

Rafik Hariri University	Fall 2023
College of Engineering	MECA442 Microcontrollers for Mechatronics
Mechanical and Mechatronics Engineering Department	Project Topics and Deliverables

## **Project Topics**

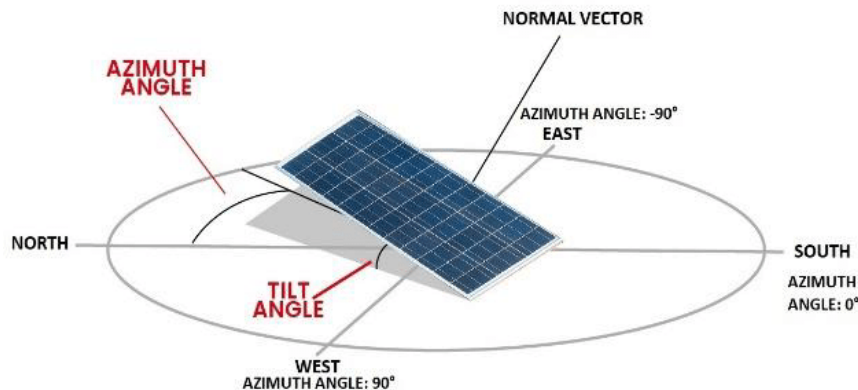
### **1. Smart Plug and Adjustable Circuit Breaker**

This project is about building a smart plug that can provide safety measures to the connected load and has the following capabilities:

- Switch OFF the electricity whenever the rms value of the voltage is outside the acceptable range (say 210V to 230V). The user shall be able to configure this range.
- Specify time interval during the day so that the electricity is only switched ON during that time interval. The user shall be able to configure time intervals.
- Specify adjustable tripping current for the plug, say 4.5A for example. Whenever the load current exceeds this adjusted current, the electricity is switched OFF.

### **2. Solar Sun Tracking System**

This project is about building a mechanism with 2 degrees of freedom. The mechanism will be used to hold a PV panel and keep it oriented perfectly towards the sun all day. For this project, no need to install the PV panel, just the rectangular frame that will hold it. The mechanism shall be able to rotate in the horizontal plane (azimuth) around the vertical axis and shall be able to vary the tilt angle.



### **3. Automatic Generator Starter**

This project is about building a generator starter that can be installed on a diesel generator. The starter monitors the electric grid (EDL) and once it detects its absence, it follows the sequence:

- Measures engine temperature.
- Measures Diesel level.
- Measures oil level.
- If all the above measurements are OK (compared with predefined, adjustable thresholds), the starter indicates the readiness to start. If not, a warning message shall be issued.

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- If starter is ready, it has to wait for predefined and adjustable number of seconds before it starts the generator (can be done via a relay).
- Once the generator is started, the temperature, diesel level and oil level are continuously measured and in case any of these values is not within the acceptable range, a warning message is displayed and after some time, the generator is turned off.

#### **4. Digital Power Supply with PID Control**

The objective of this project is to design a power supply circuit with adjustable voltage range from 0 to 20 V. The output voltage of the supply must be controlled so that the user can enter the desired voltage numerically (say 12.4V for example) and get this voltage exactly at the output of the power supply. A controller with PID control shall be used. The current handling capabilities of the circuit must be up to 3A.

#### **5. DC Motor: RPM Sensing and Control using PID**

This project is about precisely controlling the speed of rotation of a DC motor. User starts by entering the target RPM and direction of rotation (CW or CCW). An RPM sensor (tachometer) and a PID controller will be used for precise control of the speed of rotation of the motor to reach exactly the desired values. The driver circuit to be used in conjunction with the DC motor must provide capability of varying speed and direction of rotation.

#### **6. Maze Solving Bot with Obstacle Avoidance**

This project is about building a wheeled robot to be used for processing/solving a maze. The robot must have necessary actuators and sensors to provide basic movement and maze solving capabilities. The controller to be used shall control the speed and movement of the robot based on sensors feedback. The algorithm to be used for solving the maze shall be clearly stated, discussed, implemented, and tested.

#### **7. Automated Appliances Activator Based on Active Source of Power**

Due to the instability of the national electric grid, we all have secondary sources of power at home, such as subscription or solar power. The objective of this project is to build two controllers, a master controller that acts on the source of power and a slave controller that acts on the appliance. The master board must be able to detect the active source of power (EDL, subscription, generator, solar, etc...) and communicate this info to the client controller that activates or deactivates the connected appliance based on the active source of power (this needs to be configurable by the user). The communication between the master and the client controllers must be wireless.

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## 8. Smart Cup

The objective of this project is to build a smart and interactive cup that tracks the amount of water drank by its owner per day. The cup must include sensors, controller, and adequate display. Each time the amount of water decreases in the cup, it is considered as being drank by the user. We need to take into account that the cup can be filled multiple times per day. All the time, the cup must display the cumulative amount of water drank by the user during the day and issue warnings/reminders when the amount is low. Also, the cup must warn the user whether the temperature of the water is inadequate for drinking (too hot or too cold).

### Important Notes for All Projects

<b>Project Members</b>	Preferred 2 students. 3 are also allowed. 4 is strictly forbidden!
<b>Deliverables</b>	<ul style="list-style-type: none"> <li>▪ Live Demonstration</li> <li>▪ Recorded Demonstration (Video – 2 Minutes)</li> <li>▪ Technical Report (Soft Copy) <ul style="list-style-type: none"> <li>➤ Project Description</li> <li>➤ Functional Specifications</li> <li>➤ Block Diagram</li> <li>➤ Principle of Operation</li> <li>➤ Complete Schematic Diagram</li> <li>➤ Bill of Quantities</li> <li>➤ Results and Conclusion</li> </ul> </li> <li>▪ Proteus Simulation and Arduino Code (Soft Copy)</li> <li>▪ Hardware Prototype</li> </ul>
<b>Deadline</b>	Thursday, Dec 14 <sup>th</sup> , 2023 – Soft Copies (Report, Video, Simulation, Code) Friday, Dec 15 <sup>th</sup> , 2023 – Live Demonstration