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

EEE304(January 2023)
Digital Electronics Laboratory

Final Project Report

Section: A1Group: 05

Password Protected Automated Car Parking System

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AcademicHonestyStatement:

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1. Abstract

In today's modern era, the demand for private cars is on the rise. Simultaneously, the need for a secure car parking system and enhanced security measures is growing. In our project, we have developed an automated car parking and security management system. Firstly, an LED indicator informs users of parking slot availability. When a slot is empty, users can park their cars and set a security password. An automatic timer starts to measure the parking duration. Users pay the bill and enter the correct password to retrieve their cars. Incorrect passwords or attempts to move the car trigger an alarm, alerting parking attendants. The timer continues counting until the correct password is entered. After correct password submission, the timer pauses. Users can reset it by pressing a designated button, allowing them to safely retrieve their cars. Our system ensures vehicle safety and offers a user-friendly parking experience, addressing the growing need for secure car parking.

2. Introduction

As the demand for car parking and security continues to rise, a secured car parking system is undeniably essential. However, traditional car parking management systems have several issues. First and foremost concern of the car owners is security system. Secondly, the manual process of checking parking slot availability consumes valuable time for car owners. Furthermore, ensuring accurate parking bill becomes a source of worry for parking slot owners, sometimes leading to frustrating situations in real life.

These issues can be addressed in several ways. To tackle security concerns, we have introduced a password security system, benefiting both car owners and parking slot operators. To save time for checking slot availability, we have implemented an indicator LED lamp. In addition, we have introduced a timer to accurately measure parking duration and calculate parking fees. Realizing these solutions requires engineering expertise.

Indeed, there are alternative solutions available to address the challenges in car parking management. These include ticket-based systems, online car security information systems, and online banking payment systems and so on. These

alternatives offer different approaches to enhance the car parking experience.

3. Design

3.1 Problem Formulation

Our objective is to design a smart car parking system with password protection security system. We want to build a car parking system where a car owner can assure safety. We want to build one parking slot with smart billing system and password protected security system. When a car entered at the parking slot, we have to make sure that any new car can't be able to enter and none can leave without giving correct password.

3.1.1 Identification of Scope

Our projects includes smart billing system and password protected security system. We only used IC components and sensors to design our project. We did not use any microcontroller. Our project is relatively of low cost as we are using basic electronic devices to get our outputs.

3.1.2 Literature Review

We have to study the theory of electronic devices for the theory of our project. We have to learn working principle of IC components that we used. We have to understand their truth table.

3.1.3 Formulation of Problem

We need to observe how our circuit behaves when a new car entered, when some gives wrong password or right password and when someone left entering wrong password or without entering password. To design these output, we use LED valve. For billing system we need to make sure that counting only stops when car owner leaves legally.

3.1.4 Analysis

We Several LED lights to display. Each LED has their own meaning. L1 is active low when slot is currently full, L2 is ON when correct password is given, L3 is ON when incorrect password is given, L4 is ON means unauthorized movement, L5 is ON means warning, L6 is red means door is closed and L6 is green means door is open. We also observe when a car enter, LCD display stars counting and it stops when car leaves after entering correct password.

3.2 Design Method

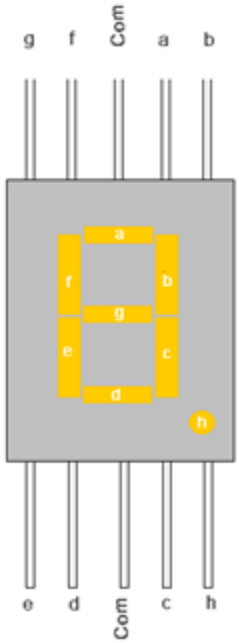
We divide our project into three parts: Smart Parking System, Smart Billing system, Password protected Security system.

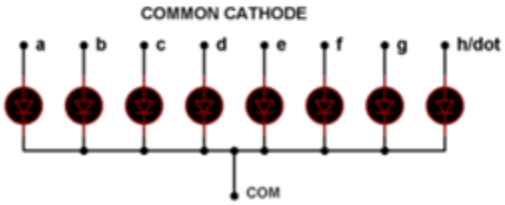
Smart Parking System: To design smart parking system, we use two IR sensor. IR sensor1 is attached in front of parking slot and IR sensor2 is attached with the gate.

Fig: IR Sensor Module

Infrared sensors work with radar technology and they both emit and receive infrared radiation. This radiation hits the objects nearby and bounces back to the receiver of the device. Through this technology, the sensor can not only detect movement in an environment but also how far the object is from the device.When a Car park in a parking slot, the IR sensor1 gives output that slot is full. IR sensor2 is use to warn other vehicle that slot is already filled up.

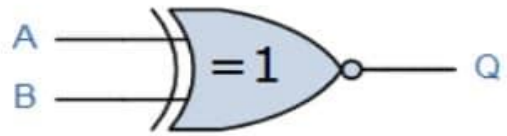
<u>Smart Billing system</u>: To design smart billing system, we use 555 Timer, CD4026 Decade Counter, 7-Segment LED Display. 555 timer is use to generate clock pulse. Whenever a car entered in parking slot 555 timer start to generate clock pulse. CD4026 use this clock pulse to drive common cathode 7 segment display. In common cathode 7 segment display cathodes of all the LEDs are connected together, and all the positive terminals are left alone





We use 3 CD4026 and 3 7-segment LCD Display to count 0 to 999. From the display we can calculate the bill.

<u>Password protected Security system</u>: For password protected security system, we use XNOR gate, AND gate and NOT gate. XNOR is active high when inputs are similar.

Symbol	Truth Table		
 2-input Ex-NOR Gate	A	B	Q
	0	0	1
	0	1	0
	1	0	0
	1	1	1
Boolean Expression Q = A XNOR B			

Set password and input password are compared using XOR gate. When XNOR is active high means entered password is correct and when XNOR is active low means entered password is incorrect.

3.3 Circuit Diagram

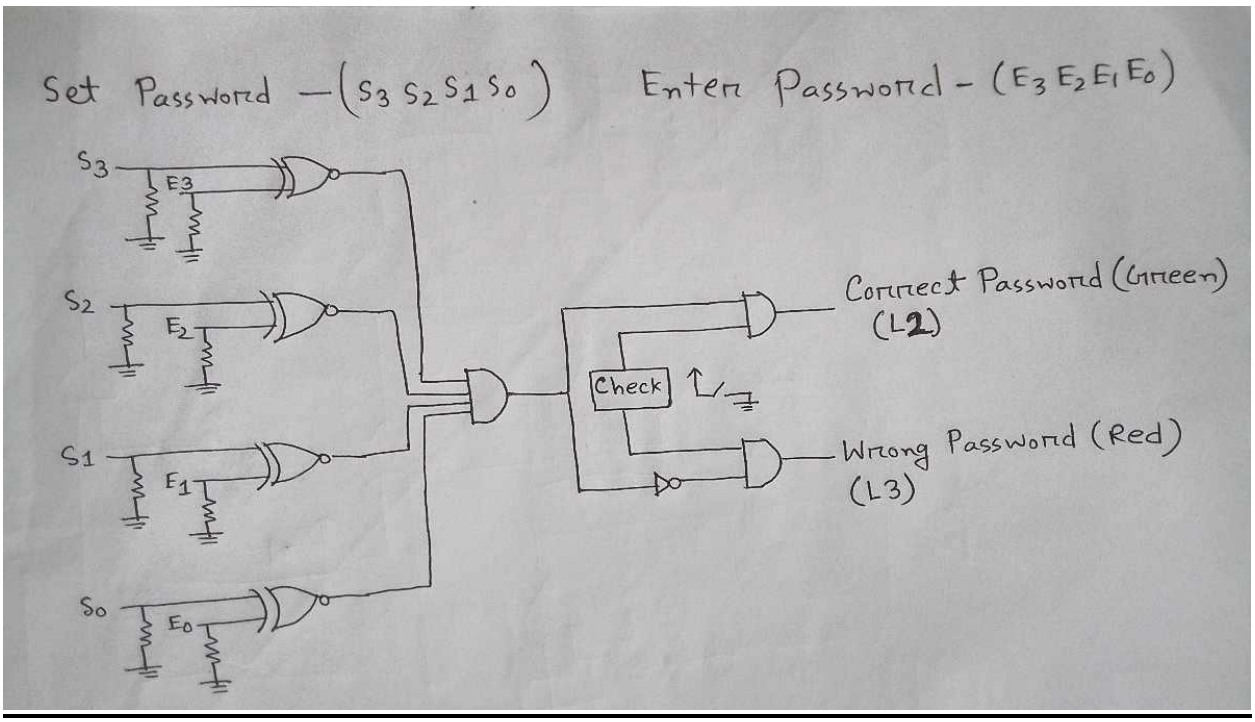


Fig: 4 bit Password Security System

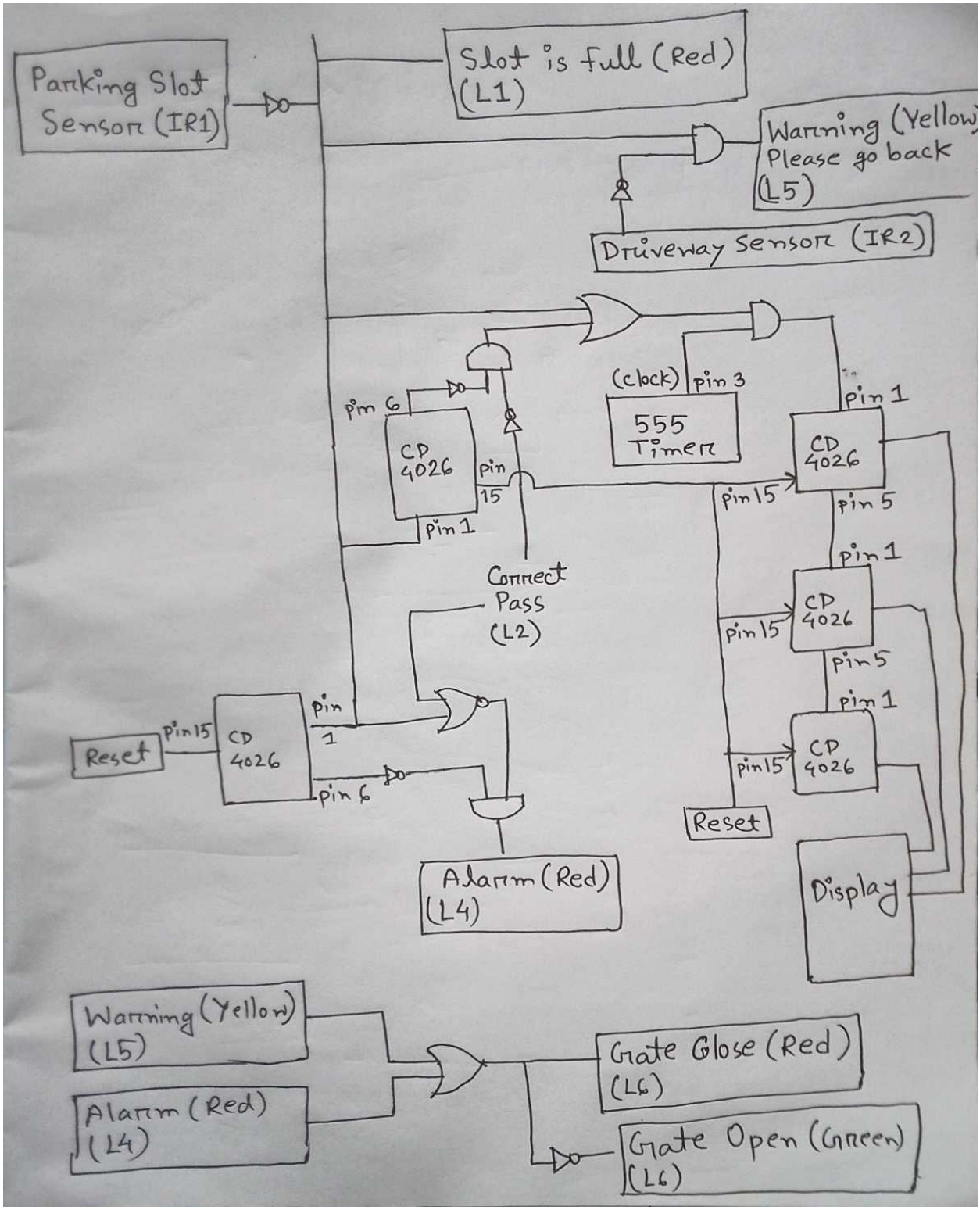
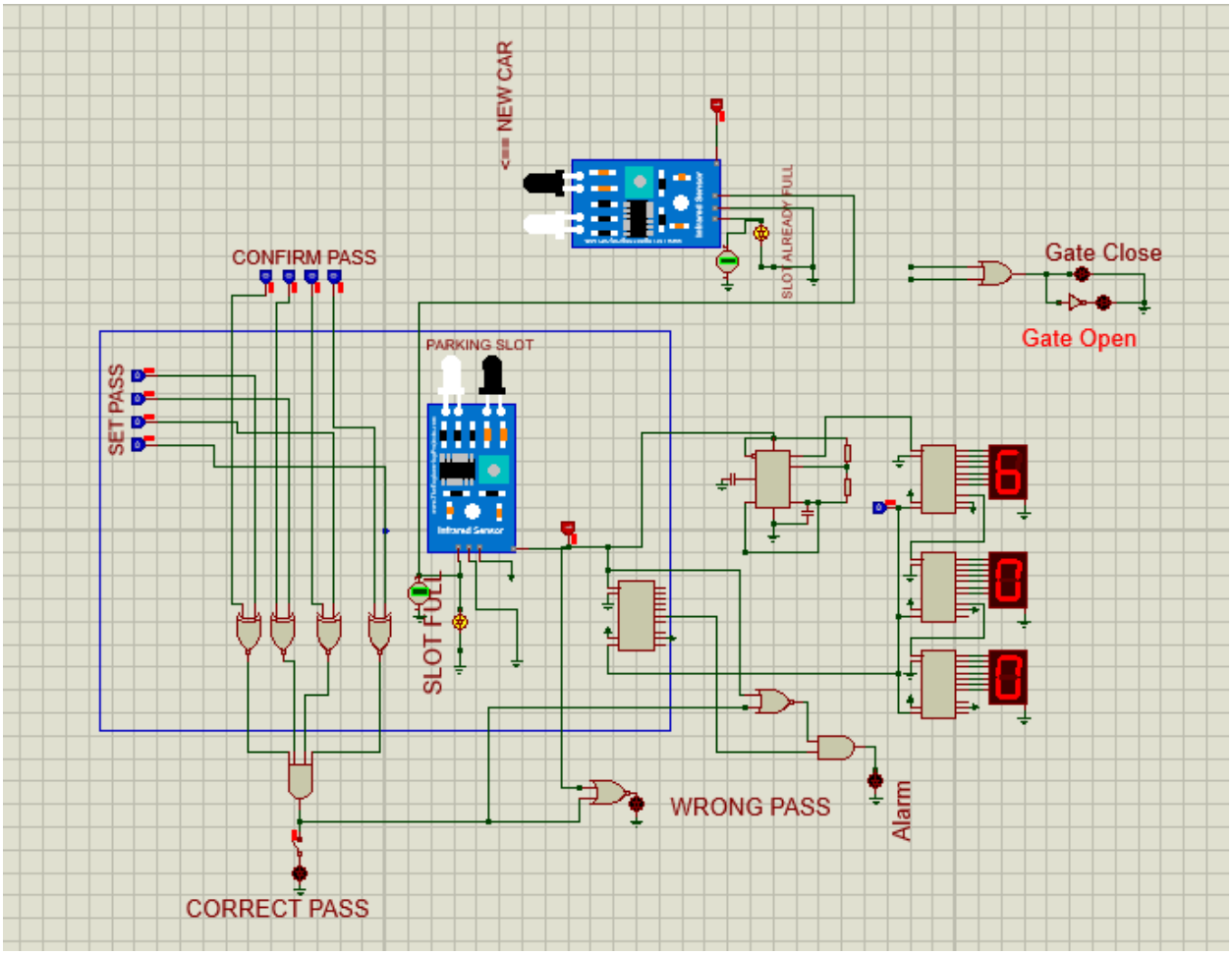


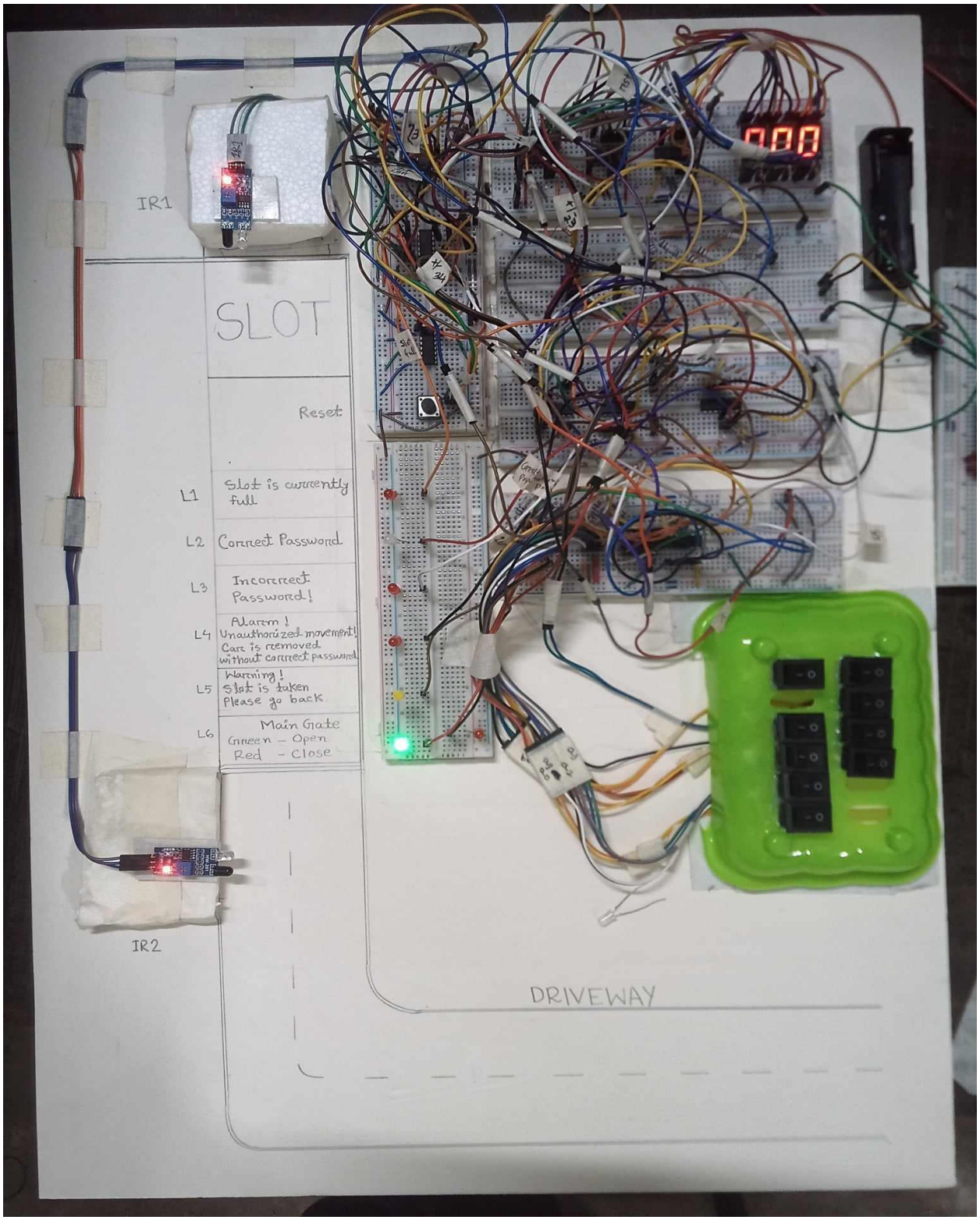
Fig: Smart Car Parking System

3.4 Simulation Model



This is our basic simulation model in Proteus. We have started our work based on this design. Over the course of time, we have added some adjustments to make our project more functional. These are included in the next figure.

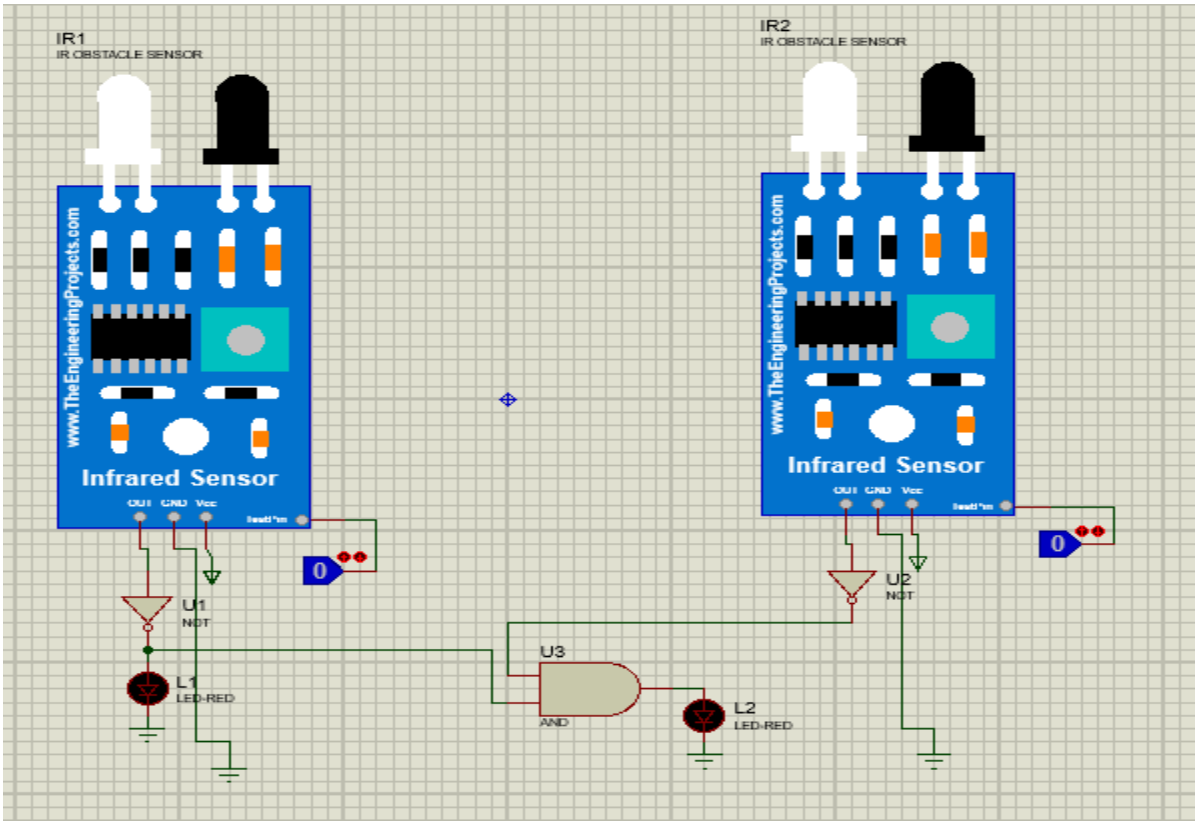
3.5 Hardware Design



4 Implementation

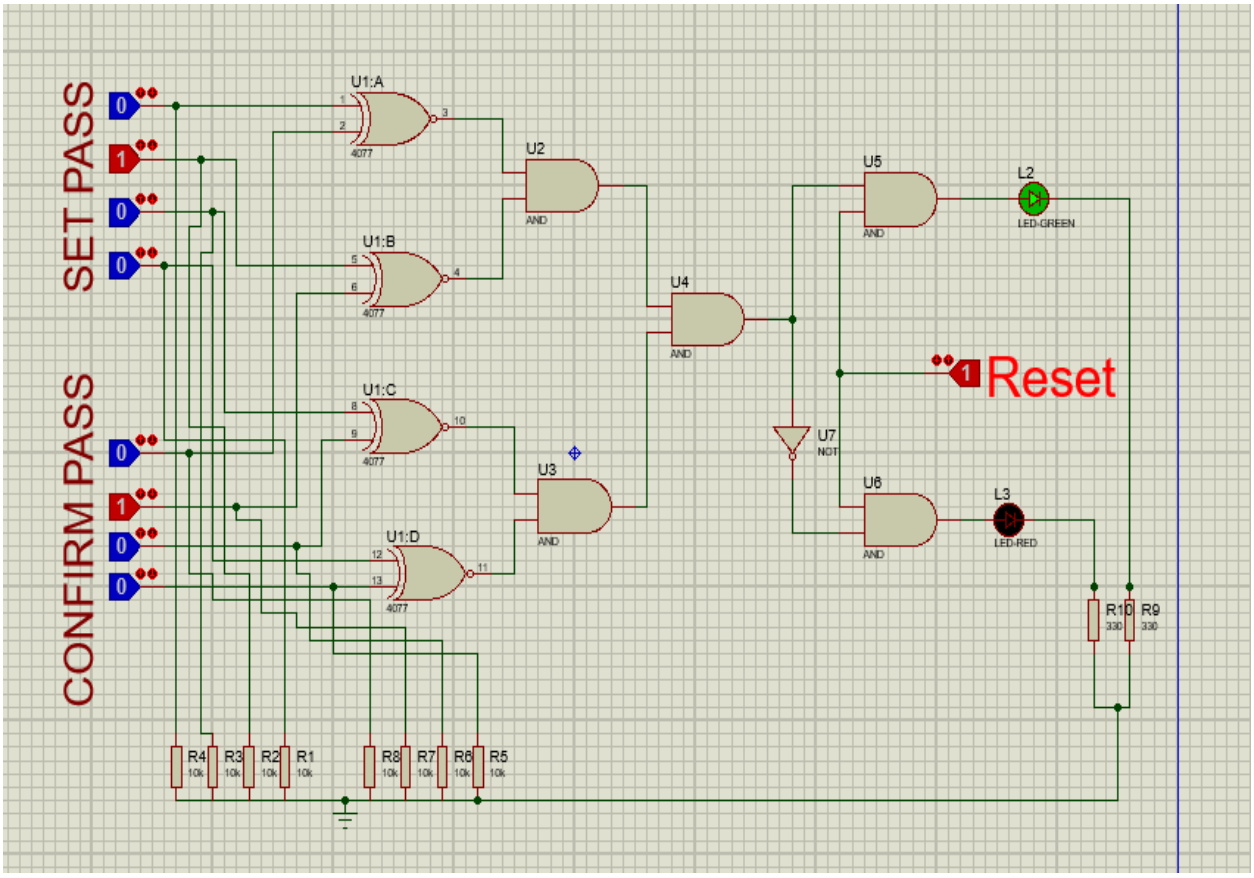
4.1 Description

Now the objective of our project is to design Smart car parking system. We use two IR sensor (IR1 and IR2) and five switch button as inputs and six LED (L1, L2, L3, L4, L5, L6) as Outputs. When a car is arrived at the parking slot IR1 becomes active low and the output is connected with a LED (L1) via NOT gate. So if L1 is ON means slot is currently full.



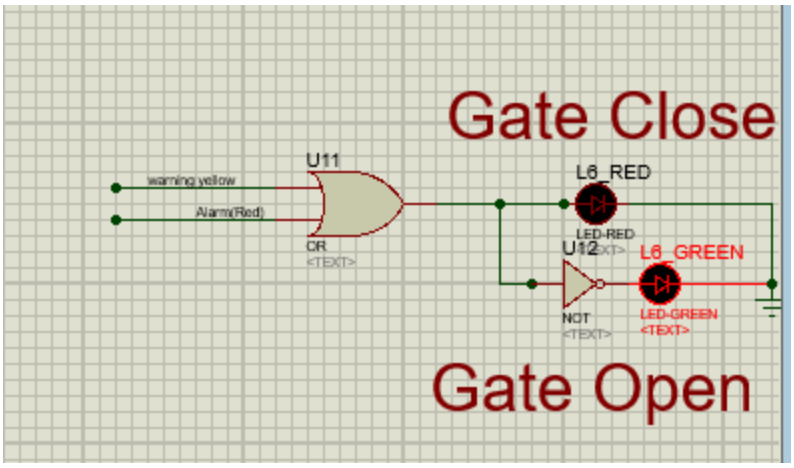
Now if new a car tried to enter, IR2 becomes active low and L2 is ON which give warning to the new car.

Now when IR1 is active low, 555 timer start to generate clock pulse and billing is start to count. Now if the car tries to left without giving password or giving wrong password, counting won't be stop. A reset button is used to reset counting.



Car Owner have to set a password and then he have to enter a password before leaving. If a car gives correct password, L2 will ON. If a car gives wrong password, L3 will ON.

When someone tries to leave after entering wrong password, L4 and Red L6 will be ON. Red L6 means gate is closed and green L6 means gate is Open.



4.2 Experiment and Data Collection

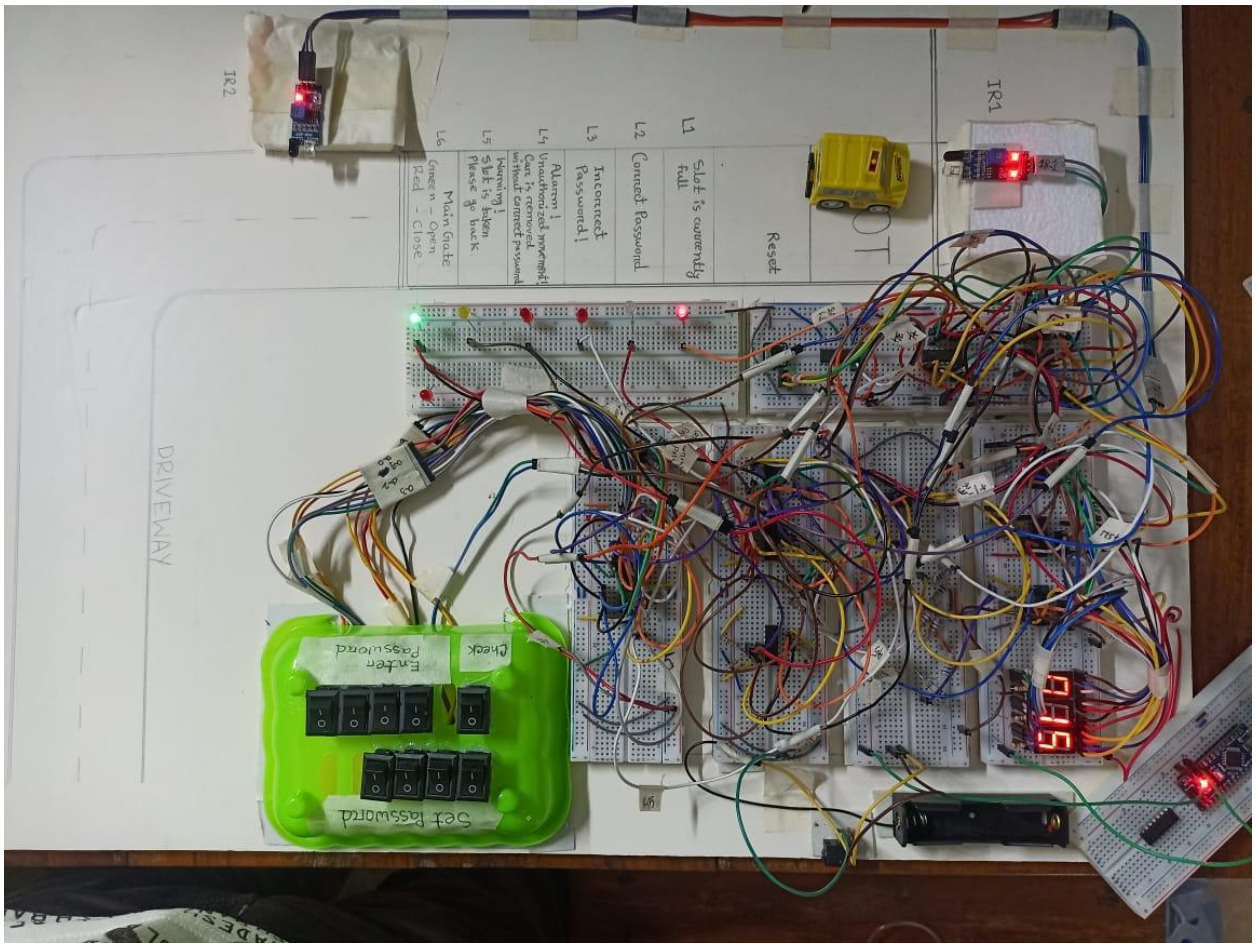
Incident	Output
When a car entered	L1 is ON, green L6 is on, others are OFF. Counting starts.
When a new car entered	L1, L5& red L6 is ON, others are OFF
When a car entered right password	L1, L2 & green L6 is ON, others are OFF.
When a car entered wrong password	L1 & L3 is ON, green L6 is on, others are OFF
When a car left without giving password	L4 & red L6 is ON, others are OFF. Counting doesn't stop.
When a car left entering wrong password	L3, L4 & red L6 is ON, others are OFF. Counting doesn't stop.
When a car left entering right password	L2 & green L6 is ON. Counting stops

4.3 Data Analysis

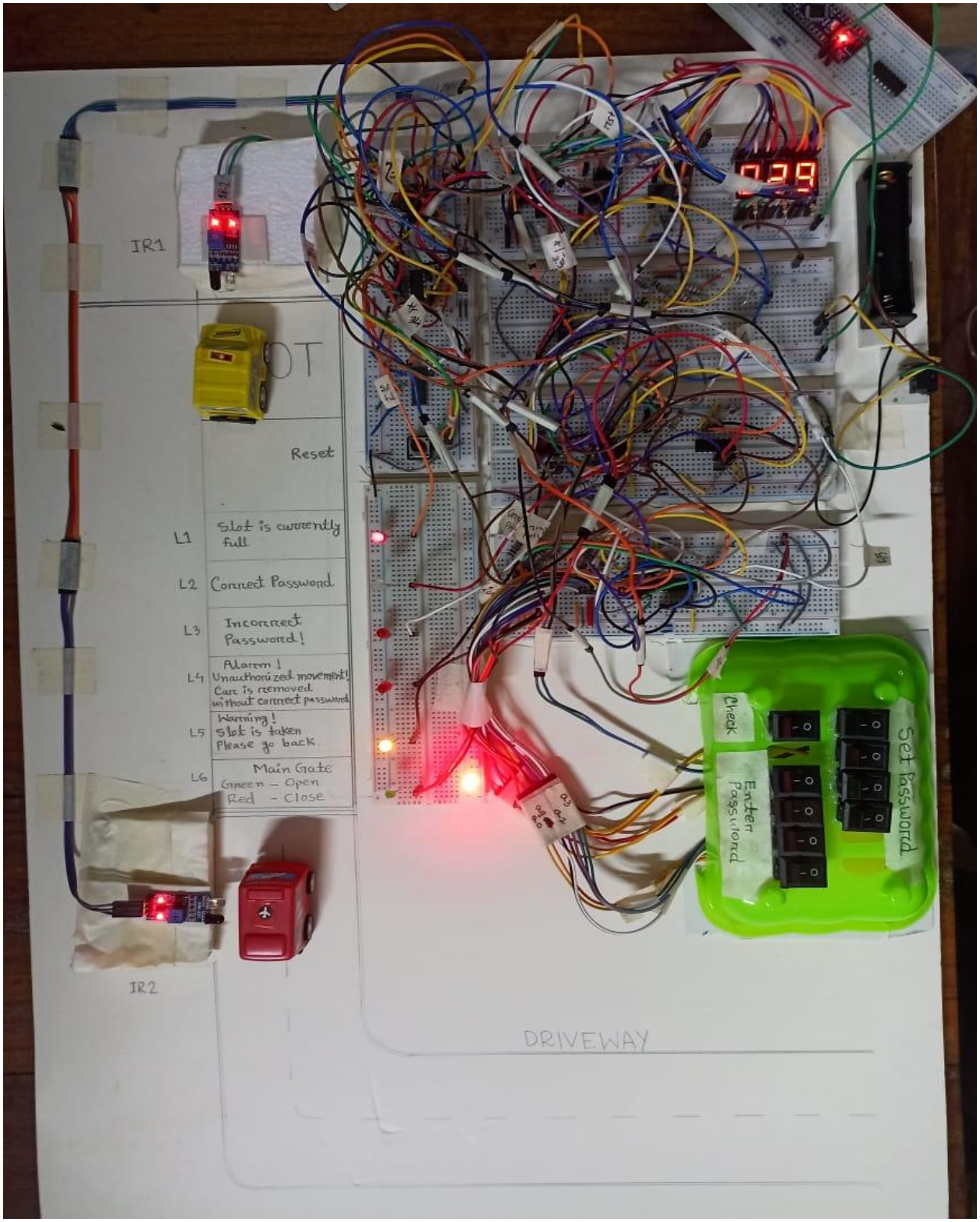
From data collection, we can see
L1 is only ON when car stays a parking slot.

L2 is only ON when car owner gives correct password.
L3 is only ON when car owner gives wrong password.
L4 is only ON when car left giving wrong password or without giving password.
L5 is only when new car try to enter while there is a car in the slot.
L6 becomes red when someone tries to leave illegally or when a new car arrive otherwise L remains green.
Counting starts when a car arrives and stops when a car leaves legally.

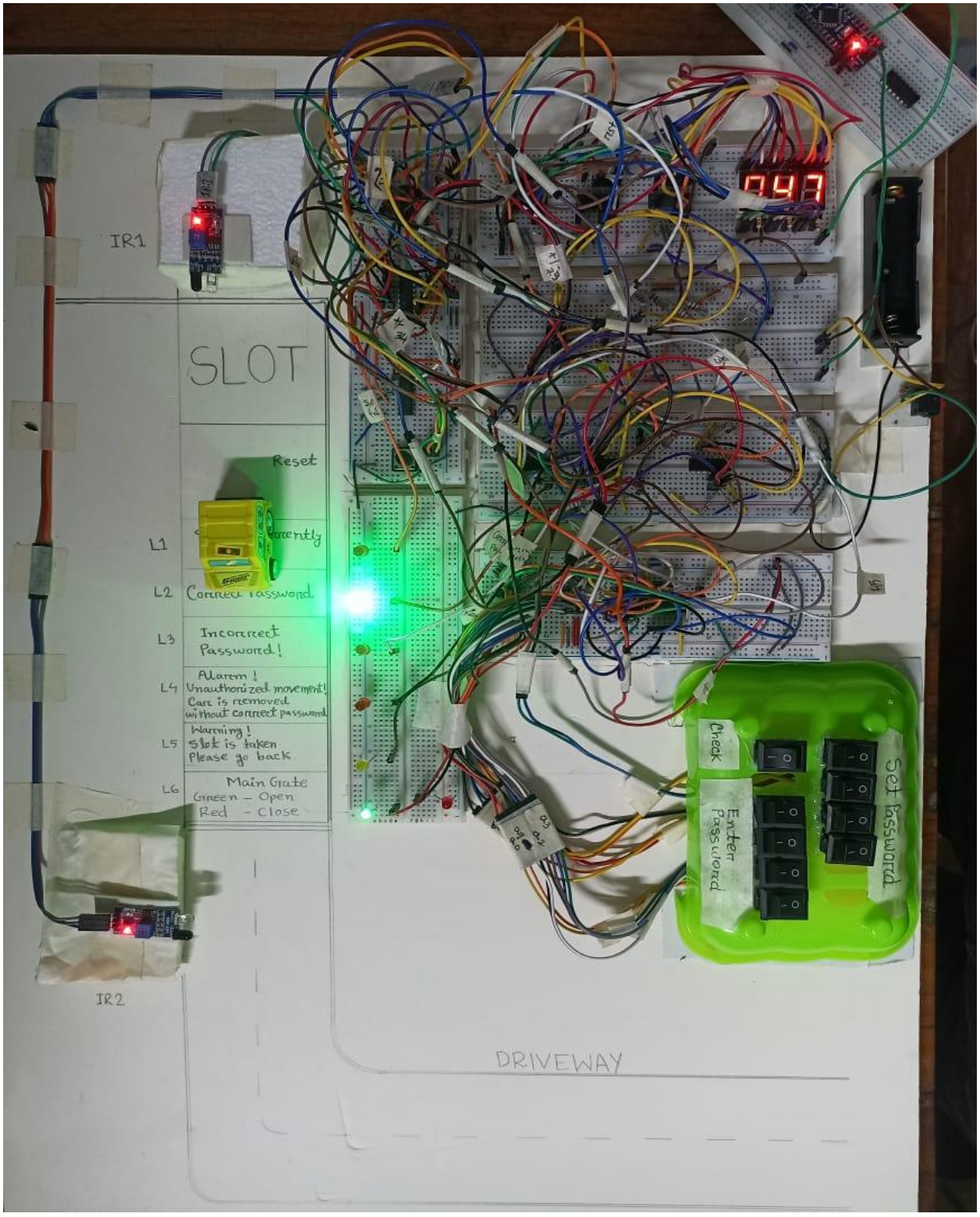
4.4 Results



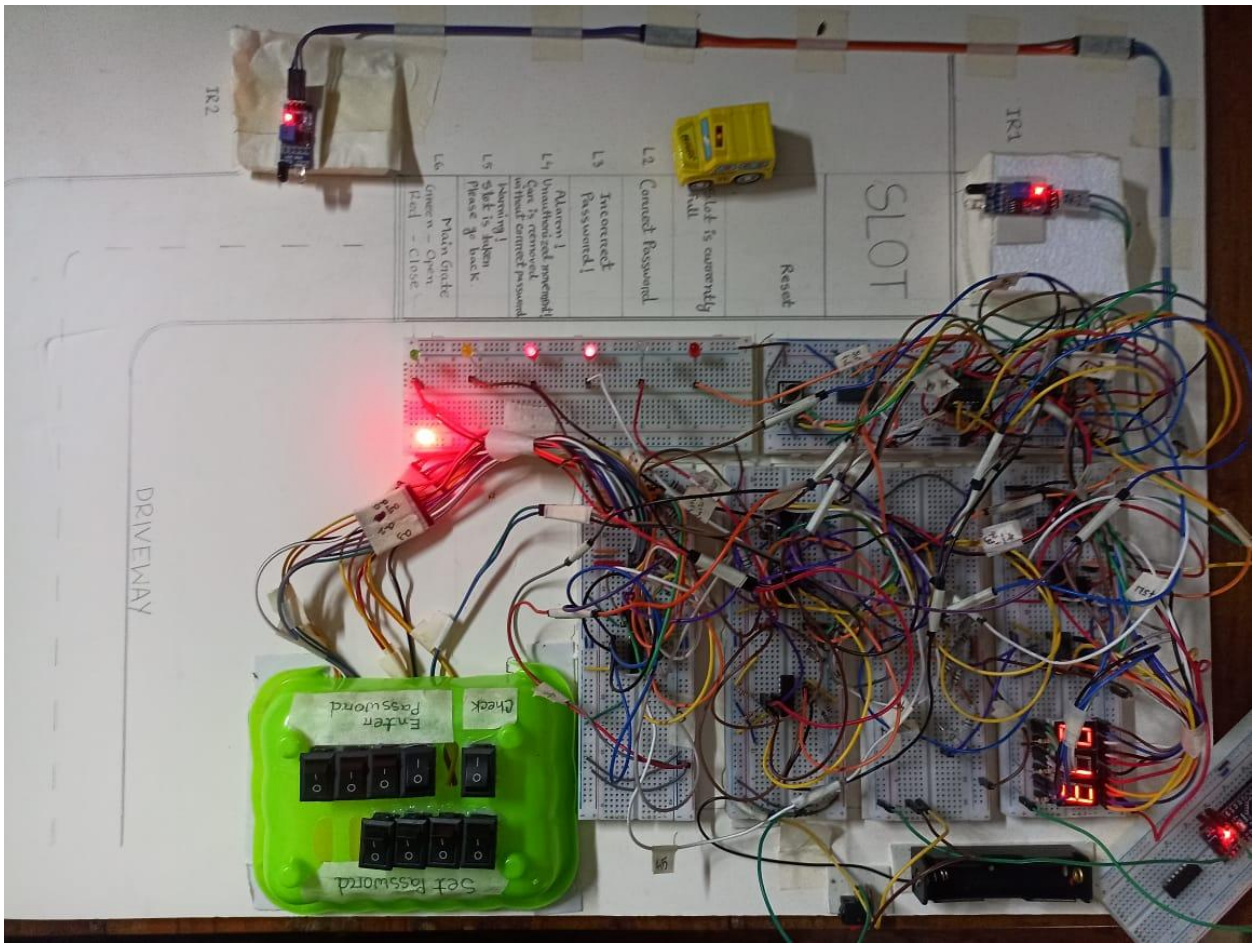
L1 is on when new car enters. Counter is counting. L6 is green (gate open).



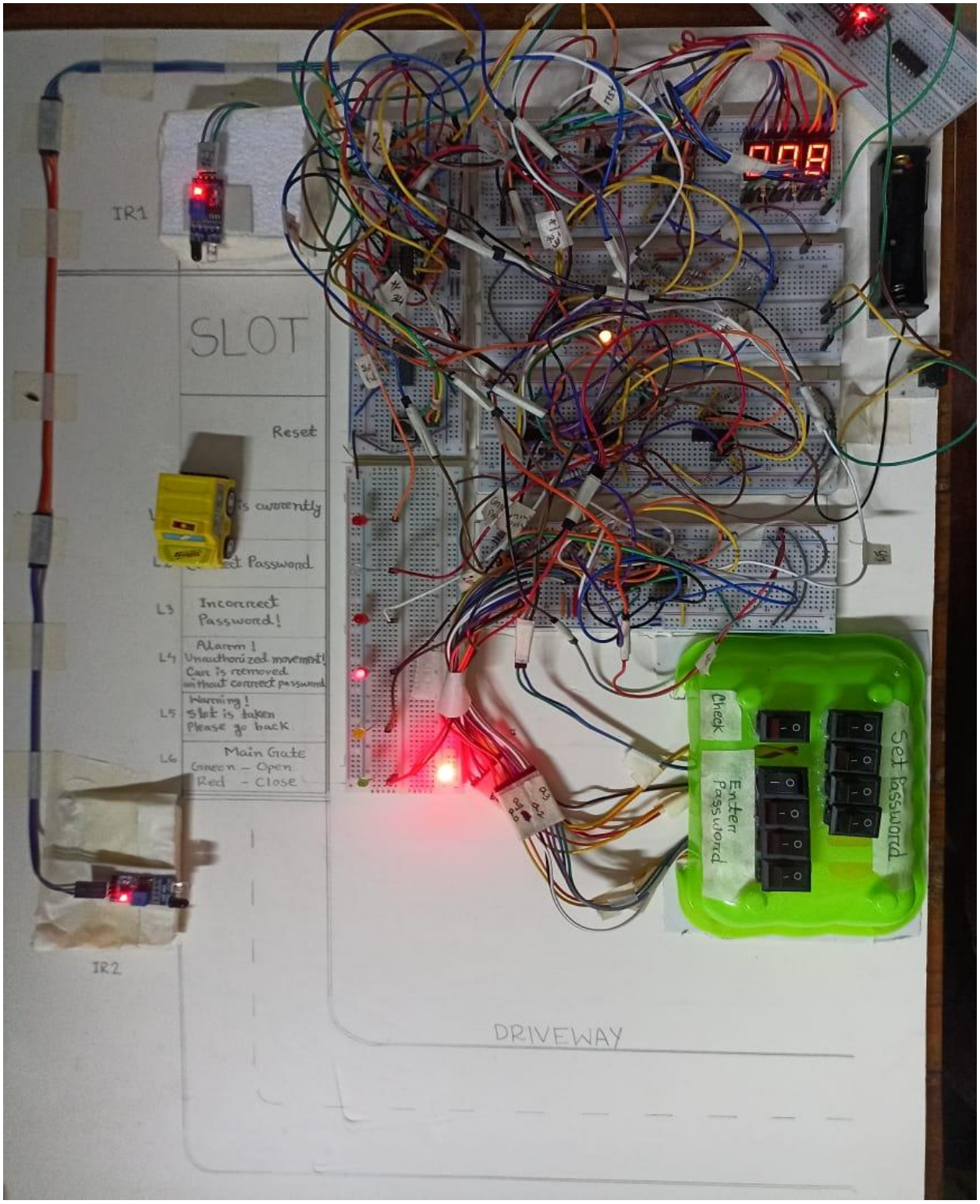
When new car approaches gate while L1 is on, L5 turns on. L6 is red (gate close).



When a car gives correct password, leaving the slot stops the timer. Gate is open.



When a car gives wrong password, leaving the slot triggers alarm signal (L4). Gate is closed. Timer does not stop.



When a car does not give password, leaving the slot triggers alarm (L4). Counter does not stop. Gate is closed.

Based on our data, we can say that our project is completed and it worked successfully.

5. Design Analysis and Evaluation

5.1 Novelty

Although many digital car parking systems are available nowadays, but our proposed method has some extra facilities. First of all, before a car enters a certain slot, the car owner has to set a password for his own security. After his car enters the parking slot, a green LED will turn on, which will indicate that the slot is occupied. At once, the car enters the slot, time counting starts. The car owner has to pay the bill according to the time counted by the counter. After the owner has finished his job, and wants his car to take back he has to re-enter the password he set previously on another keypad. Without entering the correct pass he can't take his car back. If anyone initiates a attempt to move his car without entering password or with wrong password an alarm indicator will turn on. Our car parking system is thus highly secured. We think these many facilities in a single car parking system are new compared to the parking systems that are available today. If we can implement our project in large scale, surely it will gain a lot attention.

5.2 Design Consideration

5.2.1 Consideration to Public Health and Safety

Our project was on the basis of ensuring the security of cars for the car owners**.** Car parking is a major issue of concern in our country. People parks there vehicle here and there which causes many chaos and traffic congestion. This irregularity in parking system is too much irritating for people of every class. If our project can be implemented in real life it can nicely solve the issue. And our project provides high security. One who parks his car in our slot, can be ensured of his vehicles safety. And of course a systematic system of car parking will be very helpful for public health and overall transportation system.

5.2.2 Consideration to Environment

If our project can be applied upon our current situation, it will greatly improve environmental conditions. First of all, it will greatly reduce traffic congestion that we face today due to uncontrolled parking of cars and vehicles on the street. Secondly if a systematic method id developed to park cars, it will also save many areas from being occupied by random vehicles. And it can also reduce pollution by cars' exhaust substances. So, we think our project will provide a great environmental improvements to our capital city and the whole country as well.

5.2.3 Consideration to cultural and societal needs

Our project can be easily applied to the societies and cultures that we consider developed today. Developed countries and societies with high living statues always maintains regulations in every sector of life. So if we can provide our 'password protected car parking system' to high societies they will surely consider approving it. We will be very happy to see this project applied to the underdeveloped or developing societies as well. Our project is very much likely to suit with the modern cultures and societies.

5.3 Investigations

5.3.1 Literature Review

Many companies and NGOs in developed countries provide secured car parking system. We tried to add extra facilities to the car parking systems that are available today. We added password protection system to the overall system to enhance the security. We also added a charging process that his fully digital clock depended. User will pay bill according to clock reading. We tried to combine many digital systems together. Parking system, password protection and time counter, these facilities that we have in our society can be used to implement our project. It will greatly improve the car parking methods that are already available.

5.3.2 Experiment Design

Currently, we built our project on academic scale, not in industrial scale yet. We

used breadboard as the base of the hole project design. We used jumper wires to connect between power supply and ICs. For logic gates several 74 series ICs were used. As indicators and alarms LEDs of various colors were used.
-A green LED indicates that slot is full.
-A yellow LED turns on if another car tries to enter at that moment.
-And the gate closes immediately, which is indicated by a red LED
-If anyone enters correct pass a green LED is on, and the car is safe to remove.
-Wrong pass turns on a red indicator.
-Without entering password or wrong pass turns on a alarm which is indicated by another red LED as well.
-And in this case gate closed indicator will be on again
-For the normal cases the parking way gate is open, and its indicated by a green LED.
CD4026 counter ICs were used for time/charge count. 555 ic generates the clock pulse for the circuit. A pushbutton was added that can reset the counter ICs so that time count can be freshly started for a new user.
Finally a password protection system was added to the whole system. We used SPDT switches password buttons. When the passwords entered previously and the pass entered later matches the logic circuit gives a high output. This was a short description of our designed project.

5.3.3 Data analysis and interpretation

While building the circuit our main concern was the power supply. Cause high voltage sources can damage the circuit elements. Most of the ics and elements used in our circuit had a optimum operation voltage of 5 volt. High current flow can damage them. On the other hand low current may not be able to drive the circuit elements. Specially if the battery charge goes low , and logic ICs and IR sensors fail to operate properly. They can give unpredicted values on the outputs. So a minimum voltage is always required to drive the circuit. Also we had another matter of concern that, keeping the logic ICs pin floating can randomize the ICs output results. So to attain the certain result we had to connect some resistors of kilo ohm range across the pins of ics. So that when a input pin isn't getting any signal it is actually in 0 or 'low' state.

5.4 Limitations of Tools

In our real life we does not get logic gates separately. We have to use Integrated ICs, which comes with many logic gates of similar type in one single pack. Determining the input and output pins of these ICs are sometime confusing. Also we had to use too many jumper wires to build our circuit which covered a great sight of the view of our project. And the IR sensors that are available for ours scale of project, are basically 'active low'. Which means whenever the sensor senses obstacle it goes low, it gives 'high' state one output otherwise. That's why we had to use extra Not gates to get a high voltage when the IR sensors are active. These were the notable limitations that we faced while building the circuitry.

5.5 Impact Assessment

5.5.1 Assessment of Social and Cultural Issues

We built our project in such a manner that it can attain public response on a large scale. While producing the idea of our project, it was a major issue of concern that, currently lack a systematic method of car parking in our country. If we can really implement our idea in real life it solve a great problem of our society. And of course we always try to match with the cultures that developed world is enjoying. We think implementing our project will be a big attempt of moving forward for both our society and culture.

5.5.2 Assessment of Health and Safety Issues

While building this circuitry, we were aware that nothing is present in the project that can be harmful to public health or security. Safety and security of vehicles was the main concern here. And as we have mentioned earlier, providing a proper system of car parking can help improve our mental health on daily life and physical life as well. Making this project available in real life can be great relief for our transportation, movement and car management systems.

5.5.3 Assessment of Legal Issues

In building process of our project, all the legal issues were maintained. We did no such thing that can be considered as violation of copyright law. The total idea , and circuitry design credit were solely of our own. Also This project can be applied in commercial scale without violating any kind of legal convention. So we don't think legality is a matter of concern here.

5.6 Sustainability and Environmental Impact Evaluation

Basically, our project was planned and designed in such a way that it can be actualized in large scale very easily. If our project is to be implemented in industrial or commercial scale, there will must need some managers and co-workers for management. Some manpower is necessary to monitor and maintain the whole system. If the system falls in goodhand it will survive for foreseeable future. Also we have to try to reduce or totally eliminate any kind impact that can badly affect environment. A proper management and maintenance can ensure the sustainability and good environmental impact for the project.

5.7 Ethical Issues

We think from the point of ethical view, our project does a very good job. It provides a great system for car parking and at the same time it provides high security for them. Users of our project can feel totally safe with their cars. It is not to be forgotten that users must remember the password that they set before parking their cars. The bills that users pay, are also counted through digital timer circuit. So no issue of deception is present here. And thus no violation of ethical aspects.

6. Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

ID	Contribution
1906006	Project design, hardware implementation, debugging
1906017	Project design, Software simulation, evaluating design
1906025	Project idea selection, evaluating design, circuit implementation
1906032	Project idea selection, Software simulation, hardware implementation, debugging

6.2 Mode of Team Work

Our mode of team work is based on both collaboration and task allocation. We have always tried to work together, share our ideas to finalize our decisions. For some parts of our project, work is allocated to individual members based on their expertise and co-ordination is done accordingly to ensure works of each member come together seamlessly.

6.3 Diversity Statement of Team

We believe that diversity in a team is one of its core strength and brings the best out of a team. We have tried to create an environment where members of different backgrounds and experiences can get the chance to express themselves and thrive. We respect and value each member's unique ideas and contributions. Since, every member does not have the same level of theoretical knowledge or practical experience, we have allocated our project works according to individual strength. This diversity in our team definitely helped us achieve our objective. Thus we have maintained mutual respect and understanding between members to make us a better functioning team.

6.4 Log Book of Project Implementation

Date/Week	Milestone achieved	Individual Role	Team Role	Comments
Week 4	Project idea selection	1906025 1906032	Searched for innovative and real life project idea	Got a relatively new project idea
Week 5-6	Research and design	1906006 1906017 1906025	Searched resources and knowledge necessary for project	It was not easy as this project was not done before.
Week 7	Software simulation in Proteus	1906025 1906032	Checked if the project is actually feasible	Project simulation is successful
Week 8	Component listing and buying	1906006 1906032	Tried to build the project with less cost and with tools available in market	Bought all components within reasonable amount
Week 9-11	Circuit implementation	Every member attended	Built the circuits and tried to maintain simple and clean connection	It was the best part of our project. We enjoyed every bit of it.

Week 12	Evaluating outputs and fixing errors	1906017 1906025	Found out possible reasons of errors and debug them	There were some errors which are tricky to find. We have faced some hardships.
Week 13	Finalize the project	1906006 1906032	Made the project ready for demonstration	Our hard work comes to an end.

7. Communication

7.1 Executive Summary

Introducing the Future of Parking: Password Protected Automated Parking System (With Parking Fee Counter)

In a search for modern parking solutions, we are excited to unveil our new project: the Password Protected Automated Parking Slot with Parking Fee Counter. This innovation provides both security and convenience for drivers. Say goodbye to the hassle of finding parking spots and managing fees. With our system, your vehicle is safely protected with 4 bit password system. Parking time and fee are recorded automatically. We encourage you to use our parking system and shape the future of risk and stress-free car parking. Experience the future today!

7.2 User Manual

Getting Started:

At first, connect the system with 5v dc power supply. You can use any 5V dc battery, 5v charger or Arduino. The supply must be capable to provides at least 0.5 A current.

Using the Parking Slot:

There is one parking slot. When it is not occupied, indicator (Red LED-L1) will remain off. At that moment, main gate will remain open. Any car can enter the parking slot. As soon as the car is parked inside the slot, IR sensor will be triggered and indicator RED LED will turn on. At that moment, if any car approaches to main gate through driveway, warning sign (Yellow LED-L4) will turn on which means the car needs to go back. The gate will be closed too.

Using the Password System:

After parking in the slot, the driver will have to set their own password in a set of switches. If they do not want to give any new password, they need to memorize the current password. While taking away the car, they need to provide that same password in another set of switches and push the check button. If the both password match, correct password (Green LED- L2) will turn on. Otherwise, incorrect password (Red LED-L3) will turn on. When given correct password, the driver can remove his car. If incorrect or no password is given, removing the car will trigger alarm sign to alert security personnel and the main gate will be closed too.

Using the Parking Fee Counter:

As soon as the car is parked in front of the sensor, a counter will be triggered and keep track of the time. We have currently maintained fare of 0.01 Tk for 1 second. When the car is removed, the counter will automatically stop. The driver needs to pay the amount displayed in counter. After that, a reset button should be used to reset the counter value.

8. Project Management and Cost Analysis

8.1 Bill of Materials

Components	Per Unit Price (TK)	Price (TK)
Breadboard x6	140	840
IR Sensor x2	60	120
Jumper Wire Set x3	100	300
Switch x10	20	200
7 Segment Display x3	9	27
LEDs x10	1	10
AND IC x2	28	56
NOT IC x2	25	50
CD2046 IC x4	25	100
X-NOR IC x2	22	44
NOR IC x1	25	25
NE555 IC x1	10	10
PVC Board x1	180	180
10k Resistor x20	2	40
10 uF Capacitor x5	1.6	8

	Total	2035

9. Future Work

In our project, we introduced 3 features for automatic car parking system. There are a lot of scope for improvement.

- The project is designed for single parking slot. The design can be expanded for multiple parking slots along with the indication for available parking slots for a new vehicle.
- Automatic door open and close system can be implemented for enhancing security.
- In case of unsecured conditions for any vehicle, automatic text message to the car owner can be introduced.
- Mobile app integration for parking slot availability information can be included.
- Digital payment system can be implemented.

10. References

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Password Security System (slideshare.net)
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