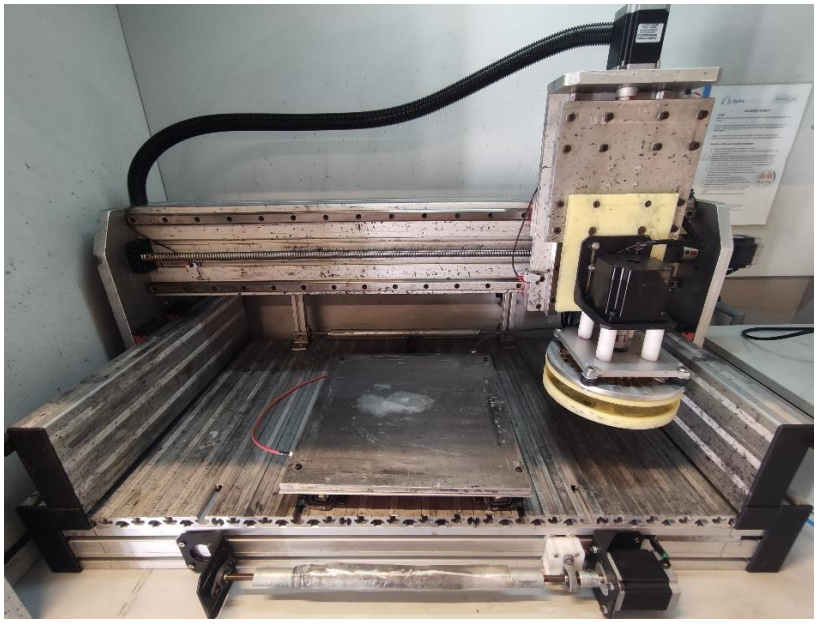
Introduction:

I am Moayad Rajjoub, an enthusiastic and dedicated electronic engineer who recently achieved the significant milestone of receiving my bachelor's degree in September 2022. My journey in the field of electronic engineering has been characterized by a passion for innovation and a relentless pursuit of knowledge. Throughout my undergraduate years, I actively sought out opportunities to engage in hands-on projects, pushing the boundaries of what I could achieve. Now, as I embark on the next phase of my academic and professional journey, the objective of this document is to offer a comprehensive and detailed overview of the projects I have undertaken. These projects not only highlight my technical skills but also showcase my unwavering commitment to solving real-world engineering challenges. I believe that this portfolio will serve as a testament to my capabilities and the potential I bring to the pursuit of a master's degree in electrical and computer Engineering.

Project Descriptions:

Project 1: " Coating Machine "



Objective:

This project aims to employ a coating technique under controlled atmospheric conditions.

Methodology:

A body of sigma profiles with flat surface and bridge to allow the movement in the three dimensions, hooked to a spinning head with polishing pad attached, was programed using an Arduino Mega. Where it controls the stepper motors speed, timing, and pressure point by getting feedback from an Arduino Uno that read the applied pressure and adjust the

temperature of an Aluminum plate placed on the flat surface of the body where the coating process being performed.

The Aluminum plate was designed to hold the intended substrate film to be coated using a vacuum pump. Where on the back of it a silicon heater was attached, a K-type thermocouple was inserted from the side to monitor the temperature and work as a PID along with a Relay.

In order to increase the accuracy of pressure sensors (Load Cells), Coil Springs were replaced right above the sensors under each corner of the Aluminum plate.

Finally, to make it easier for the user to run the whole system a Graphical User Interface (GUI) was programed in Python using PyQt5 library for the design and PySerial library to accomplish the communication between the two Arduinos and the GUI.

Results:

As a result of this machine, the user is able to perform the coating technique with the same parameters as much as he wants and even change it to get better results. For instance, it can be used in the laboratory to experiment this technique on different chemical solutions and play with the parameters to get the best possible thermoelectric performance.

Challenges:

As it was the first big project right after my graduation the whole process was a challenge for me, but I came out of it with really good skills. For a start I had to dive in the way stepper motors operate in order to run them in the fastest possible speed where it was not possible using usual libraries.

I faced a big problem trying to read, write and run the motors from one Arduino at the same time without affecting the speed where at the time it appeared to be impossible, I start my attempts to get the fastest response using different Arduino to get the data. Eventually, after learning how to create a user interface and struggling even with small things like splitting the incoming data to presented in different blokes, I find that the best response can be done communicating between Arduinos through Python coded user interface.

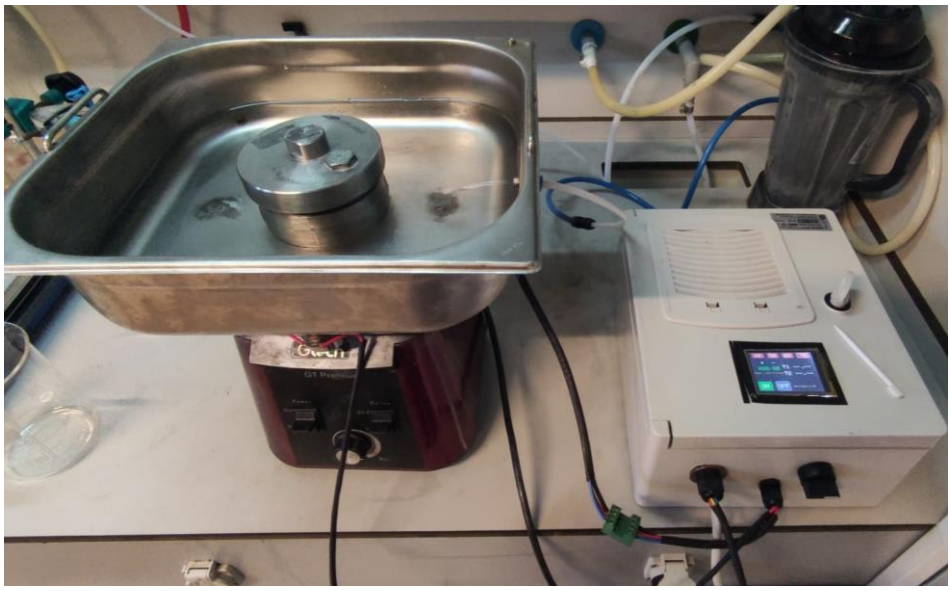
The challenges were not limited to electronics and coding, as the machine was built from scratch, I had to learn using different cutting machines like Universal Milling, Manual Lathes, and Horizontal Sawing. I also learnt how to organize, wire, and build a safe electrical panel for the machine.

Relevance:

This project is what started my passion for the field of Automation and Control in the first place, watching what you spend hours and days finally moving or operating in the way want on front you.

You can find the codes and more information about the project on my **Github**.

Project 2: " Ultrasonic Machine "



Objective:

The goal of this project is to mix some chemicals while they are exposed to ultrasonic waves.

Methodology:

A small metal container with tight cover to prevent any leaks, placed in the center of a gastronome to cool and transfer the ultrasonic waves produced by four transducers attached to the back of it is designed to be used with normal fruit blender to work as a mixer to the chemicals.

As the mixing process have to be done while it is exposed to the ultrasonic waves, an Arduino Uno connected to TFT LCD screen, 4 Channel Relay model and 2 LM35 temperature sensors was programmed to monitor the transducers drivers temperature, stop and run the ultrasonic waves beside the blender based on the set timer and temperature limit on the screen so the drivers do not get damaged and the ultrasonic waves operate along with blender.

Results:

As a result of this system the user can easily control the machine from the screen and run the system as long as he wants without worrying about any damage.

Challenges:

The hardest part of this project was to calibrate the touch screen. Even after trying different libraries included touch screen calibration codes, I had to test a lot of parameters to reach the best one.

Relevance:

This project aligns with the logic of Programmable logic controller (PLC) which I am looking forward to improve in the future.

You can find the codes and more information about the project on my **Github**.

Project 3: " Winding Machine "

Objective:

The objective of this project is to pull fiber strands at an appropriate speed.

Methodology:

The system was programmed by an Arduino Uno to move a speed-adjustable roller holder right and left in three different speeds which can be set through three On-Off switches, along with limit switches on each side to reverse the motor direction.

Results:

As a result, the user can easily adjust the speed of the holder to match the pulling speed so the fiber strands can be spread equally on the roller.

Challenges:

One of the challenges of this project was to detect the state of limit switches in order to change the direction of the motor.

Relevance:

As with the other projects are, this one also aligns and feeds my passion to control and convert simple tasks into automated systems.

You can find the codes and more information about the project on my **Github**.

Project 4: " Digital Voice Recorder "

Objective:

Main objective of this project is to create a digital voice recorder that can record your voice, playback a selected voice recording, and delete single or all recording data. During this project, various modules such as Timer, PWM, ADC, and External Interrupts will be used.

Methodology:

The system is programmed in C using STM32 Nucleo G031K8 board without including any HAL or equivalent libraries. An analog microphone with on-board amplifier was connected for recording process, two 24LC512 Electrically Erasable Programmable Read-Only Memories (EEPROM) based on the I2C (Inter-Integrated Circuit) used to save up to five records, a speaker with circuit of variable pot, LM386 and different capacitors was designed to amplify the low voltage Audio to play back the recordings, A keypad attached to operate the device, and finally a 7SD used to display the operations and status.

Results:

As a result of this project the user can easily read the statue of the memory from 7SD display and record up to 4 records 5 seconds each, where there is one key on the keypad assigned for recording a voice and stop/save the record automatically after 5 seconds being counted down on the display, four keys for track select when not recording, one key for playing/pausing the selected track when not recording, one key for deleting the selected track, and one key for seeing the track status which will be displayed on the 7SD display as the button is pressed.

Challenges:

During this project I faced few problems like setting PWM and ADC functionalities where it took me a long time to figure out the exact problem, playing clear and understandable record, stop the flickering on the displays and brightness difference on the 7SDs.

Relevance:

This project serves my interests in Embedded systems, where it requires more knowledge in microcontrollers and the functionality of EEPROM in order to know how to deal with the calculation of memories data size to find the appropriate data rate to my recordings period requirements.

You can find the codes and more information about the project on my **Github**.

Project 5: " Reducing Speech Noise "

Objective:

This project aims to reduce the noise in a noise-added audio signal, to obtain as much as possible a at the output.

Methodology:

Let’s say that we have a noise-added audio signal going through a box called the System and come out of it as a noise-free audio signal, the function of this system, in the closed box, is to filter out the noise as much as possible, thus ensuring a clearer understanding of the speech. Therefore, the system should basically consist of a filter.

As an application in this project, the frying noises of different foods were added to the speaking voices of different adult men. Our aim is to suppress the frying noise in the background of conversations as much as possible.

This will be coded in Python using Anaconda platform by firstly analyzing the amplitude spectrum of a noise-added audio signal and then design an appropriate filter that will cover the band width of the noise.

Results:

The low pass filter we used reduced frying noise to a certain extent but could not completely suppress the noise.

One of the reasons why the filter cannot completely suppress noise may be that some components of the noise are located in the pass band of the filter.

On the other hand, since some components of the speech sound were outside the pass band of the filter, some distortion occurred in the speech sound.

Challenges:

The most challenging aspect of noise reduction is often determining the appropriate parameters and thresholds for the gating process. This involves selecting the right window size, overlap, and deciding on the threshold levels for distinguishing between noise and signal components in the spectral domain. Additionally, handling complex audio signals with varying noise characteristics and ensuring that the gating process doesn't degrade the quality of the desired signal can be challenging.

Relevance:

In applications involving voice recognition or audio-based control systems, noise reduction plays a significant role. Removing background noise from audio signals can improve the accuracy of voice commands and enhance the overall user experience in automated systems.

You can find the codes and more information about the project on my **Github**.

Technical Skills:

I possess proficiency in a diverse range of tools, languages, and platforms, including MATLAB, C/C++, Arduino, NI Multisim, LTspice, and Python for simulation and programming tasks. Additionally, I am well-versed in Microsoft Office applications such as Word, PowerPoint, and Excel for documentation and presentations. I also have some experience with GCode for CNC machining, Mach3 for CNC machine control, SOLIDWORKS for 3D modeling, and LightBurn for laser engraving and cutting, although my knowledge in these areas is limited to occasional use. Furthermore, I have experience with FPGA development using Intel Quartus Prime and Xilinx Vivado, along with expertise in Verilog for hardware description and synthesis. These technical skills collectively contribute to my ability to tackle a wide spectrum of engineering and programming challenges.

Future Goals:

My aspiration in pursuing an MSc in Electrical and Computer Engineering is to delve deep into the cutting-edge technologies that drive innovation in our rapidly evolving digital world. I am passionate about contributing to the advancement of smart systems, artificial intelligence, and sustainable energy solutions. Through this program, I aim to acquire the knowledge and research skills needed to address complex engineering challenges. Ultimately, my goal is to leverage this education to make meaningful contributions to the field, whether through groundbreaking research, industry innovation, or teaching the next generation of engineers.