BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 304 (January 2023)

Digital Electronics Laboratory

Final Project Report

Section: A1 Group: 02

Smart Car Parking System

Course Instructors:

Hamidur Rahman, Associate Professor
Mrinmoy Kundu2, Part-Time Lecturer

Signature of Instructor: _____

Academic Honesty Statement:

IMPORTANT! Please carefully read and sign the Academic Honesty Statement, below. Type the student ID and name, and put your signature. *You will not receive credit for this project experiment unless this statement is signed in the presence of your lab instructor.*

"In signing this statement, We hereby certify that the work on this project is our own and that we have not copied the work of any other students (past or present), and cited all relevant sources while completing this project. We understand that if we fail to honor this agreement, We will each receive a score of ZERO for this project and be subject to failure of this course."

Signature: _____ **Full Name: Muzakkir Ahmed** **Student ID: 1906002**	**Signature:** _____ **Full Name: Sad Abdullah Sami** **Student ID: 1906011**
Signature: _____ **Full Name: Md. Sabbir Ahmed** **Student ID: 1906004**	**Signature:** _____ **Full Name: Rayhan Siddiq** **Student ID: 1906022**

Table of Contents

1 Abstract

With the rise of modernization and urbanization the usage of motor vehicles especially cars have increased a great amount. The amount of cars in an urban region is very high nowadays. Due to having a great number of automobiles in a small area, finding parking spot in congested urban areas is a tiresome and hard task. This leads to wastage of time, traffic congestion and negative emotional effect for the people. Our project “Smart Car Parking System” provides a solution to this troublesome issue. This project can provide real-time information on parking availability and enable drivers to locate parking spots easily.

2 Introduction

In this project when a car enters through the gate and moves to a parking spot The LED of that allotted slot will be turned on. Our smart system keeps count of the vehicles that are parked here. In this prototype model we kept 8 parking slots. We show the number of filled parking spots and also the free parking spots in separate displays. A new car that entered through the gate can easily see whether a parking spot is open or not by observing the corresponding LED. If all the spots are filled than a display will show “FULL”. And new cars trying to enter will be able to see it. If a new car try to enter after all spots are filled than a buzzer will start immediately also the gate will not open. Implementation of gate is a bit difficult as it needs to rotate in both direction. Also working with IR sensor is difficult as it often responds incorrectly.
We will basically use adders to implement the project. Another alternative is to use counters.

3 Design

3.1 Problem Formulation

3.1.1 Identification of Scope

The project's scope encompasses the creation and deployment of an advanced parking management system with the primary goal of enhancing the parking experience in urban areas.
Initially, the project will target a specific urban location, city, or a particular parking facility for system implementation and testing. Future expansion to other areas may be considered.

Scope Elements:

Software Development:

Design and construct the necessary software infrastructure for the Smart Car Parking System.

Hardware Integration:

Incorporate essential hardware components like sensors, ICs.

User-Friendly Application:

Create an easy-to-use mobile or web application that enables users to access parking information, reserve parking spots, and make payments seamlessly.

Security Measures:

Integrate robust security features to safeguard user data and ensure system integrity, including encryption, access controls, and authentication protocols.

Payment Processing Integration:

Merge payment gateways to allow users to make parking-related payments directly through the application.

Technical Limitations:

The scope addresses the resolution of technical limitations that may arise during system development and deployment, including compatibility issues and hardware constraints.

Potential for Expansion:

While the initial emphasis is on a specific area, the scope acknowledges the potential for future expansion to other urban areas or regions as the system's efficacy is demonstrated.

3.1.2 Literature Review

Smart car parking systems have gained increasing attention due to the rapid growth of urban areas and the rising number of vehicles. Researchers and developers are keenly interested in these systems as they offer the potential to efficiently manage parking, alleviate traffic congestion, reduce environmental impact, and enhance urban living.

Technology and Components

Numerous studies highlight the integration of diverse technologies within smart parking systems. These technologies encompass sensors like infrared, camera-based devices, as well as communication networks such as IoT. Additionally, data analytics and mobile applications are employed to monitor and manage parking spaces effectively.

Parking Space Detection and Management

Extensive research explores real-time parking space detection and management techniques.

Environmental Benefits

The literature underscores the potential environmental advantages of smart parking systems. By minimizing the time spent searching for parking spaces, these systems can contribute to reduced fuel consumption and lower greenhouse gas emissions.

User Experience and User Acceptance

User experience and acceptance are pivotal factors in the success of smart parking systems. Research delves into user preferences, concerns, and behaviors, shedding light on the design considerations needed to cater to both drivers and parking facility operators effectively.

Security and Privacy

Ensuring security and privacy within smart car parking systems is a recurring theme. Researchers emphasize the importance of safeguarding data, preventing cyberattacks, and protecting user information.

Economic Viability

The literature also delves into the economic feasibility of implementing smart parking systems. Cost-benefit analyses, revenue generation models, and return on investment assessments provide insights into the financial viability of these systems for both public and private stakeholders.

Challenges and Future Directions

Despite progress, challenges persist in the smart car parking field. These include the need for standardized protocols, scalability issues, and the integration of autonomous vehicles into smart parking systems. Future research is expected to focus on addressing these challenges and advancing technology in this area to meet the evolving demands of urban environments.

3.1.3 Formulation of Problem

Conventional parking management systems often lack effectiveness and real-time data, exacerbating these issues. The development of a "Smart Car Parking System" is crucial to address these challenges.

Problem Statement:

The problem at hand revolves around the inefficient utilization and administration of parking spaces in urban settings. Present parking systems grapple with various issues, including:

Inefficient Space Management:

Parking facilities frequently struggle to optimize the allocation of parking spaces, leading to the inefficient utilization of valuable urban land resources and financial losses for facility owners.

Environmental Consequences:

The constant circling of vehicles searching for parking not only contributes to traffic

congestion but also leads to increased fuel consumption and emissions, negatively impacting the environment.

User Hassles:

Users encounter difficulties in locating parking, making payments, and accessing parking facilities efficiently, resulting in a less-than-ideal user experience.

3.1.4 Analysis

The problem statement for the "Smart Car Parking System" project addresses a pertinent urban challenge - the efficient management of parking spaces. A closer examination of this problem formulation reveals several noteworthy aspects:

Relevance of the Problem:

This problem is highly pertinent in light of urban expansion and the resulting surge in vehicles. Urban congestion and environmental concerns have become increasingly acute, underscoring the need for effective parking management. The issue is in alignment with contemporary urban dilemmas, calling for innovative solutions.

Existing Challenges:

The problem statement adeptly identifies prevailing issues in parking management, including suboptimal space utilization, environmental repercussions, and user inconveniences. These issues are well-documented in urban settings, contributing to traffic bottlenecks, resource wastage, pollution, and user dissatisfaction.

Objectives and Expected Outcomes:

The problem statement presents precise and distinct objectives. The project seeks to optimize parking space allocation, diminish environmental impacts, and elevate the overall user experience. These objectives harmonize with the aspirations of smart city initiatives and sustainable urban progress.

Significance and Impact:

The problem formulation underscores the importance of successfully executing the project. Mitigating parking management issues will result in reduced traffic congestion, enhanced air quality, improved user experiences, and a more effective utilization of urban space. Furthermore, the project aligns with broader objectives aimed at cultivating intelligent and sustainable cities.

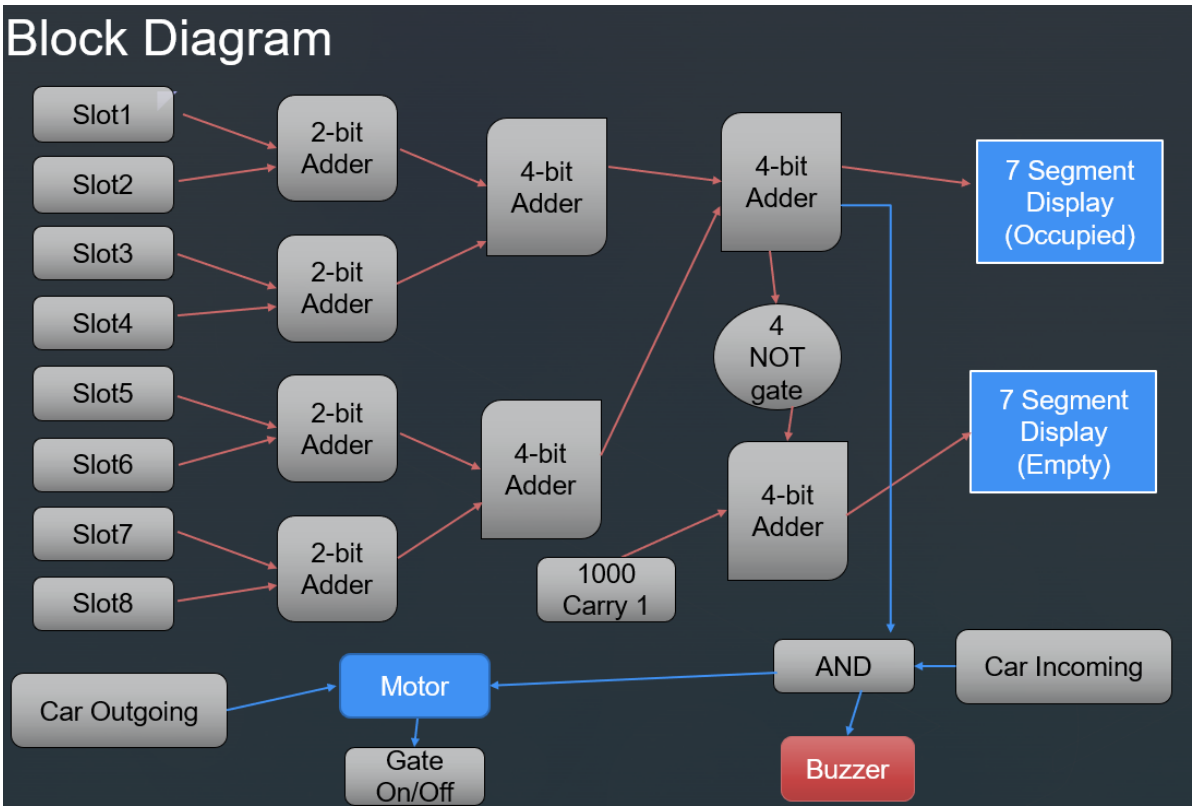
User-Centric Approach:

The problem formulation accentuates a user-oriented approach by recognizing and addressing user challenges and inconveniences within current parking systems. This emphasis on users is critical for ensuring that the eventual solution meets the requirements and anticipations of both drivers and parking facility administrators.

In summary, the problem formulation for the "Smart Car Parking System" project adeptly identifies pressing issues in parking management, outlines clear objectives and anticipated results, defines the project's scope and deliverables, underscores its

significance, and adopts a user-centered perspective. This formulation lays a robust groundwork for the development of a solution with the potential to significantly influence urban mobility and sustainability.

3.2 Design Method



As depicted in the block diagram, IR sensor is placed at each 8 slot. IR sensor gives 0 logic output when it detects an object. Output from IR sensor is passed through NOT gate thus we get 1 logic output when object is detected. Four 2-bit adder individually adds the data from the IR sensors. We could not find 2-bit adder IC 7482 in the market and alternatively used 4-bit adder IC 74283 in place of 2-bit adder.

Outputs from 2-bit adders then again added using two 4-bit adder and again output from two 4-bit adder is added using another adder. That is we finally count the number of occupied slots by this addition method. This number is then showed in a 7 segment display using display driver IC.

Now to find number of empty slot, total occupied slot is subtracted from total number of slots. To do so, occupied number is 2's complemented and added to 8 (1000). 2's complement is done by inverting each digit using not gate and a carry of 1 is added in a adder circuit. Resulted empty slot number is then showed in a 7 segment display using display driver IC.

When all the slots are occupied by the cars, adding all 8 digits should give binary 1000. Here to notice that MSB is 1. Using this property, Buzzer and motor in the gate.

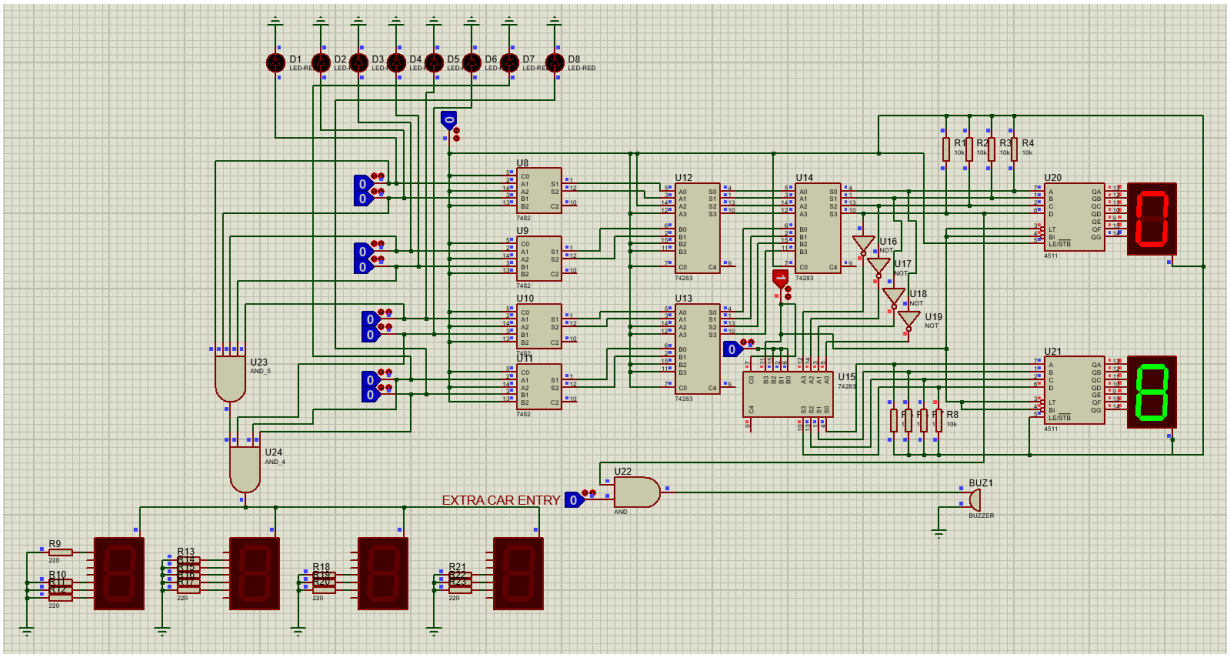
When all slots are filled and another extra car tries to enter, a sensor in the gate senses the presence of the car and that data is ANDed with the MSB digit 1 to ring the buzzer. Two DC gear motor in the gate is used for entering and leaving the cars. The gate opens when a car tries to enter provided that there is empty slot for the car. If there is no empty slot, then the gate does not open. This phenomenon is done using a NAND gate, 2 micro limit switch for each motor. Input to the NAND gate are power supply (logic 1) and MSB of the adder output. As described earlier, MSB only gives 1 when all the slots are occupied, otherwise it is 0. As a result, the NAND gate output is 1 except the case when all the slots are occupied.

The exit gate permits the cars to exit the slots and the gating is done using a DC gear motor and 2 micro limit switch.

Additionally, there will be a display outside in which ‘FULL’ will be shown when all the slots are occupied. This can be done using the slots sensor outputs. When all the slots gives 1 logic level, the signals can be ANDed and output of AND gate can be used to power up the 7 segment displays to show ‘FULL’.

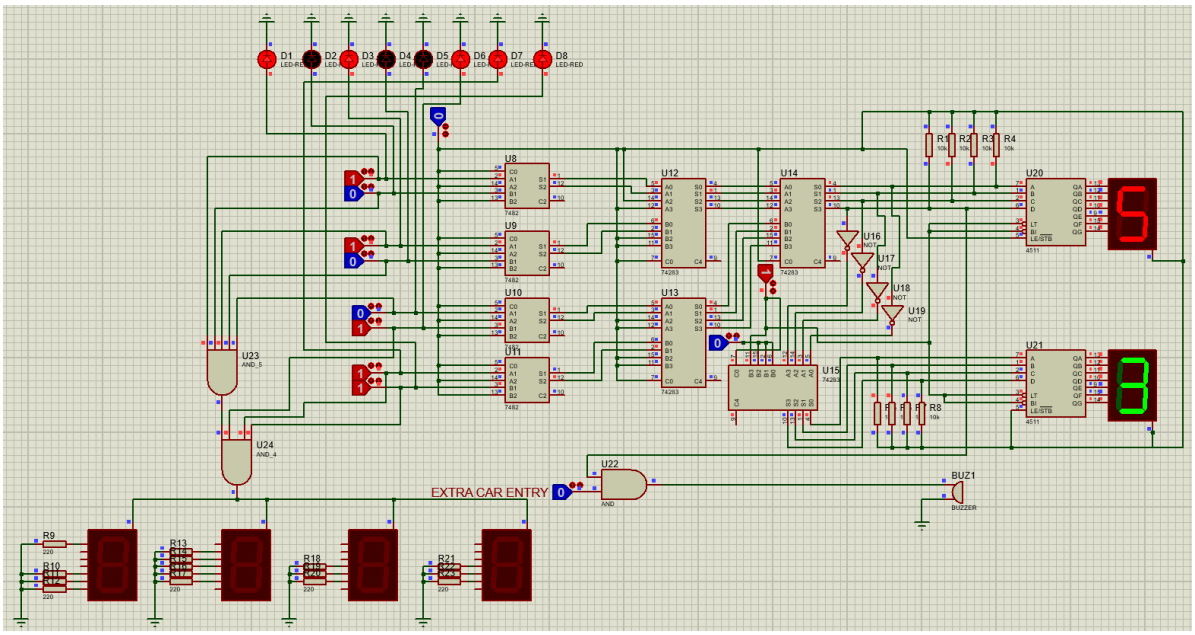
Also, at the output side, there will be 8 LED’s whose states will tell which slots are empty and which are occupied. This is done by directly connecting sensor outputs to LED’s.

3.3 Simulation Model



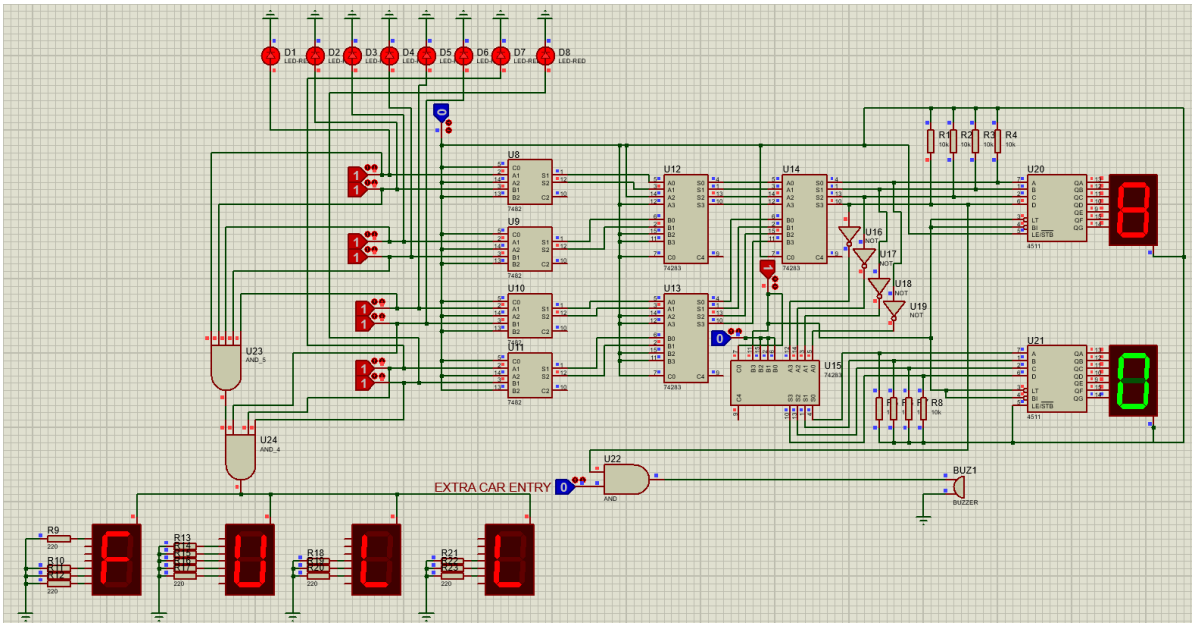
Red indicates occupied slots and Green indicates empty slots.

Now when some slots are occupied:



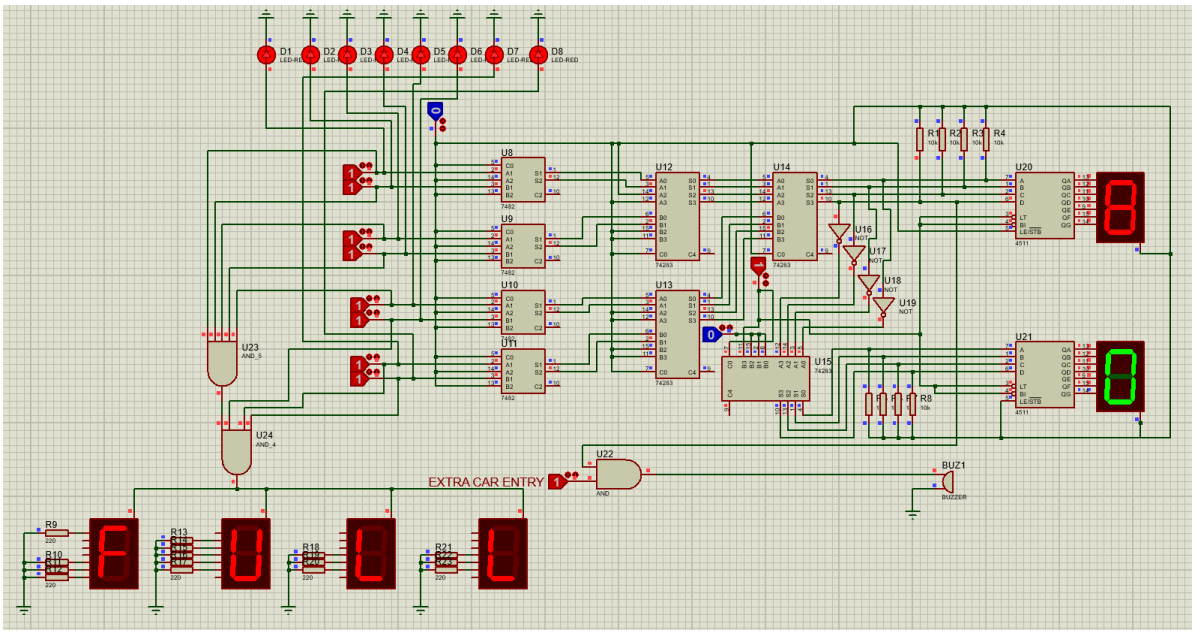
As seen from the simulation model, number of occupied and empty slots are showing correctly at the segment display. Also corresponding LED of occupied slots are lighted.

When all slots are occupied:



'FULL' is shown at segmented display when all the slots are occupied. Also occupied, empty number is displayed correctly along with the individual LEDs.

If another car tries to enter when all the slots are already filled:

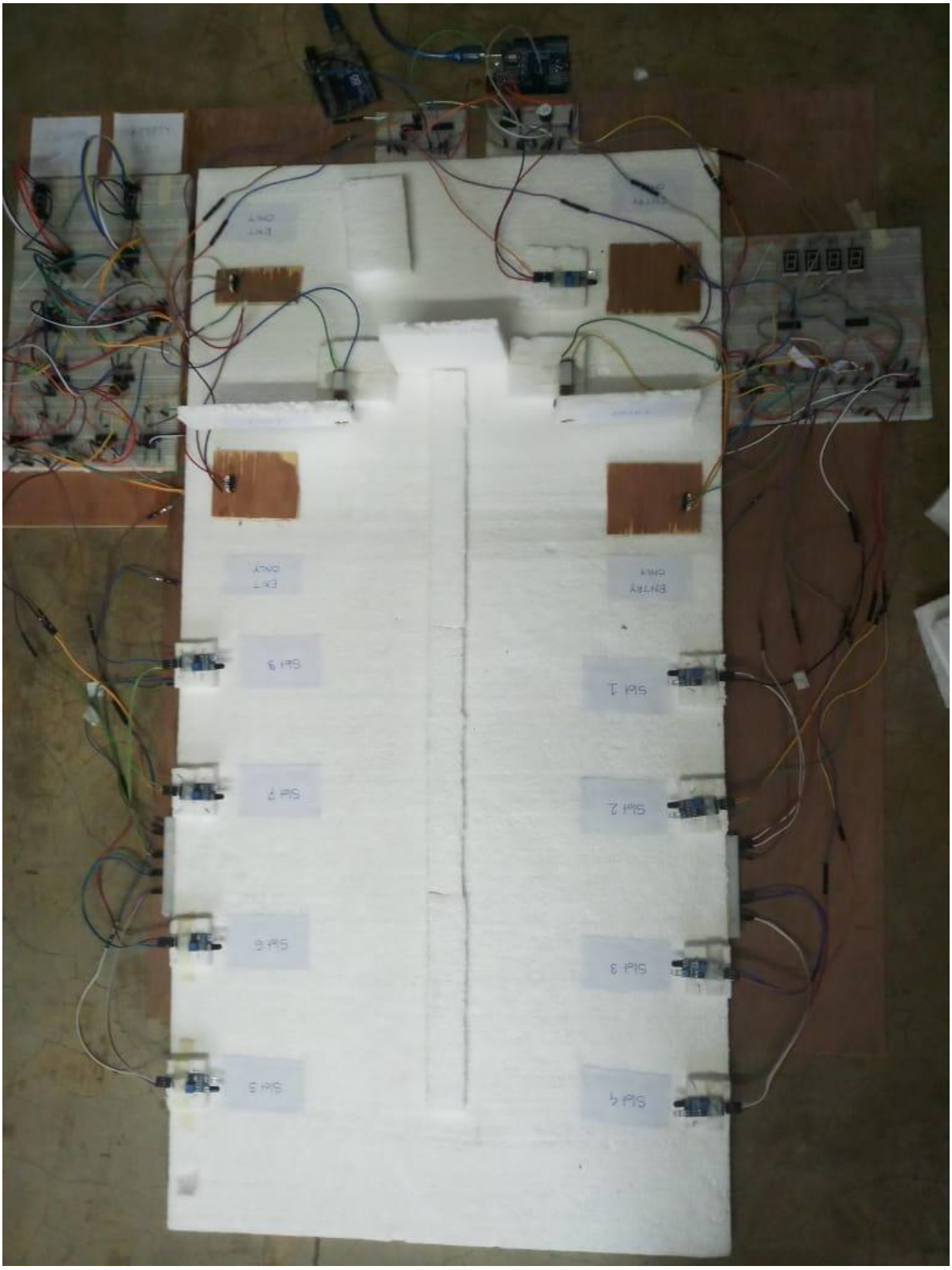


The buzzer is activated.

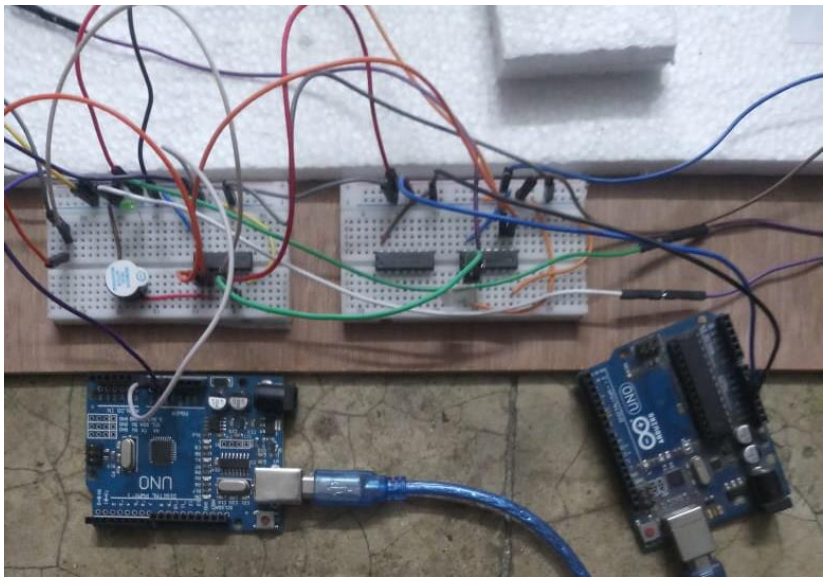
Implementing gate is not simulated. It is additionally implemented using gear motor, limit switches, and NAND gate as explained earlier.

3.4Hardware Design

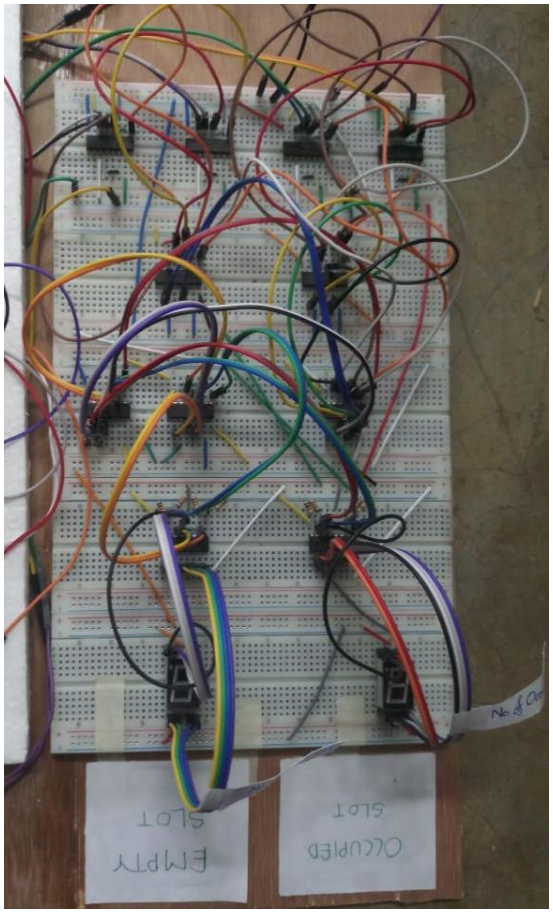
Circuits have been built in breadboards and final structure is placed on a MDF board. For powering the circuits, we have used 2 Arduino uno. Arduino is used just to take power. Cars are simulated using rectangular-shaped plastic for our demonstration purpose. Hardware design of our final project:


ENTRY ONLY
EXIT ONLY
Slot 1
Slot 2
Slot 3
Slot 4
Slot 5
Slot 6
Slot 7
Slot 8

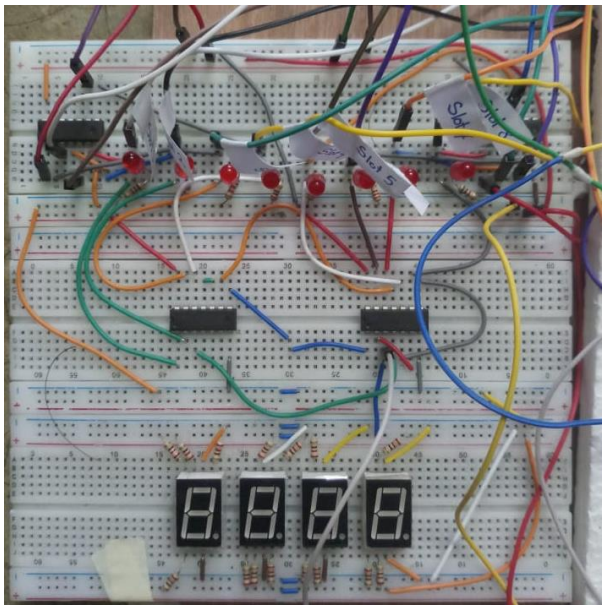
Circuits:



Power supply



Counting slots (empty, occupied)



circuit for displaying ‘FULL’ and LEDs of slots

4 Implementation

4.1 Description

We designed this experiment in a simplified way. The IR sensor act as the input device. Inputs from IR sensor first come to a NOT gate as IR sensor gives logical 0 when it detects any object. Then the output of NOT gate is connected to four 4-bit adder where every adder will add only 2-bit. As mentioned earlier, we couldn't find IC 7482 in the market hence used IC 74283 as 2-bit adder. Unused 2 bit of the 4 bit adder is connected to the ground.

Then output of four adder is connected to two 4-bit adder. Outputs of these two 4-bit adder is again connected to a 4-bit adder. Output of this adder eventually gives the binary bit corresponding to the decimal of total number of occupied slots. This bit stream is passed to IC CD4511 which drives a 7 segment display to show the occupied number of slots.

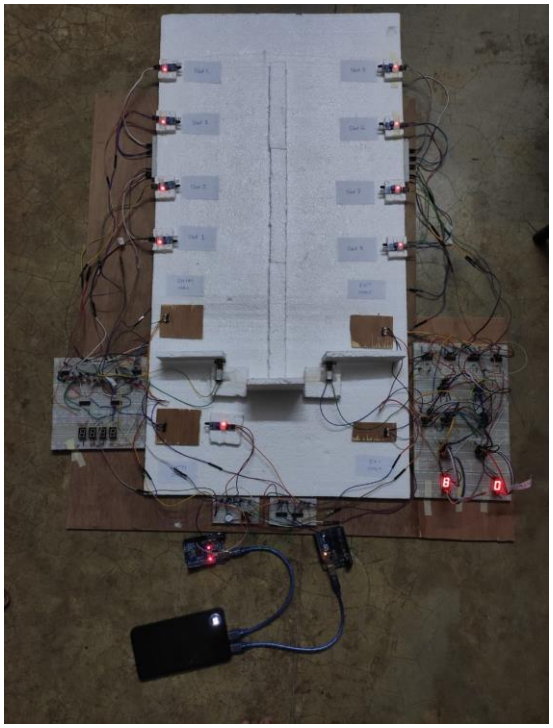
To count number of empty slots, occupied number should be subtracted from total number of slots. To do so, 2's compliment of occupied binary expression is done using four NOT gate and using another 4-bit adder, subtraction is done. Output from this adder is the total number of empty slots, it goes to CD4511 and drives another 7 segment display to show the total number of slots available for parking.

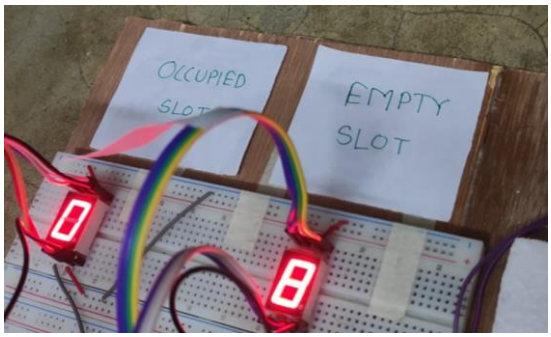
A gate has been added in front of the design. We used two DC motor. One for entry, other for exit. Now the entry gate will open until parking slot is full. Once parking slot is full, it will not open until at least one spot is emptied. A buzzer has been added. If another car tries to enter the slot through gate when the slot is full, the buzzer will give a sound. "FULL" text will pop-up once the parking slot is full.

Gating mechanism is done by using limit switches and NAND gate logic. Explanation of the gating mechanism has been described in the 'Design Method' portion. Displaying 'FULL' is done by using AND logic when all the slots are occupied. Also a total of 8 LEDs are connected through 8 outputs of the IR sensor to give the current state of the slots. If corresponding LED is on, then the slot is occupied otherwise empty. Thus by observing from outside, driver can know which position is available and where to park.

4.2 Experiment and Data Collection

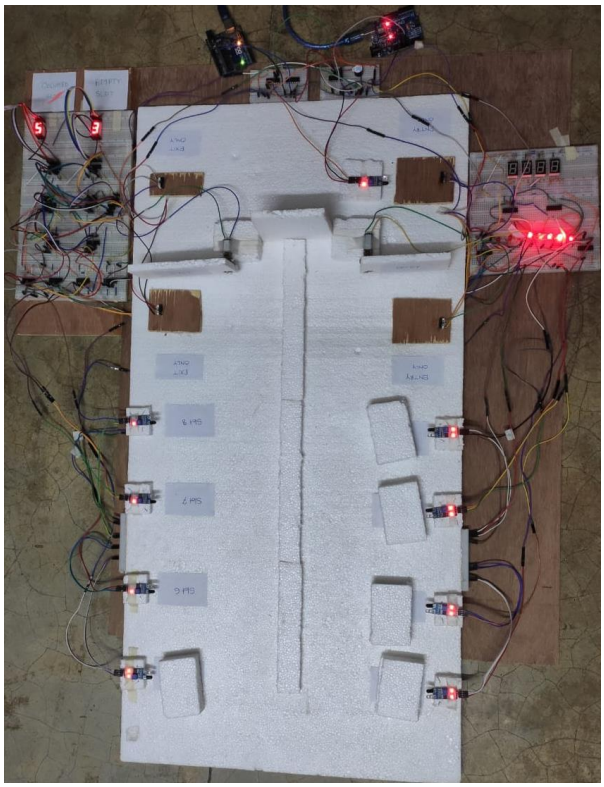
When all the slots are empty:



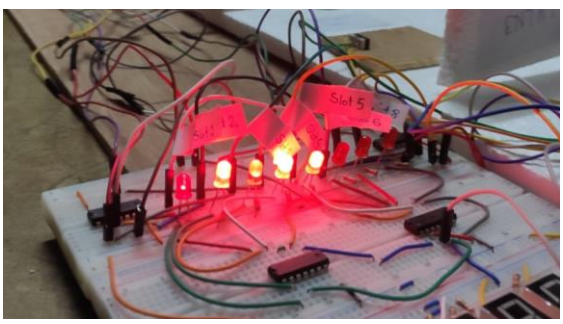


Occupied and empty slots are showing 0 and 8 as expected.

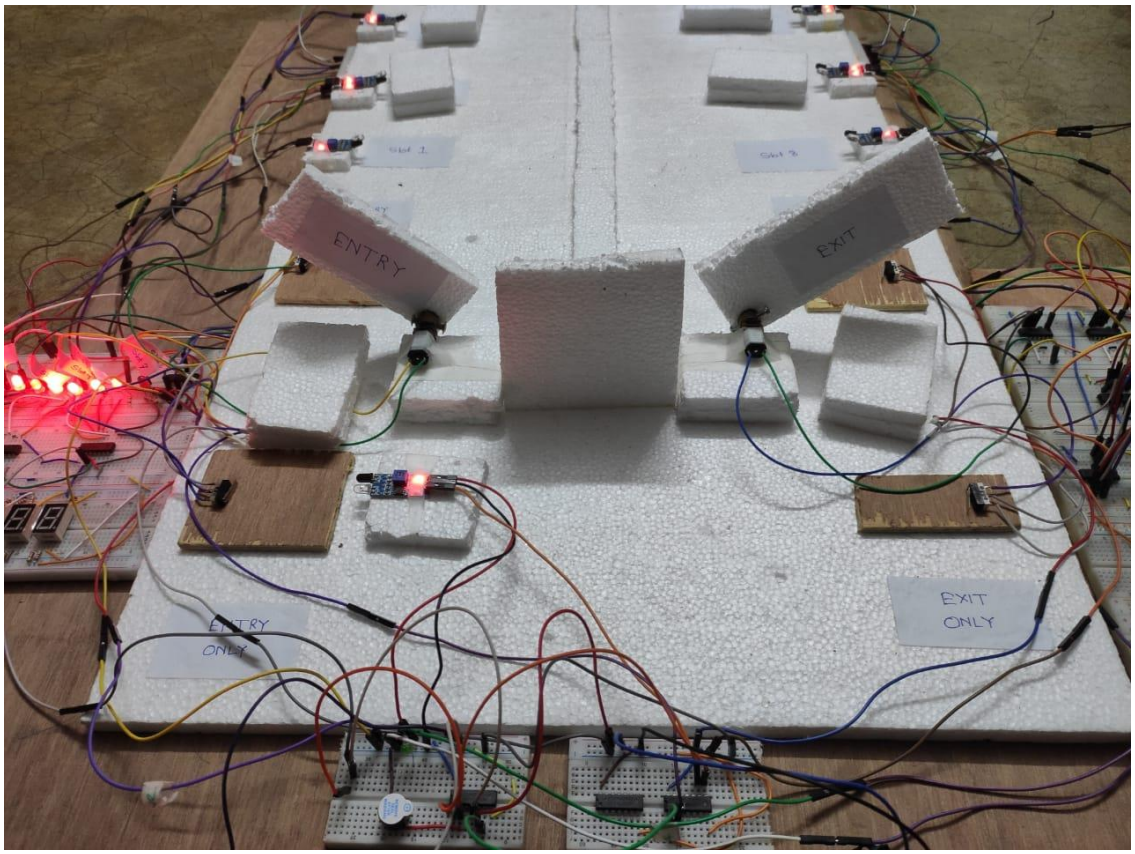
After some slots are filled:



5 slots has been occupied and the display in the occupied and empty slot is showing exact result. Also the corresponding LED of each occupied slots is lighted. As we can see in the picture, 1, 2, 3, 4 and 5 slot's LEDs are lighted.

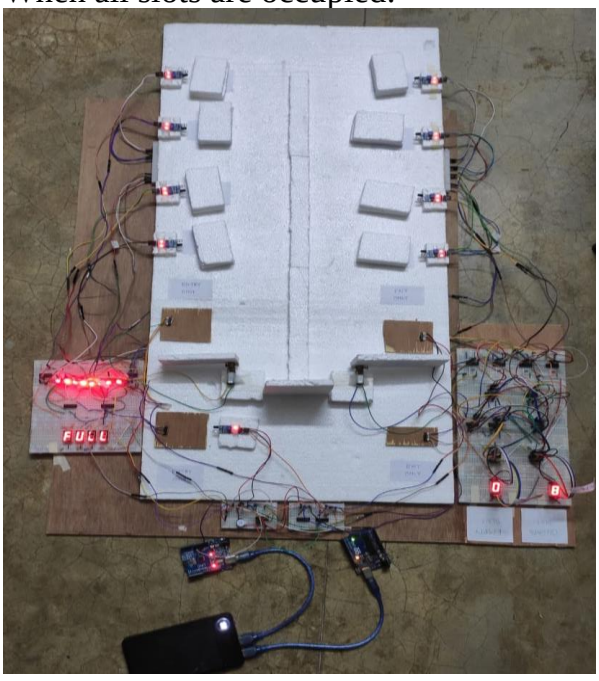


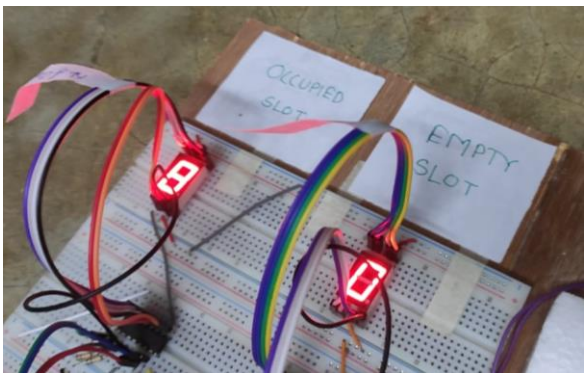
Gate:



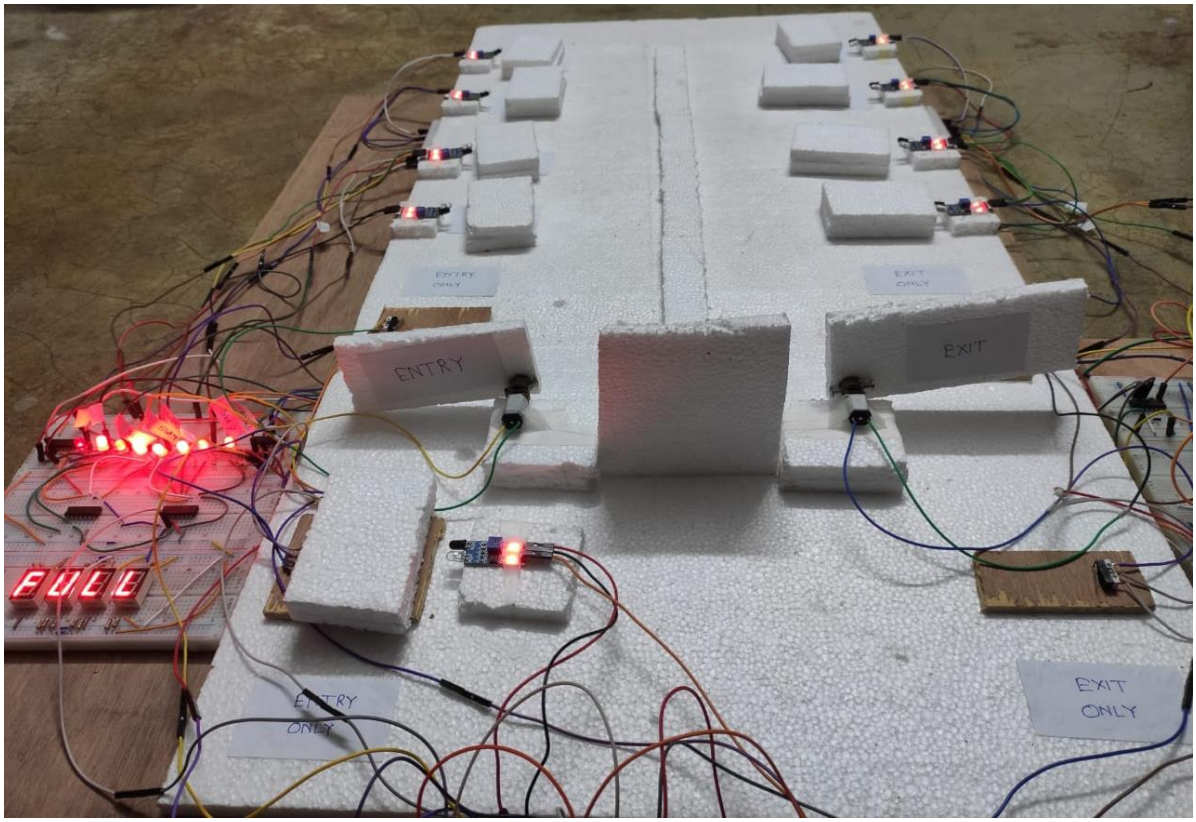
When empty slot is present, Entry gate allows next car to go in and park. Exit gate allows car to exit the parking spot.

When all slots are occupied:





Occupied and empty slots shows 8 and 0 respectively.



'FULL' is displayed and all 8 LEDs are lighted when all the slots are occupied. Also buzzer is giving beep when another car is trying to enter. Gate is not allowing to enter extra car while all the slots are filled.

4.3 Data Analysis

No of Car	No of LED ON	Occupied	Empty	"FULL" text	Entry Gate	Buzzer
0	0	0	8	off	on	off
1	1	1	7	off	on	off
2	2	2	6	off	on	off
3	3	3	5	off	on	off
4	4	4	4	off	on	off
5	5	5	3	off	on	off
6	6	6	2	off	on	off
7	7	7	1	off	on	off
8	8	8	0	on	on	off
9	8	8	0	on	off	on

4.4 Results

Hardware implementation of our project gives expected result as we get from the simulation. We used 8 four bit adder, several logic gates, driver ICs, segmented display and all worked as expected. Buzzer and LED also worked fine. Motor and limit switches functions perfectly. IR sensos gives a little error sometimes in sensing and that causes our results to deviate from expectation.

5 Design Analysis and Evaluation

5.1 Novelty

We added one way gate feature in our project. Cars will enter through one gate and exit through another. Also, if a car tries to enter the parking lot when it is full of its capacity, the gate will no open. It will remain close until another car leaves the parking lot. A buzzer will also turn on and indicate that the car cannot enter the lot.

5.2 Design Considerations

5.2.1 Considerations to public health and safety

Public safety was one of our main consideration while doing this project. Often people get hurt or accident occurs by the traffic standing on road side. So, our project will reduce this problem because every car will be placed in a parking spot which will reduce traffic density in the road

5.2.2 Considerations to environment

All automobile items produce greenhouse gas. They also emits a lot of carbon dusts as their engine is on. To reduce the harmful effect of these, our project will help. As the car will be parked, there engine will remain off. So, emission of these thing will be less than before.

5.2.3 Considerations to cultural and societal needs

As our country is developing, many vehicles are entering in the transport and roads every year. It is almost a social need of having a personal car. As in our city free space is scarcity, this project will help to fulfill this social demand. Also aesthetic decoration of parking spots will improve the beauty of that place.

5.3 Investigations

5.3.1 Literature Review

We needed some mechanism to detect whether a spot is occupied or not. Optical sensor solved this issue. Then we wanted to know how many spots were filled. The outputs of the censors were fed to a multi-stage 4-bit adder combination. The final stage 4-bit adder provides us with a value between 0 to 8 to show how many spots are occupied. We also wanted to show how many spots are empty. We used the final stage 4-bit adder output and used 2's compliment mechanism to subtract it from 8 (number of total spots). We needed it to display these values and 7-segment displays helped in this regard. 7-segment displays also helped in showing "FULL" indicating that there is no spot available. Even after this if anyone tries to enter through gate a "Buzzer" sound will immediately start. We needed a gate mechanism to decide whether a car would be allowed to enter or not. We solved the issue using a NAND gate.

5.3.2 Experiment Design

A total of eight 4-bit adder IC 74283, eight breadboard, two Arduino uno, 9 IR sensor, 4 NOT gate IC 7404, 3 and gate IC 7408, two driver IC CD4511, 2 anode 7 segment display, 4 cathode 7 segment display, 4 limit switch, 2 DC gear motor, 2 gear motor coupler and total 8 LED's are used in our project design.

5.3.3 Data Analysis and Interpretation

From the data analysis part, we get an overview of our project. As number of occupied car increases from 0 to 8, display, LED and motor outputs and functionality changes as expected.

5.4 Limitations of Tools

IR sensor is sensitive. If often senses object from distance which may cause error.

5.5 Impact Assessment

5.5.1 Assessment of Societal and Cultural Issues

Some mentionable societal and cultural impacts of the project are:

Accessibility and Inclusivity:

Smart car parking systems often heavily rely on technology, such as mobile applications or digital payment methods. This dependence may exclude individuals who are not technologically proficient or lack access to smartphones. So we ensured in the project that the system remains accessible and inclusive for all members of the community, irrespective of their age, income, or technological competence.

Socioeconomic Disparities:

The introduction of a smart car parking system may potentially widen existing socioeconomic gaps. For instance, if the system depends on expensive sensors or necessitates costly subscription fees, it may disproportionately affect individuals with lower incomes who cannot afford these services. Ensuring that pricing and access are fair and equitable is essential to prevent such disparities. Our project was driven towards diminishing these disparities.

Economic Gains and Stress Reduction:

Efficient parking procedures can alleviate the stress associated with locating parking spaces, potentially leading to mental health benefits and overall improved well-being.

Community Engagement:

Involving the local community and integrating their input can cultivate a sense of community ownership and collaboration, nurturing a safer and more inclusive atmosphere.

While the "Smart Car Parking System" project is anticipated to yield a multitude of positive effects on societal and cultural issues, it remains imperative to conduct regular evaluations and address emerging concerns to ensure the sustained well-being of users and the community

5.5.2 Assessment of Health and Safety Issues

Some mentionable health and safety impacts of the project are:

Improved Air Quality:

Diminished traffic congestion and smoother parking procedures will result in fewer vehicle emissions, contributing to the enhancement of air quality in the vicinity. This is likely to have a direct beneficial effect on the respiratory health of the local populace.

Lower Risk of Vehicle Accidents:

Clearly marked signage, traffic management features, and speed limits within the parking facility can curtail the probability of vehicle collisions and pedestrian accidents, thus contributing to overall safety.

Health and Safety Protocols (Post-Pandemic Considerations):

Implementing health and safety protocols such as touchless payment options and sanitation stations can mitigate the risk of infectious disease transmission, thereby promoting public health and safety.

Compliance with Health and Safety Standards:

Strict adherence to health and safety standards ensures that the parking facility attains and maintains high safety standards, safeguarding the well-being of users and the surrounding community.

While the "Smart Car Parking System" project is anticipated to yield a multitude of positive outcomes for public health and safety, it remains imperative to conduct regular evaluations and address emerging concerns to ensure the sustained well-being of users and the community.

5.5.3 Assessment of Legal Issues

We designed our project considering all possible legal issues. We did not pirated any content or used any component that has restrictions.

5.6 Sustainability and Environmental Impact Evaluation

Alleviating Traffic Congestion:

The project's provision of real-time parking data is expected to alleviate traffic congestion by expediting the parking process, resulting in reduced fuel consumption and lower emissions of greenhouse gases.

Enhancement of Air Quality:

Reduced traffic congestion and less vehicle idling will lead to improved air quality, reducing the environmental harm caused by pollutants.

Use of Sustainable Materials:

The utilization of sustainable and recycled materials in construction and maintenance minimizes the project's ecological footprint by conserving resources and reducing waste.

Reduction in Carbon Footprint:

Streamlined parking processes lead to reduced vehicle idling and emissions, directly resulting in a smaller carbon footprint.

The "Smart Car Parking System" project underscores a dedication to sustainability and environmental responsibility by incorporating diverse features and practices aimed at mitigating its ecological impact and fostering a more sustainable urban setting. Continuous monitoring and an unwavering commitment to sustainable practices are essential for ensuring the project's enduring environmental benefits.

5.7 Ethical Issues

While doing this project, we had to keep a sharp eye whether it violets ethical issues. After completing the project, we can say that there was no serious ethical issues found. Our work was completely of our own.

6 Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

ID	Contribution
1906002	Built circuit in breadboard, debugged errors, assembled the model
1906004	Designed simulation model, debugged errors, assembled the model
1906011	Bought components, analysis and wrote report
1906022	Built circuit in breadboard, assembled the model, debugging errors

6.2 Mode of Team Work

Our team took a collaborative approach in doing things. We tried to work as a team while completing individual responsibilities. For completing a particular test multiple member tried to work together (at least two) so that errors could be minimized. Decision making was done through consensus.

6.3 Diversity Statement of Team

As everyone worked fluently and efficiently, the team was dynamic. We set a target every week and tried to fulfill it. As the team was diverse, we accomplished our target every week.

6.4 Log Book of Project Implementation

Timeline	What we did
Week 6	Build simulation file
Week 7	Bought components
Week 8	Started building circuit
Week 9	Completed circuit building
Week 10	Started building the model

Week 11	Completed the model
Week 12	Debugged errors
Week 13	Completed the project

7 Communication

7.1 Executive Summary

Introducing the Smart Car Parking System: Revolutionizing Urban Mobility

[City, Date] – We are thrilled to unveil our innovative Smart Car Parking System, set to transform urban parking. Leveraging real-time data, user-friendly mobile apps, and predictive analytics, this system streamlines parking, reduces congestion, and benefits the environment. Drivers can easily find, reserve, and pay for parking spots, while cities benefit from enhanced traffic flow and reduced emissions. Stay tuned as we roll out this game-changing solution in select locations, ushering in a smarter and more sustainable future for urban transportation.

Please get in touch with 01763110902 with any media queries.
Company: XYZ Smart Tech Limited
Website: www.xyzsmarttech.com
Phone: 01763110902
Gmail: sabbirahme354@gmail.com

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7.2 User Manual

1. Introduction:
This smart car parking system can provide solution for traffic congestion.

2. Important Safety Warning:
Caution! Check circuit connection is completed before turning on
Caution! Do not connect the circuit with wet hand

3. Product Overview:
i. Logic circuit
ii. DC Gear Motor
iii. DC Gear Motor Coupler
iv. Limit Switch
v. IR Sensor
vi. Gate
vii. Wire
viii. Power Supply

4. Installation:
i. Open the package.
ii. Place it in the open space

5. Operation
i. The logic circuit will take data and process it
ii. DC gear motor will be on when limit switch is pressed so that the gate opens and closes
iii. IR sensor will work as the input for a car entry
iv. 7 Segment display will show the number of occupied spot and empty spot.

6. Maintenance
i. Check power supply every week
ii. Carefully handle IR sensor as it has high sensitivity
iii. Check the logic circuit connection every week

8 Project Management and Cost Analysis

One member kept tracking of the money spend in this project and the others helped him to keep up with the count of the money. This project cost as nearly 6000 taka. However, if it is to implement in real life, then cost will increase.

8.1 Bill of Materials

Component	Unit Price(tk)	Total(tk)
Breadboard	140/-	1260/-
Arduino UNO	660/-	1320/-
4 bit Adder	37/-	296/-
IR Sensor	45/-	405/-
Not Gate	26/-	104/-
And Gate	31/-	93/-
7-Segment Driver IC	59/-	118/-
Jumper Box	165/-	165/-
Jumper Wire	3/-	540/-
Resistor	0.8/-	32/-
7-Segment Anode Display	9/-	18/-
7-Segment Cathode Display	9/-	36/-
LED	1/-	8/-
Limit Switch	45/-	180/-
DC Gear Motor	338/-	676/-
DC Motor Coupler	130/-	260/-
Card Board	400/-	400/-
Total		5911/-

9 Future Work

There is a huge scope for improvement in this project.

- A timer can be placed in the parking spot to measure the time spend by the car in the parking lot.
- Smart monitor can be implemented so that incoming and outgoing cars count, position can be found accurately.
- Building the circuit in a compact chassis may remove all the problem that we have face while building it.
- A smart monition can be added in this project which will show which no slot is empty so that the person who will try to enter the parking lot may get a better view of his/her parking spot.

10 References

a. https://www.electroduino.com/smart-parking-system-project-using-arduino-and-ir-sensor/

b. https://techatronic.com/automatic-car-parking-system-project-using-arduino/