Prince Mohammad Bin Fahd University
College of Engineering
Department of Electrical Engineering
Spring 2021 - 2022

Smart Parking Lot Monitoring System

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Advisor: Mr. Muhammad Omair Butt

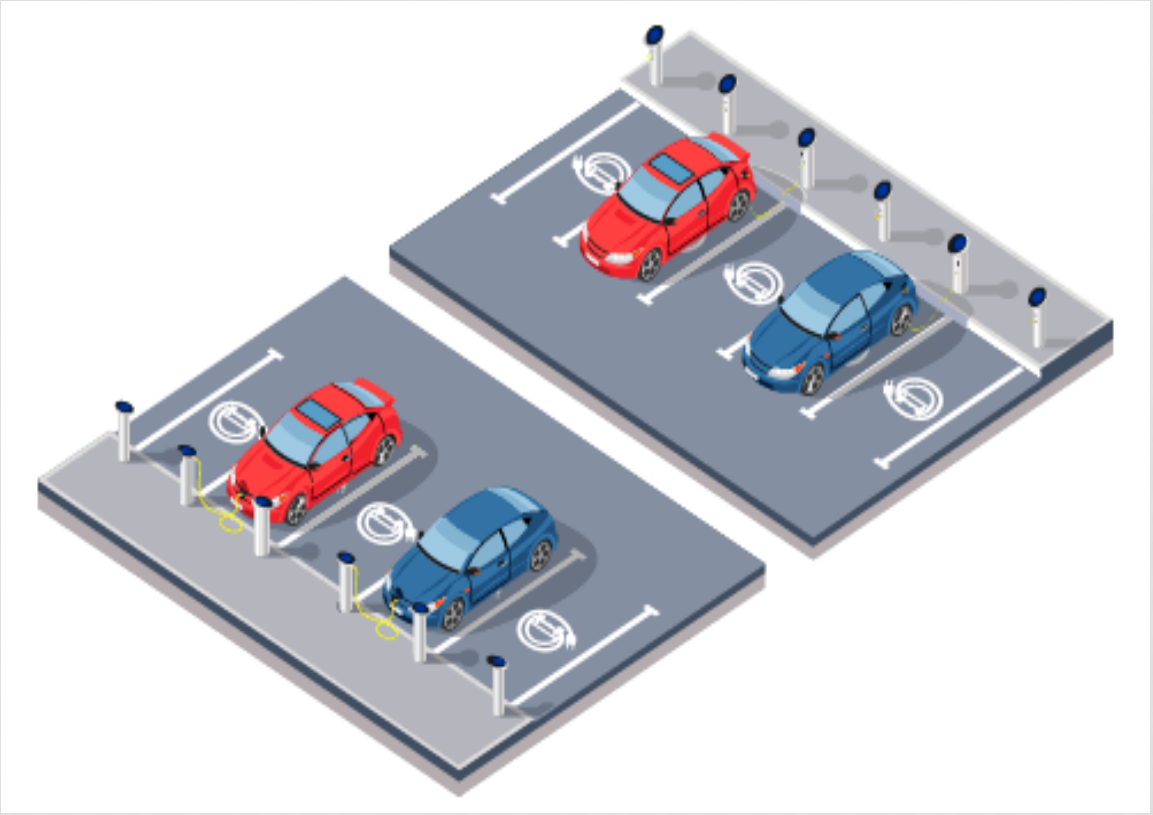
May 17, 2022

OUTLINE

- Project definition
- Project objectives
- Project specifications
- Project constraints and engineering standards
- Project architecture
- Planning
- Background
- Design: subsystems
- Testing
- Project management and teamwork
- Impact of project
- New skills acquired and applied
- Completed and remaining work
- Budget estimate
- References

PROJECT DEFINITION

To design a smart monitoring system that will bring automated management of parking lots, along with increasing the efficiency of usage and providing further measures of security.



PROJECT OBJECTIVES

i. Decrease the dependability on security guards and operators in parking lots.

ii. Utilize the technology to efficiently improve the parking experience for users.

iii. Improve security measures in parking lots.

iv. Provide useful statistics for further improvement.

PROJECT SPECIFICATIONS

i. Operates on 12 VDC power supply rated at total of 3 A current.

ii. Controls entering/exiting vehicles using RFID readers and servo motors.

iii. Provides two separate levels/groups of parking spaces.

iv. Monitors the number of occupied/unoccupied spaces using ultrasonic sensors.

v. Indicates each unoccupied space with LED light for easy reach.

vi. Displays the number of available parking spaces at the entry gate.

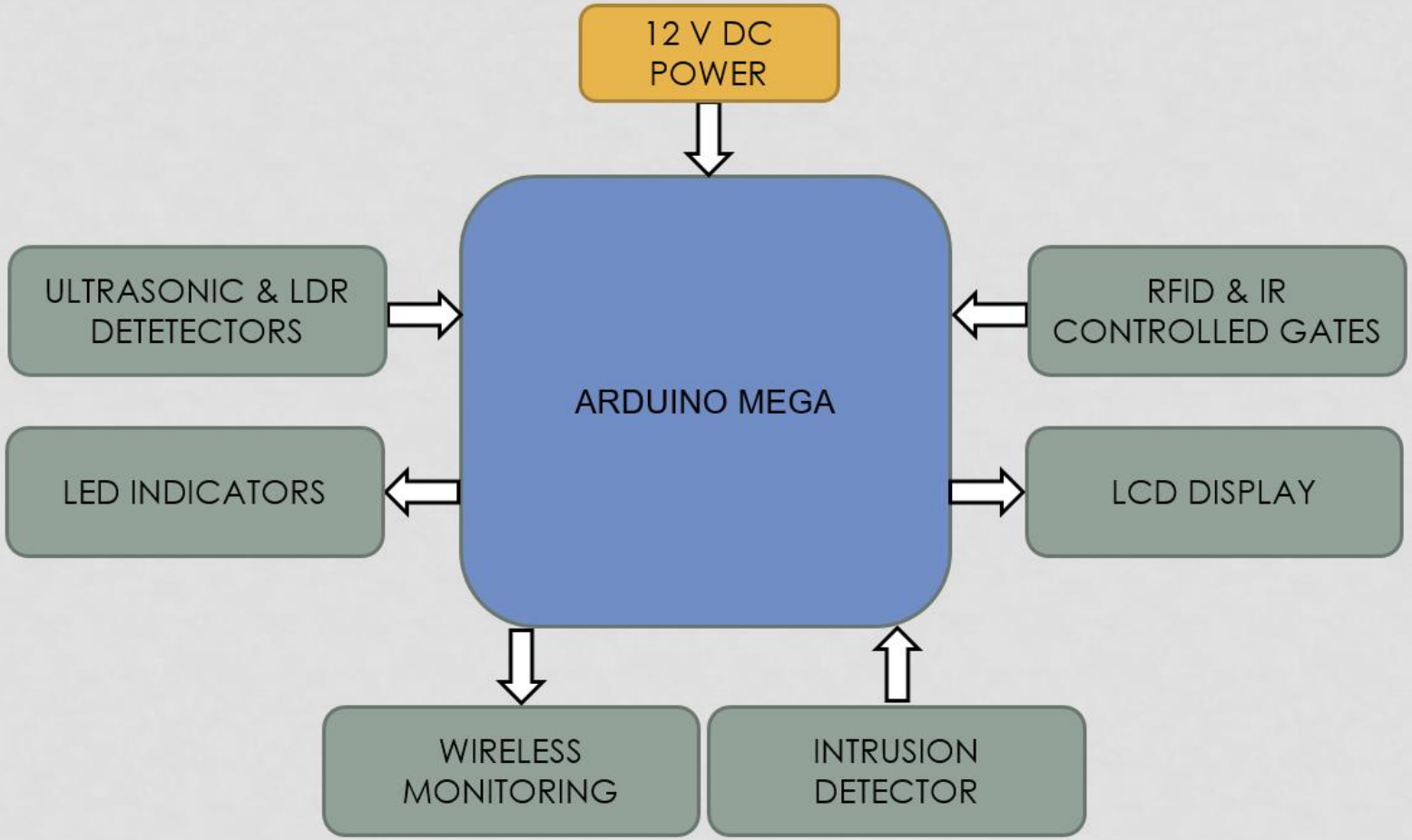
vii. Improves the level of security in the lot using laser maze concept.

viii. Provides pricing feature along with other statistics on an LCD display.

PROJECT CONSTRAINTS & ENG. STANDARDS

- Economic: set a realistic budget and stick to it.
- Engineering: the responsibility in designing and selecting proper components.
- Safety: small scale model vs. real life implementation.
- Society & culture: improve the use of parking lots.
- Practical & physical: 1- LRDs can't be reliable at night.
  2 - Blynk app introduces delay in system so its updated less frequently.
  3 - Camera live streaming can't go on Blynk because of delay introduced by data transfer through servers.

PROJECT ARCHITECTURE



PLANNING

- The system is feasible. Based on previous projects.
- About 90% of components are available locally and the rest are ordered from international suppliers to be available on time for the project.
- Testing can be performed at PMU or anywhere with an access to wall socket.

BACKGROUND: PROBLEM

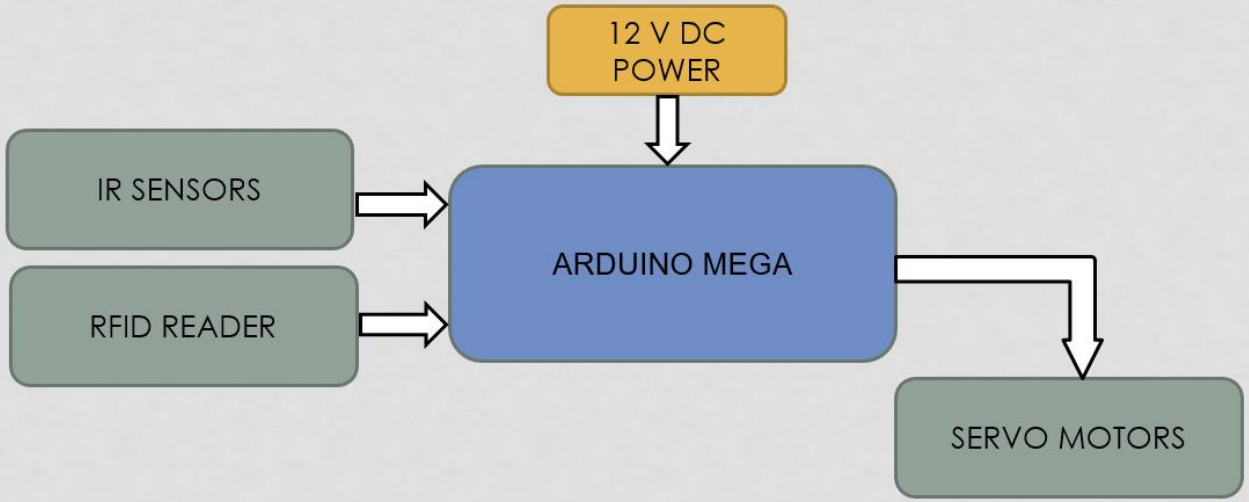
- Parking demand is increasing as the number of vehicles is increasing.
- Finding a parking spot in a lot consumes several recourses like time and fuel that increases carbon emission.
- Some drivers don't park properly which makes it difficult for other drivers to park safely.
- Overnight parking need improved security.

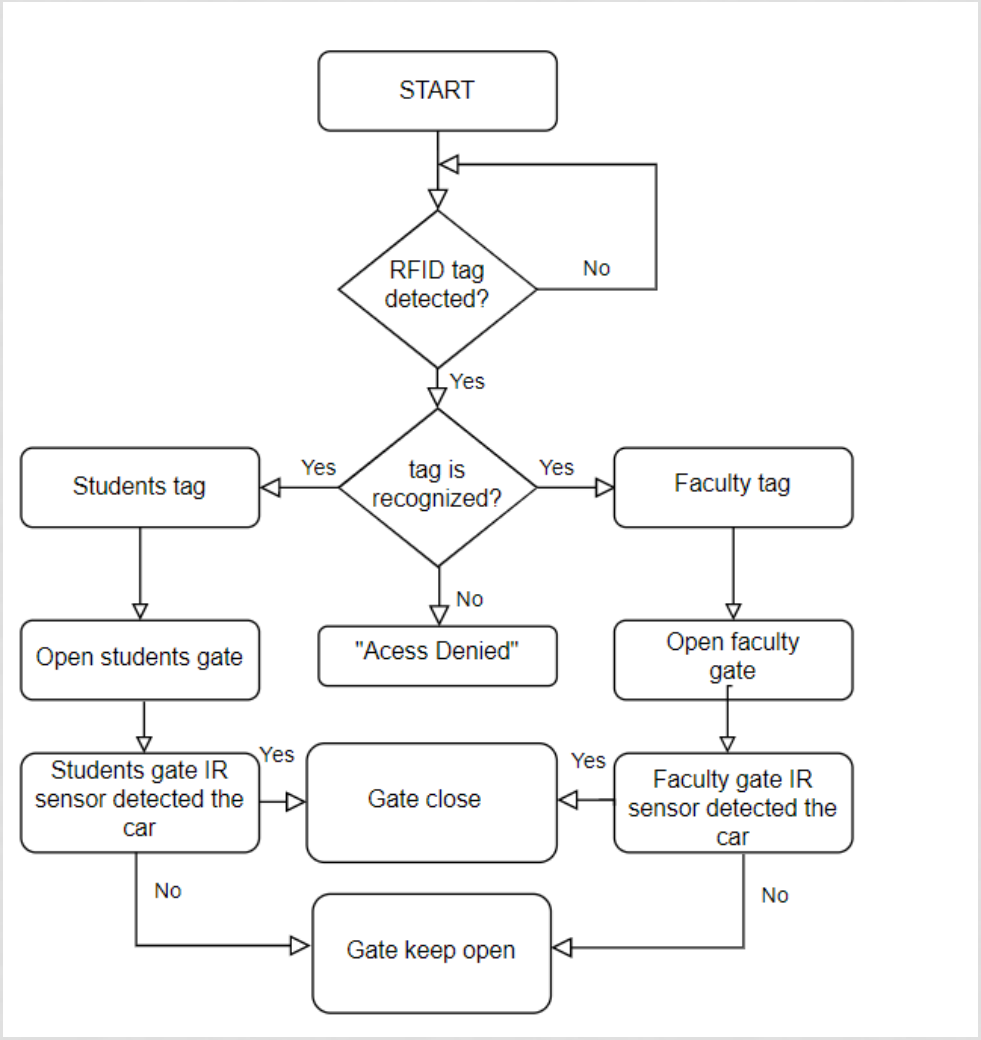
BACKGROUND: SOLUTIONS

- Save people‘s time and other resources in finding parking spots.
- Manage parking lots spaces.
- Implement self-service gates.
- Provide extra measure for proper parking.
- Increase the level of security for overnight parking.
- Provide statistics of usage for future improvement.

DESIGN: SUBSYSTEM 1 (IMPROVED)

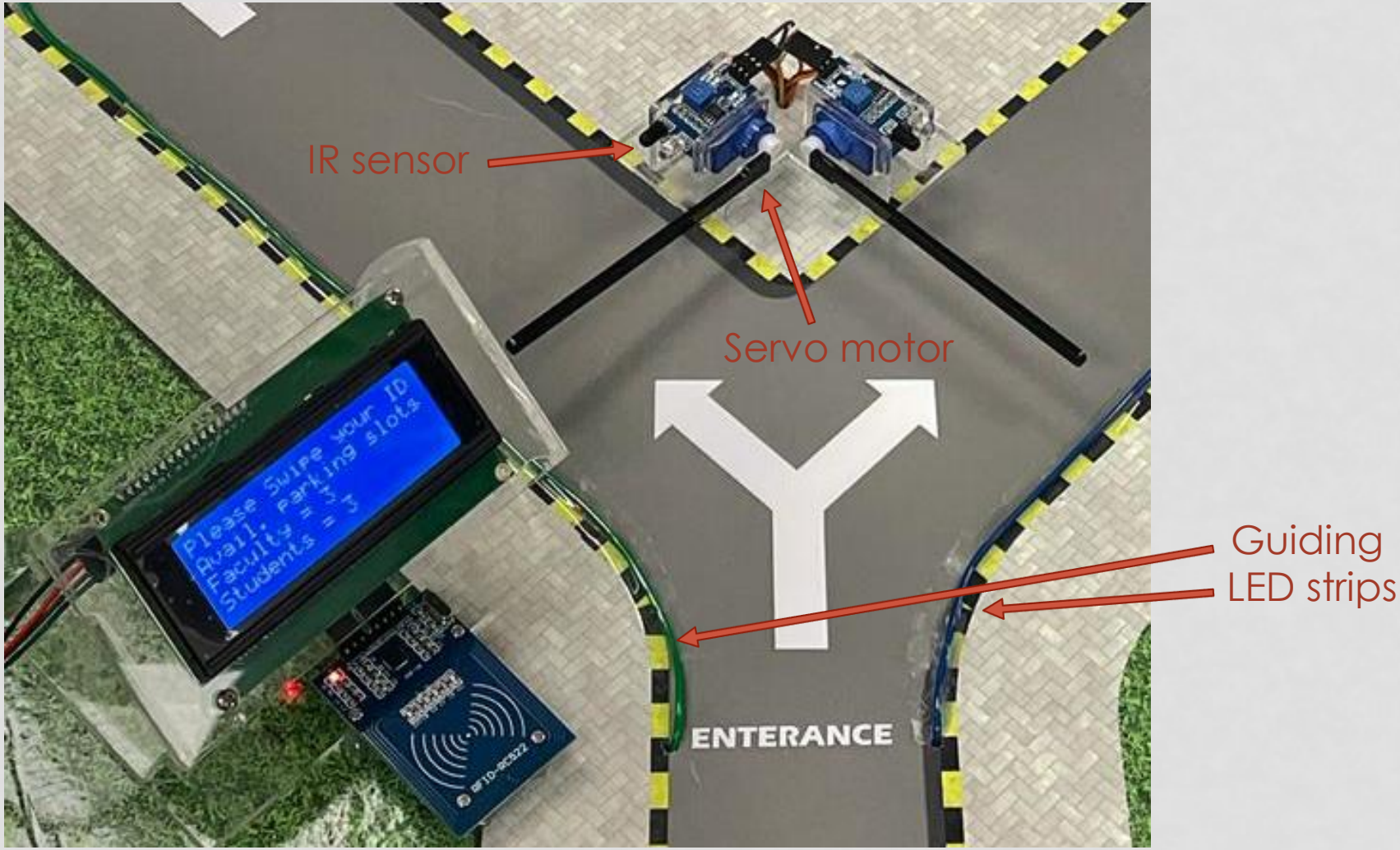
RFID and IR Controlled Gates





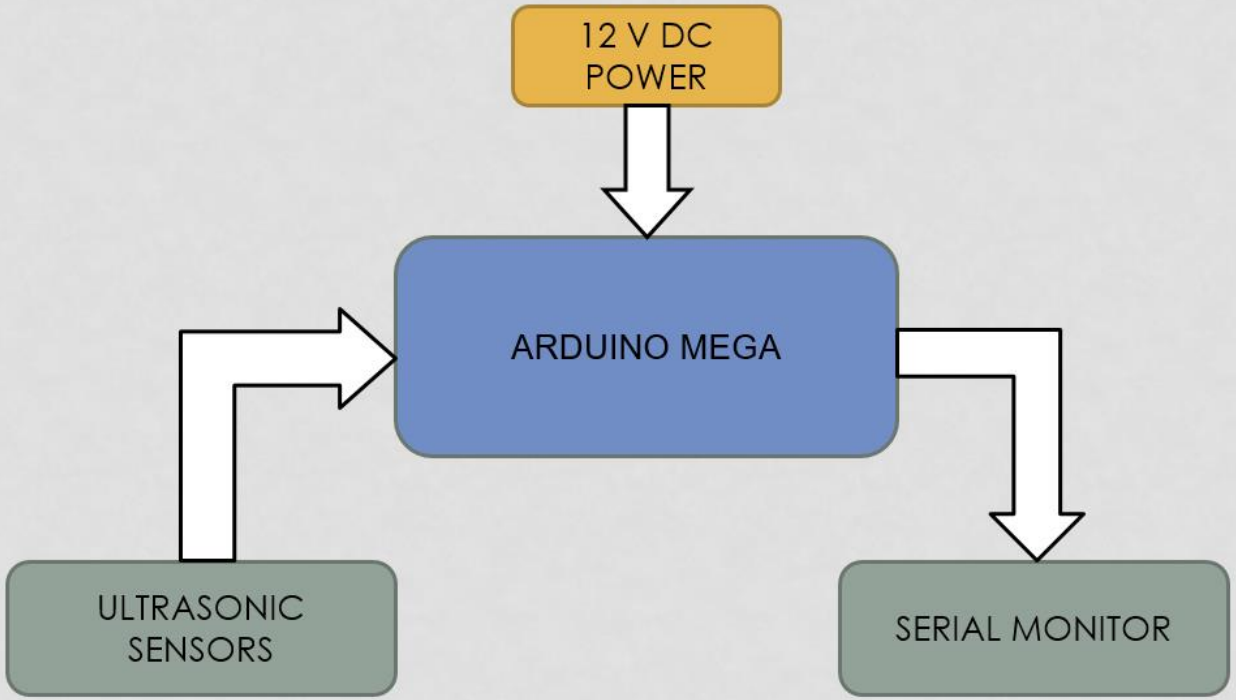
DESIGN: SUBSYSTEM 1 (IMPROVED)

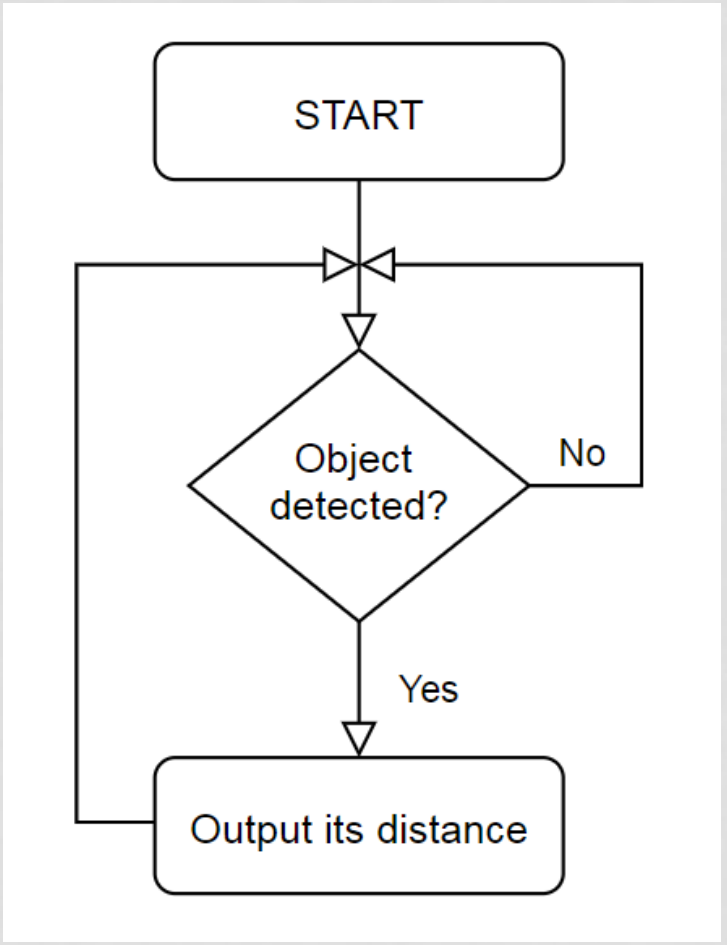
RFID and IR Controlled Gates



DESIGN: SUBSYSTEM 2

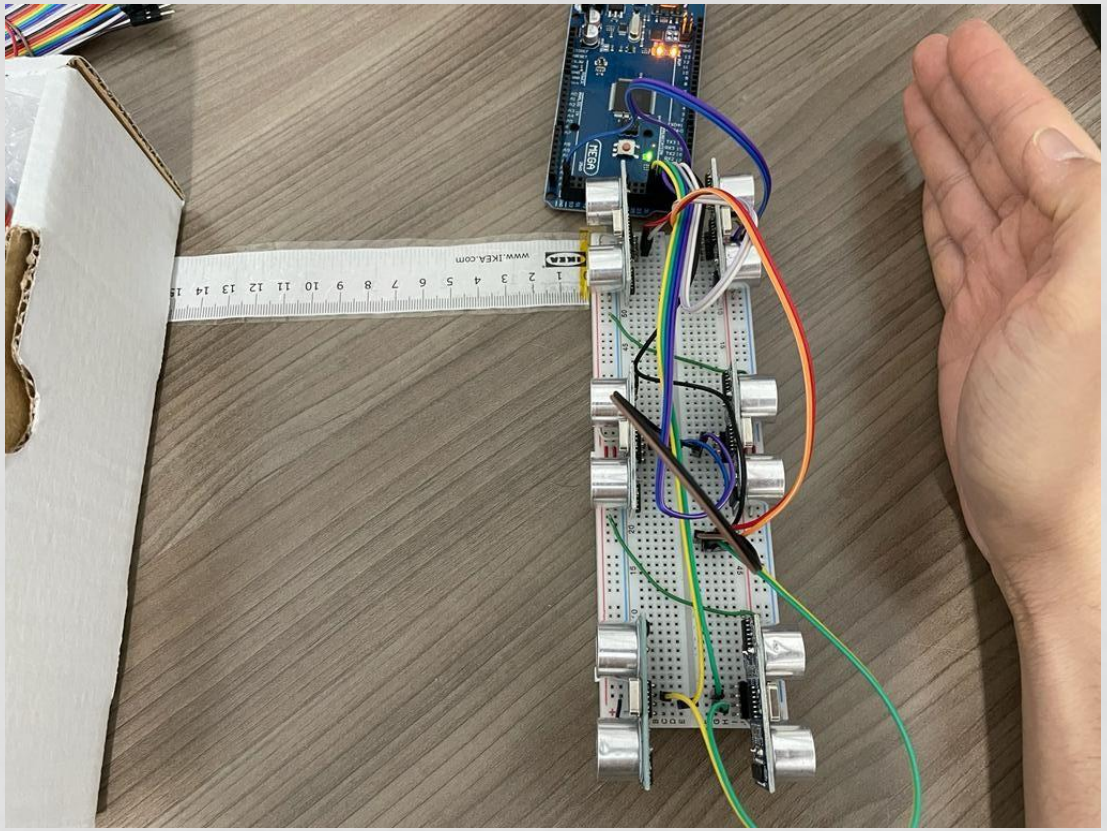
Ultrasonic Distance Measurement

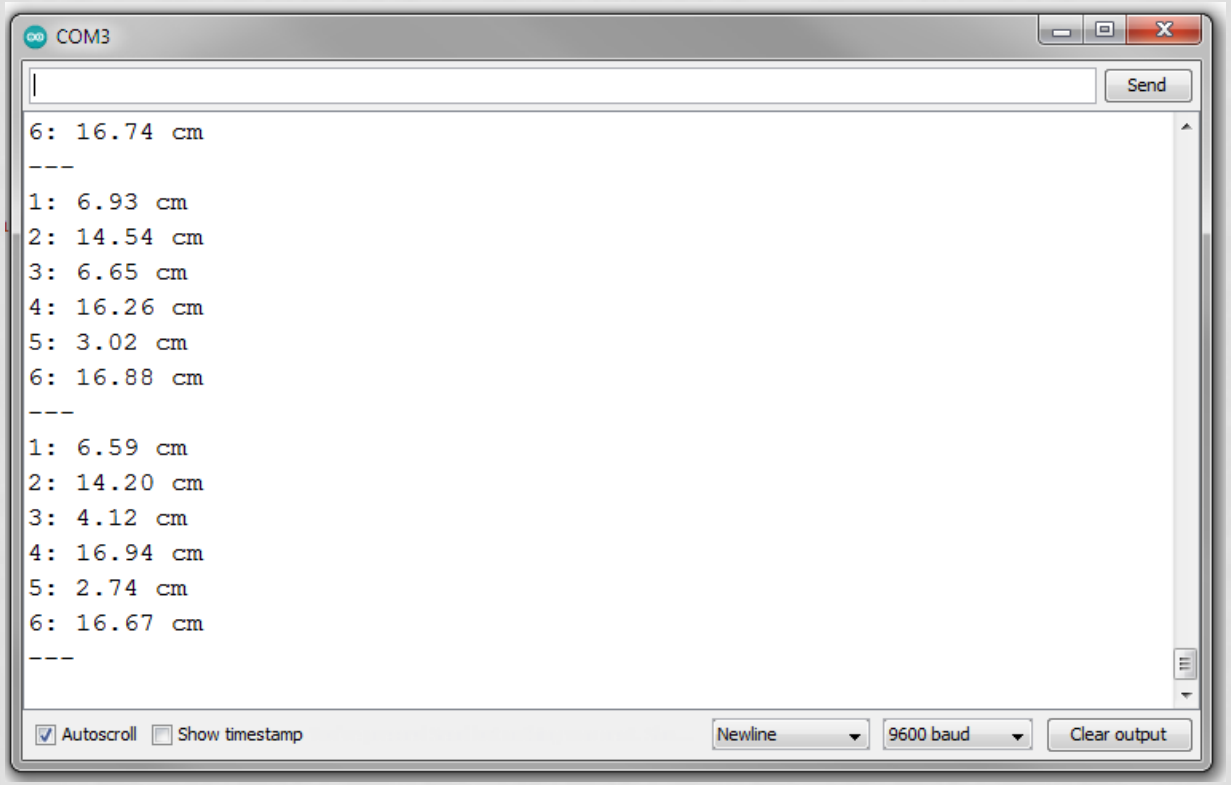




DESIGN: SUBSYSTEM 2

Ultrasonic Distance Measurement

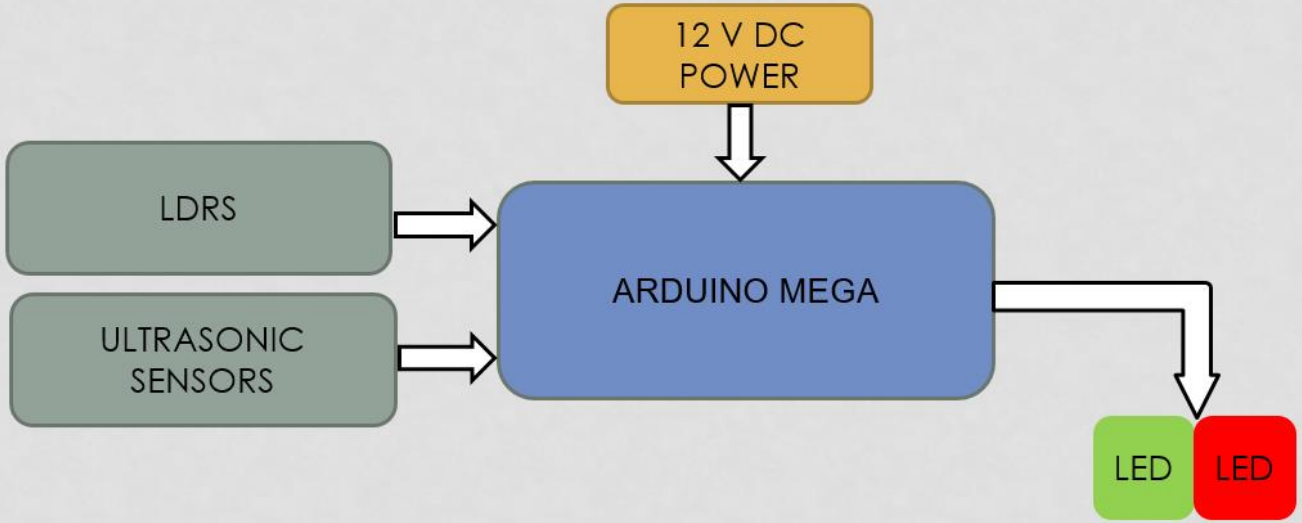


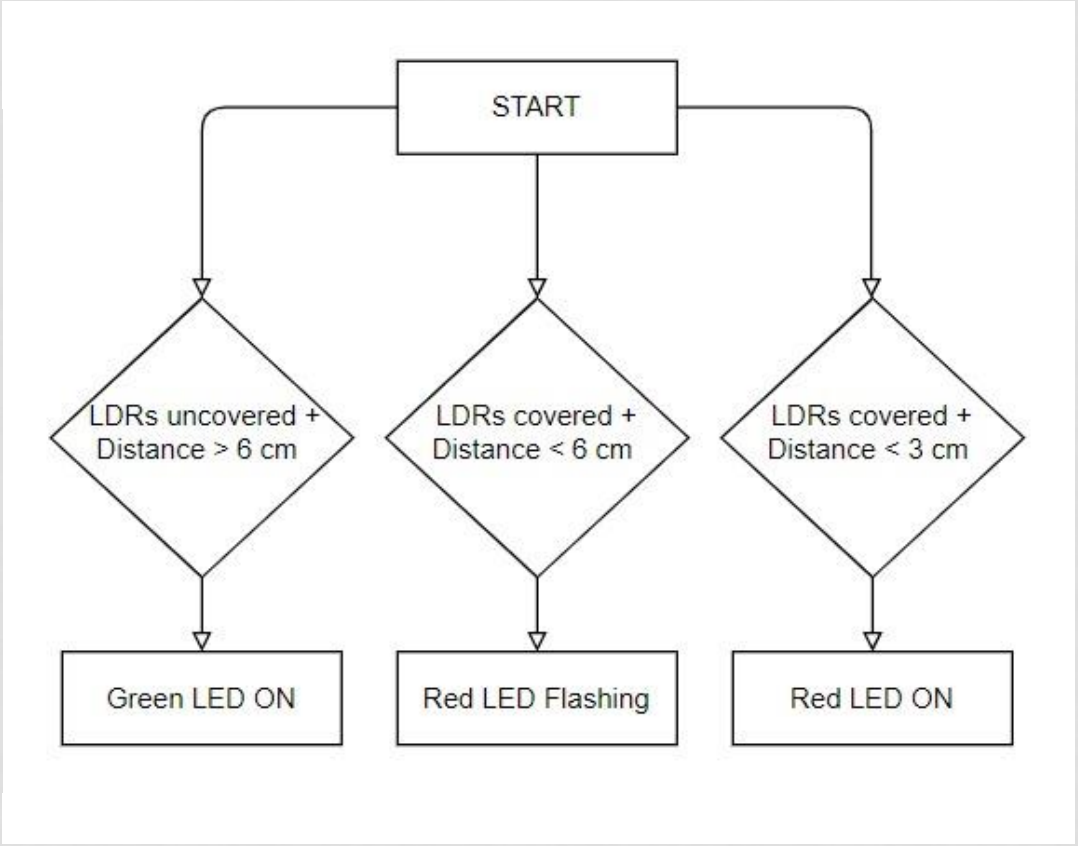


Serial monitor readings

DESIGN: SUBSYSTEM 3 (IMPROVED)

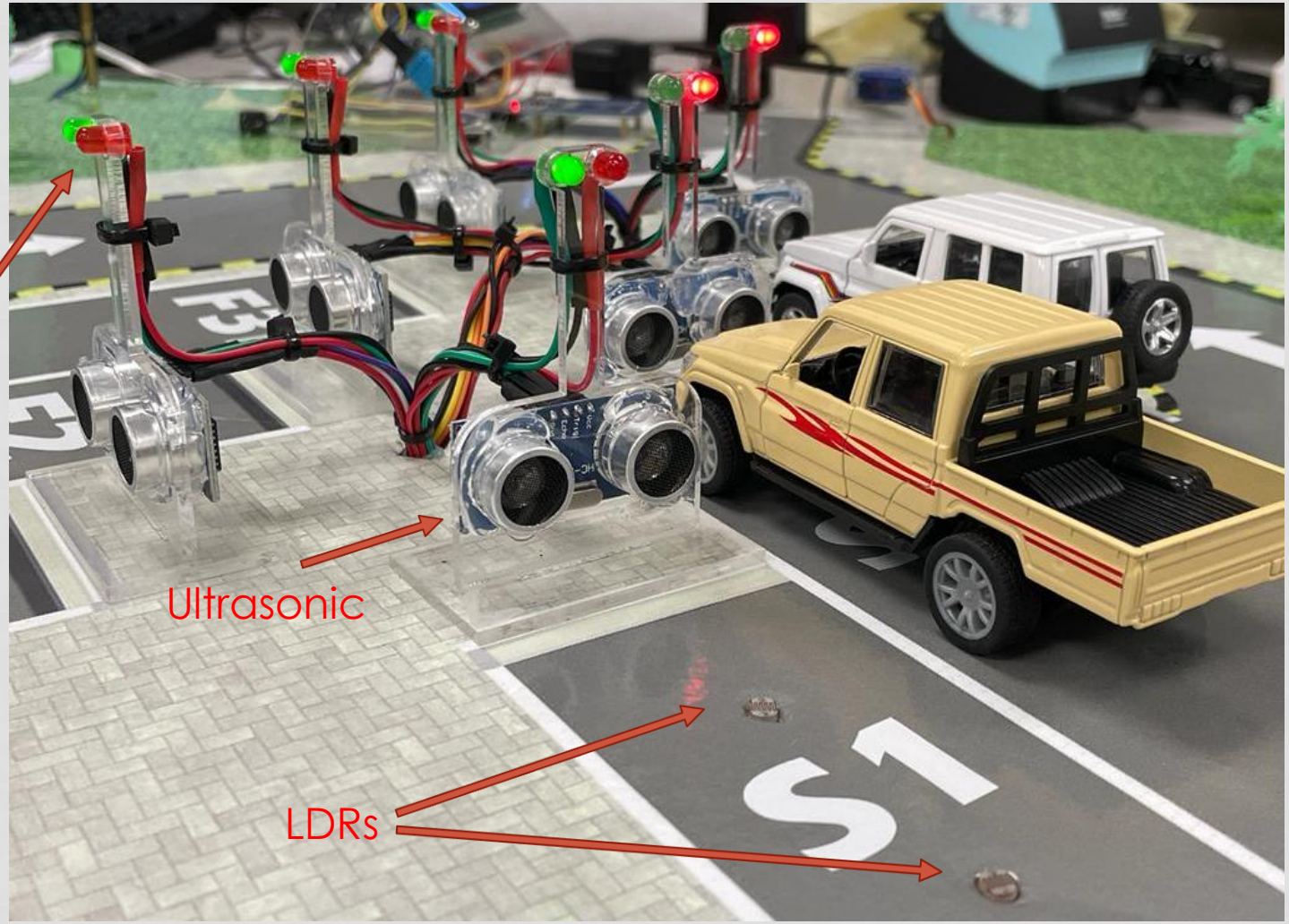
Parking Detection/Indication





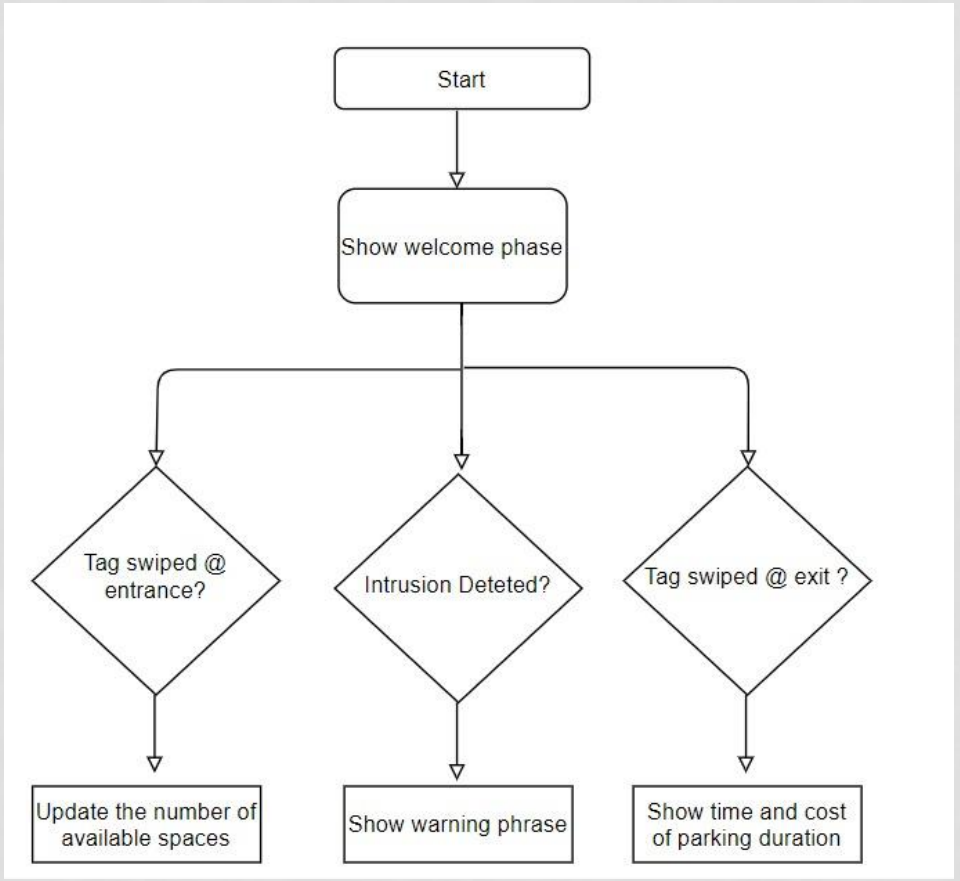
DESIGN: SUBSYSTEM 3 (IMPROVED)

Parking Detection/Indication



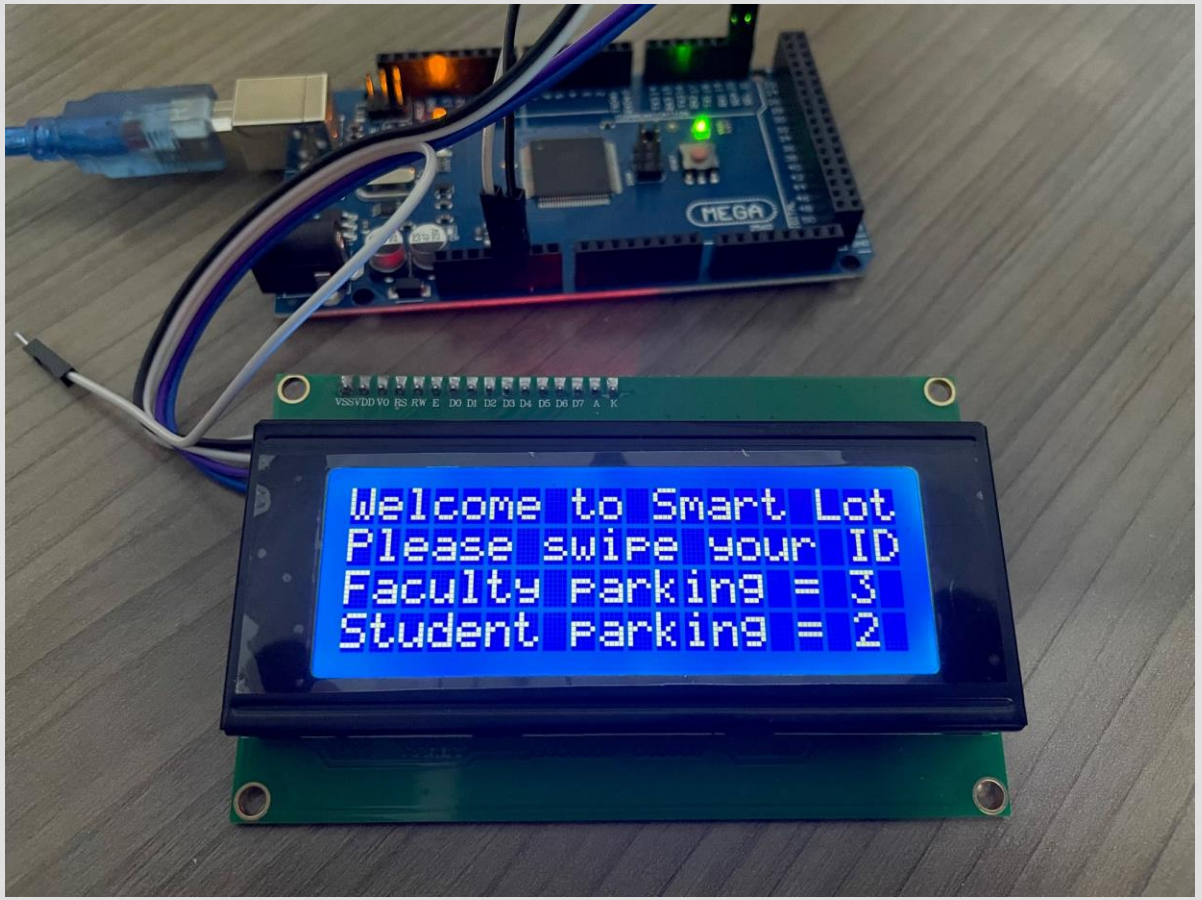
DESIGN: SUBSYSTEM 4

LCD Information Display



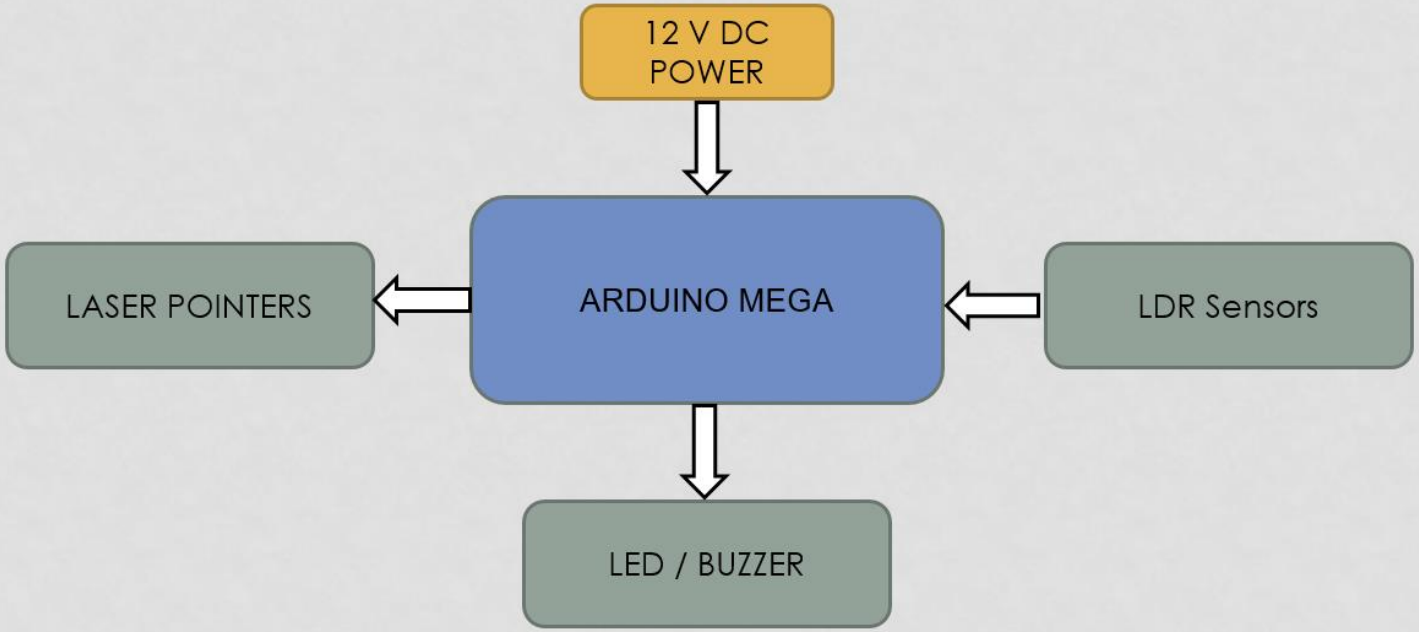
DESIGN: SUBSYSTEM 4

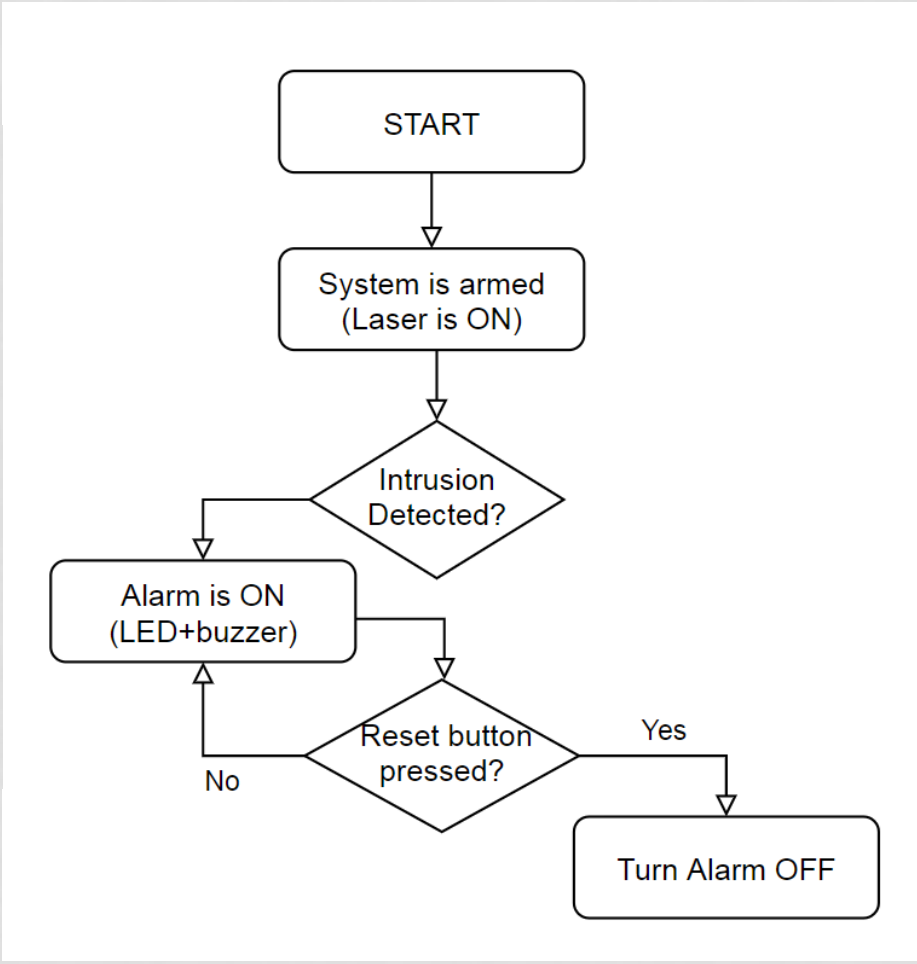
LCD Information Display



DESIGN: SUBSYSTEM 5

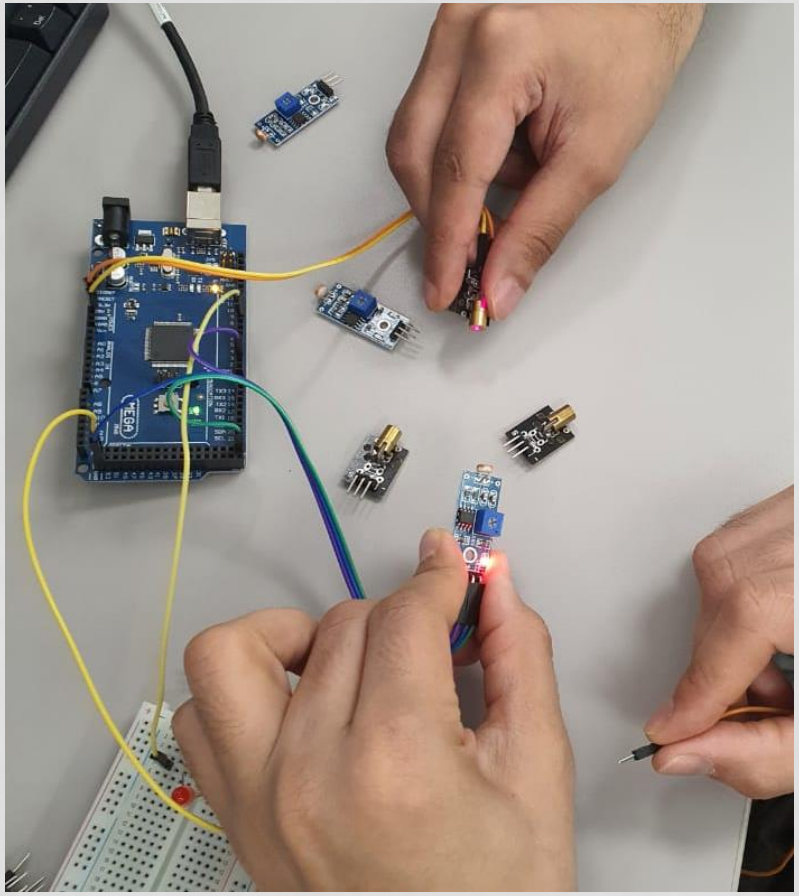
Laser Intrusion Detection

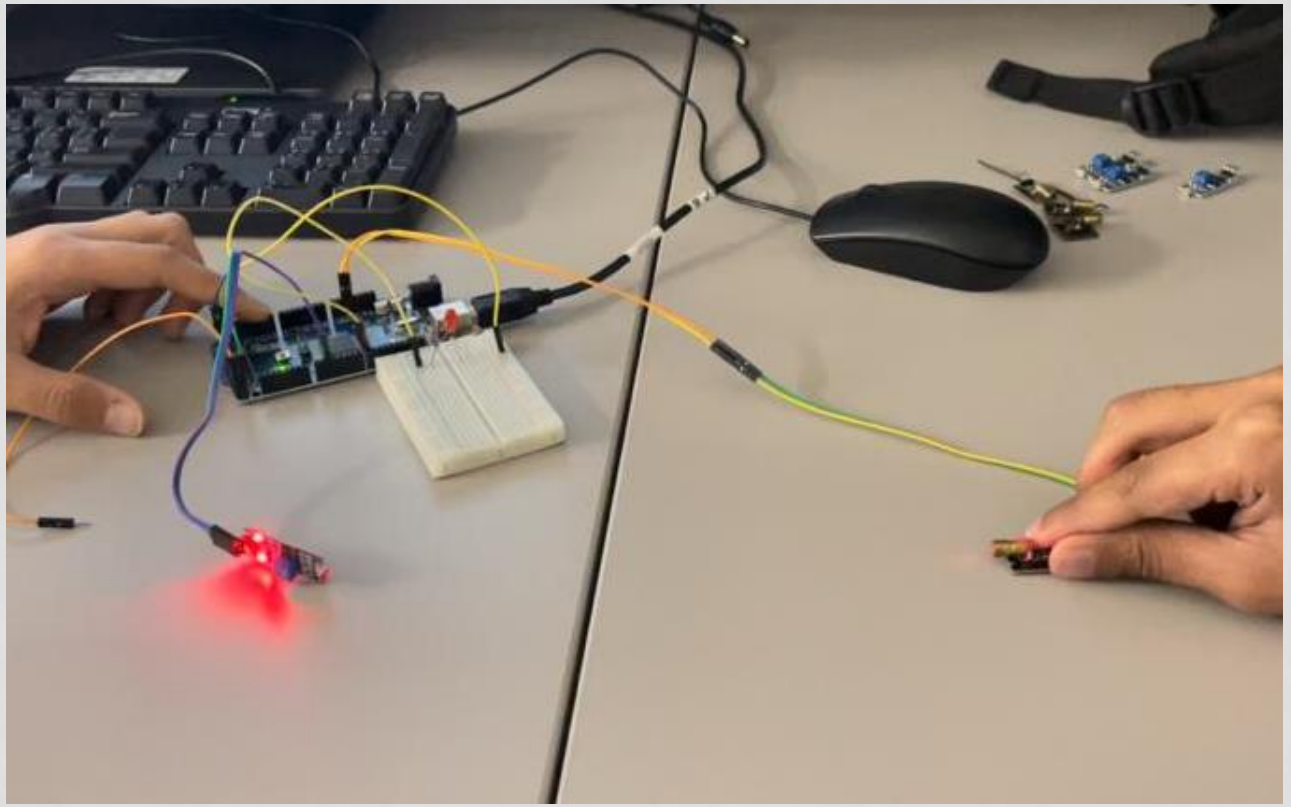




DESIGN: SUBSYSTEM 5

Laser Intrusion Detection

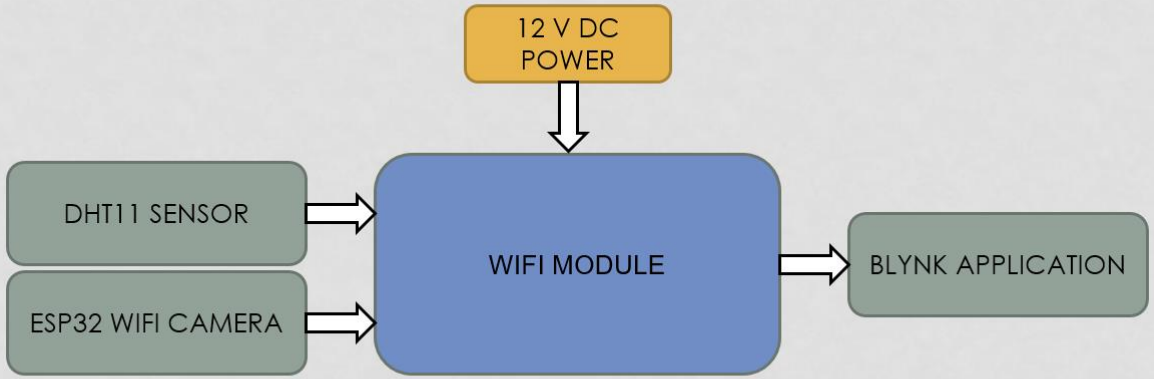


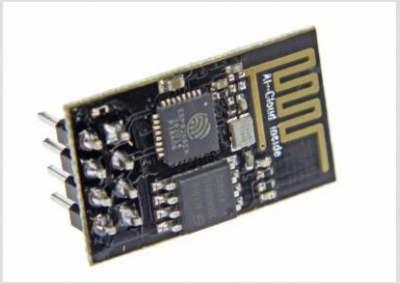


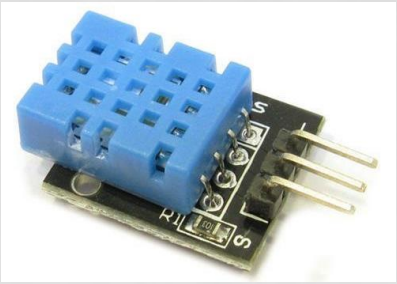
Testing and calibration

DESIGN: SUBSYSTEM 6 (ADDITIONAL)

Wireless Monitoring

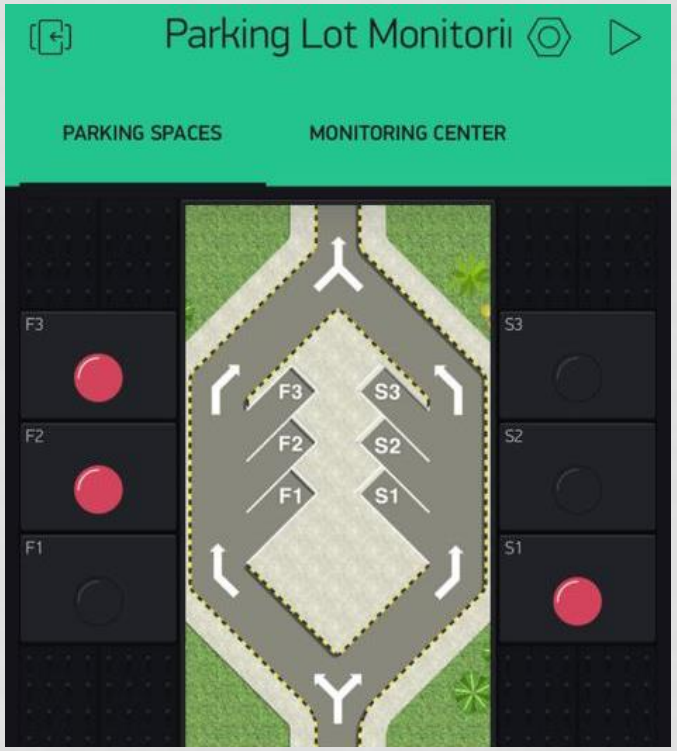






DESIGN: SUBSYSTEM 6 (ADDITIONAL)

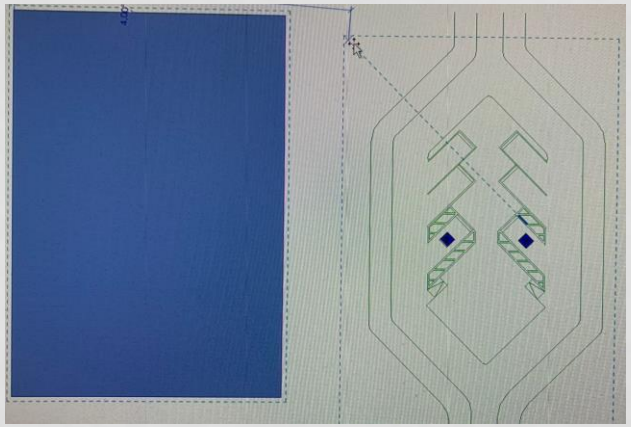
Wireless Monitoring

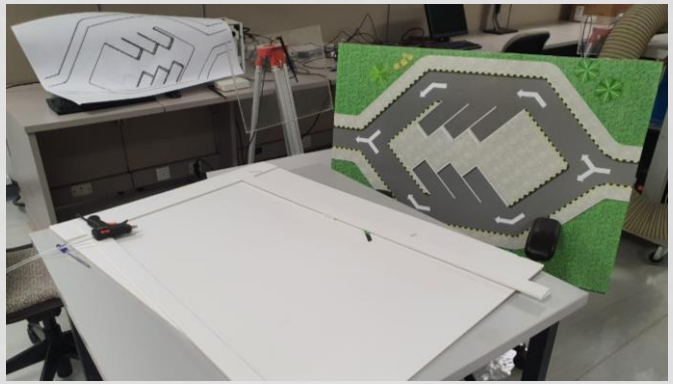


DESIGN: PHYSICAL MODEL/PROTOTYPE

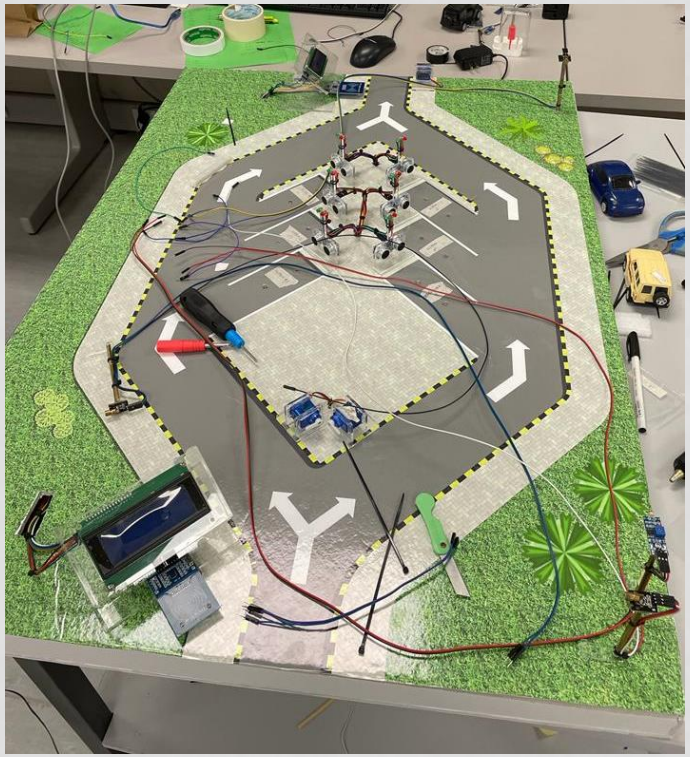
Design and assembly

Parking lot rendering

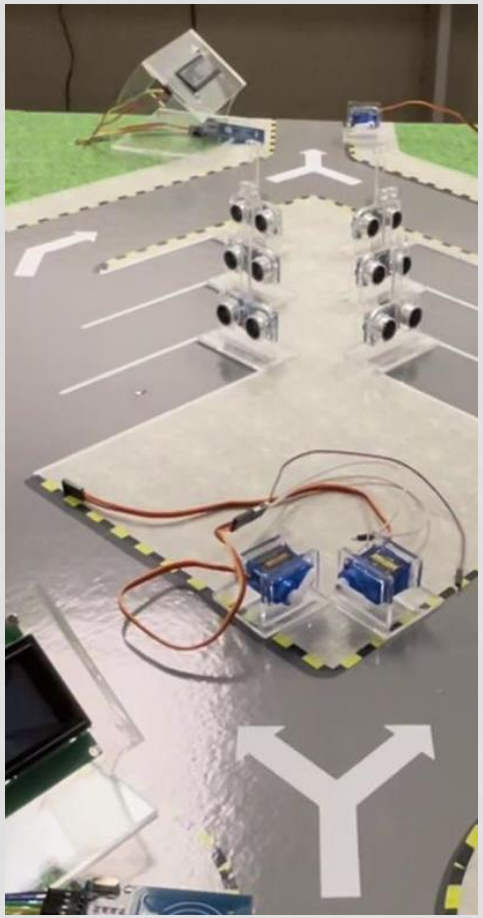




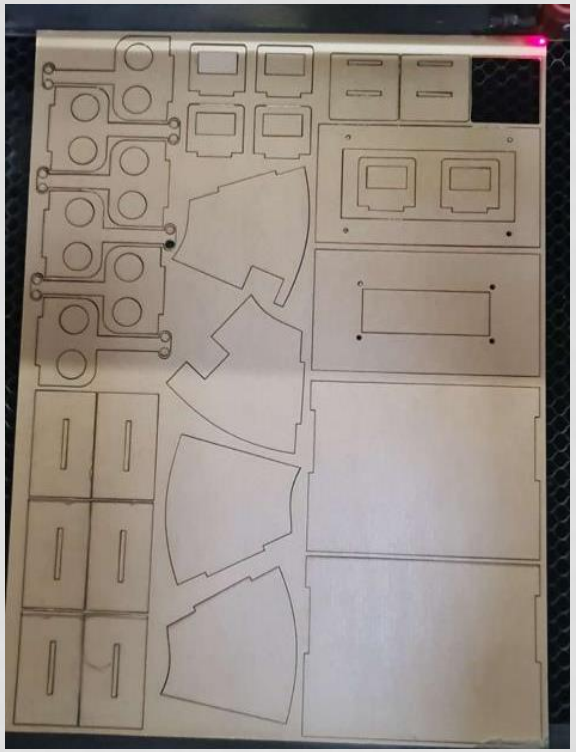
Components installation



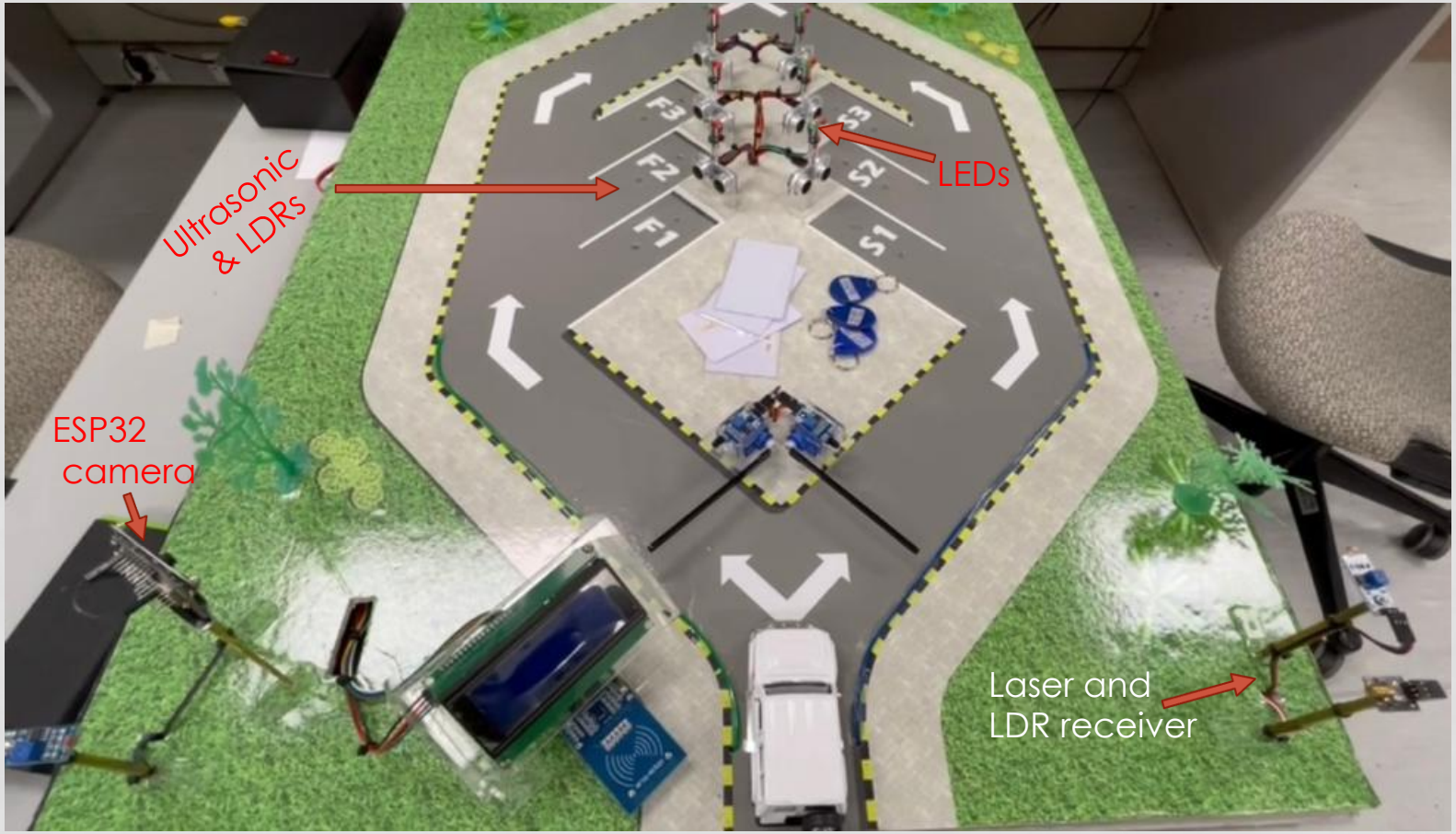
Brackets assembled



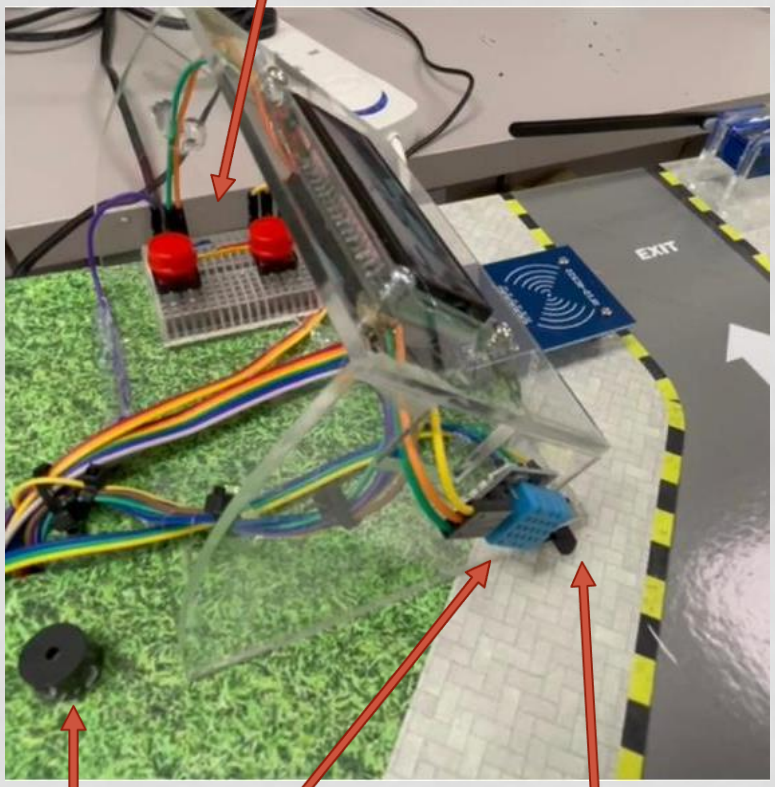
Brackets design and cutting



FINAL PRODUCT : PARKING LOT PROTOTYPE



Control buttons (what is their job?)



DESIGN: COMPLETED WORK (PHASE 1)

- Design **subsystem I** (RFID gates system) and implement with most suitable components.
- Design **subsystem II** (ultrasonic sensors system), implement it, and duplicate it to suite the number of spaces the system will offer.
- Design **subsystem III** (LED indicator system) and integrate it with subsystem II to be as its output.

DESIGN: COMPLETED WORK (PHASE 2)

- Design **subsystem IV** (LCD Display) identified appropriate LCD screen, and what information to be displayed.
- Integrating **subsystem I** and **subsystem IV.**
- Design and implement **subsystem V** (laser intrusion detector).
- Purchasing remaining components needed for the project.
- Brainstorming ideas for the model/prototype we will build.
- Design and **build** the prototype's physical model.
- **Test** each subsystem and confirm that all work properly.
- **Integrate** all subsystems and test the main system.

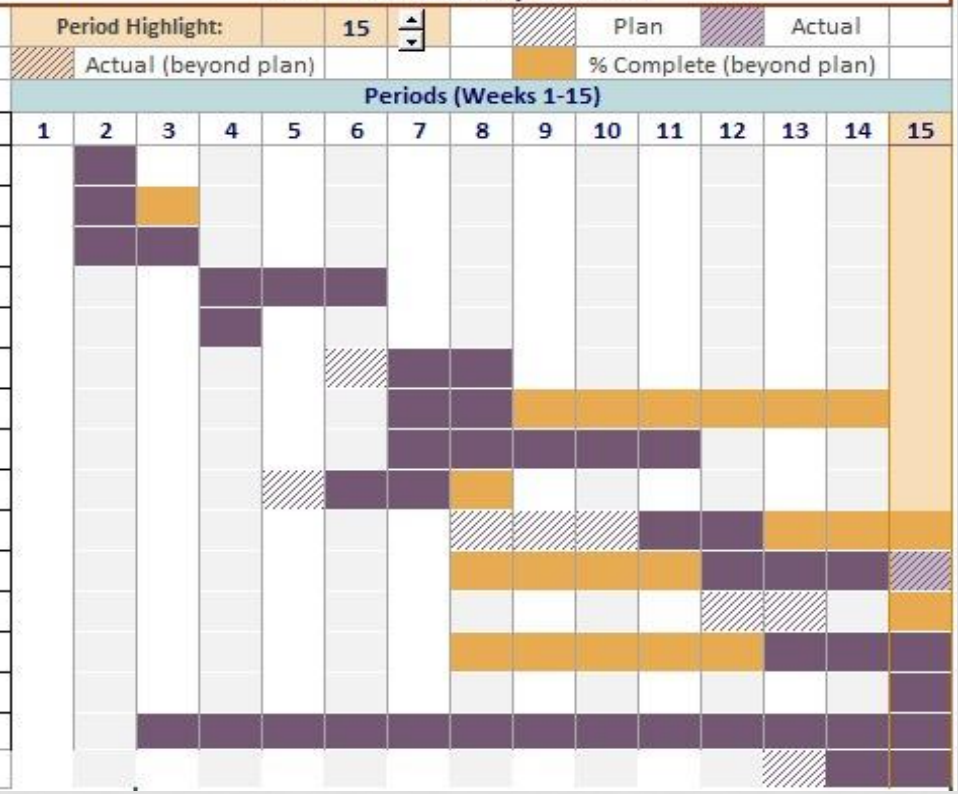
PROJECT MANAGEMENT & TEAMWORK

Task	Ahmed	Zeyad	Sadiq
Search & acquire components	35%	35%	30%
Design & Implement Subsystem 1	35%	30%	35%
Design & Implement Subsystem 2	35%	35%	30%
Design & Implement Subsystem 3	30%	40%	30%
Design & Implement Subsystem 4	50%	25%	25%
Design & Implement Subsystem 5	40%	25%	35%
Testing	35%	35%	30%
Write Reports & Presentations	50%	25%	25%

PROJECT MANAGEMENT & TEAMWORK

Title: Smart Parking Lot Monitoring System	Advisor: Mr. Muhammad Omair Butt	Design II (ASSE 3)	Spring 2022
Ahmed Alabdrabnabi (A) 201602484		Project PLAN & Progress	
Sadiq Alsalah (S) 201801773		ProgRpt No. 6	
Zeyad Alawwad (Z) 201501544		Plan updated (Date): May 17, 2022	
		Instructor: Dr. Sadiq Alhuwaidi	

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Review previous work	2	1	ALL	2	1	100%
Finalizing project specification	2	1	ALL	2	2	100%
Write project plan	2	2	ALL	2	2	100%
Design subsystem IV (LCD display)	4	3	A,Z	4	3	100%
purchase subsystem V's needed components	4	1	S	4	1	100%
Design subsystem V (laser security system)	6	3	A,S	7	2	100%
test each subsystems and confirm that all work properly	7	2	ALL	7	8	100%
Integrate all subsystems and test the main system	7	5	S,Z	7	5	100%
Prepare midterm presentation and video	5	3	A	6	3	100%
Design and build the prototype's physical model	8	5	A,S	11	5	100%
Prepapre final report	12	5	ALL	8	8	90%
Prepapre final presentation	12	2	S, Z	15	1	100%
Prepare project demo	13	3	A	8	8	100%
Submit Rpt/PPT/Brochure/Video...etc.	15	1	A, S	15	1	100%
Prepare and submit progress reports	3	15	A	3	15	100%
Design and build ADDITIONAL subsystem (wireless monitor)	13	3	ALL	14	2	100%



RISK MANAGEMENT

	Source	Events	Threats	Response
1	Power adapter	Power loss	Inability to demonstrate/operate the system	Be prepared to have alternatives
2	PC/microcontroller	Hardware or software failure	Data loss	Online backup and several flash drive copies
3	Team members	Emergency or sickness	Progress delay	Be prepared to miss a member and increase effort
4	Ultrasonic readings	Inaccurate	Might not response to the LED	Try to adjust the readings

IMPACT OF THE PROJECT

- Make it convenient and easier to park.
- Reduce dependability on human operators/workers.
- Save time of drivers looking for parking spots.
- Reduce traffic congestion in parking lots.
- Might decrease potential accidents (improper parking detection).
- Reduce carbon pollution.

NEW SKILLS ACQUIRED AND APPLIED

- Build Leadership Skills.
- Practice teamwork skills.
- Thinking creatively.
- Risk taking and risk management.
- utilizing Feedback to improve future performance.
- Learning Arduino coding.

BUDGET

No.	Description	Quantity	Unit Cost (SR)	Total Cost (SR)
1	Microcontrollers	2	80	160
2	Ultrasonic sensors	8	12.50	100
3	RC servo motors	4	12.50	50
4	LCD display	2	45	90
5	RFID module + tags kit	2	25	50
6	Laser pointer and light sensor kit	4	25	100
7	Misc. components (LEDs, resistors, etc.)			200
8	Light Sensor – LDR module	12	12	144
9	WiFi Module - ESP8266 WRL-13678	1	23	23
10	ESP32 Wi-Fi camera	1	90	90
11	IR Sensor	2	14	28
12	Humidity and Temperature DHT11 Sensor	1	11	11
13	Physical prototype components			300
Total				1346

REFERENCES

i. https://ieeexplore-ieee-org.library.pmu.edu.sa/document/9456425

ii. https://www.researchgate.net/publication/329686583_IoT_Based_Smart_Parking_System

iii. https://www.pmu.edu.sa/attachments/academics/pdf/udp/coe/dept/ee/senior%20design%20projects/final%20report%20(parking%20project).pdf

iv. http://www.joace.org/index.php?m=content&c=index&a=show&catid=68&id=411