**A Mini Project Report on**

# SWIFT PARKING SYSTEM

By

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**Department of Computer Science & Engineering**

**G. Narayanamma Institute of Technology & Science**
**(For Women)**
Approved by AICTE, New Delhi & Affiliated to JNTU, Hyderabad
Accredited by NBA & NAAC, an ISO 9001:2015 certified Institution
Shaikpet, Hyderabd-500104
JULY, 2018

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**Submitted to the Department of Computer Science & Engineering, GNITS in the partial fulfillment of the academic requirement for the award of B. Tech (CSE) under JNTU**


By

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under the guidance of

**Mrs.Ch. Radhika**
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# Certificate

This is to certify that the Mini Project report on "**Swift Parking System**" is a bonafide work carried out by

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**Jahnavi N(15251A0580)**

in the partial fulfillment for the award of B. Tech degree in Computer Science & Engineering, G. Narayanamma Institute of Technology & Science, Shaikpet, Hyderabad, affiliated to Jawaharlal Nehru Technological University, Hyderabad under our guidance and supervision.

The results embodied in the Mini project work have not been submitted to any other University or Institute for the award of any degree or diploma.

**Internal Guide**
**Mrs.Ch. Radhika,**
**Asst Professor,**
**Department of CSE**

**Head of the Department**
**Dr. M. Seetha**
**Professor and HOD,**
**Department of CSE**

**External Examiner**

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# ABSTRACT

In this century, Science & Technology has undergone some multitudinous changes within a blink, in every field. The buildouts are countless. Some of them are Wi-fi, Bluetooth, Zigbee Technology etc... under which many applications have took birth under these domains from where, the smart age got introduced to humans but then in large public places and shopping malls, it can often be quite irritating for visitors to drive around in search of a vacant parking spot. During busy hours or on weekends, this can cause an additional lead time in getting in and out of the parking area. This is why we came up with an idea of Swift Parking System (SPS) which enables the user to find the vacant parking area and gives the approachability in that respective slot. This design mainly focuses to diminish the time in finding the vacant lots and also avoids the trivial travelling through the filled spaces. Along these lines, reduces the fuel consumption which in turn reduces carbon emissions into the environment.

The proposed Parking system consists of sensors to detect car motion and display unit which is used to monitor and signalize the state of availability of each single parking space. This allows an end user to check the availability of parking space and book a parking slot accordingly. This improves the probability of successful parking and minimizes the user waiting time.

## *Contents*

# 1. INTRODUCTION:

These days finding a parking space has become extremely difficult. It is especially difficult to park a car in major cities due to an increase in the usage of vehicles. This project is significant because it aims to solve this problem by allowing the driver to know before getting to the car park if there are any free parking spaces using their smartphone without having to deal with the hassle of driving around looking for a space.

## 1.1 OBJECTIVES:

Both hardware and software development are to be implemented for this project. The hardware which is developed for this project will be used to detect whether the parking slot is empty or filled. An Arduino Program will be achieved which is based on C programming language. An Android Application will be achieved using MIT App Inventor 2, which is an open-source web application originally provided by Google. This app provides an interface between the user and the parking slots available so that the user can get the information about the parking spaces available.

## 1.2 METHODOLOGY:

There are many approaches to implement smart parking system, and in this project, the techniques related to IOT (Internet of Things) have been used. In particular, each technique can maintain similar methodologies such as finding parking lots to the driver, amending parking status, paying the parking fee, and saving whole data in the central database. However, the main difference between those systems is the type of technology and mechanism.

The smart parking system can be achieved using wireless network. With the support of the sensors in each parking slot the communication in the system can be received and forwarded through the Wireless Network.

In this project Bluetooth module has been used instead for the establishment of network between all the components instead of a Wi-fi module.

The reason to have network is for example, if one slot becomes available, it will directly update its status and pass the information to the neighbor node and keep spreading the updated status until reach the main system.

# 2. PROJECT OVERVIEW:

## 2.1 EXISTING SYSTEMS:

The existing conventional smart parking systems are able to detect the presence of a car in a parking lot using sensors like ultrasonic sensors or IR (Infrared Radiation) sensors.

These sensors can detect if a car is present or not in a specific parking lot so that the other car drivers can get to which parking lot is empty without visiting each and every parking lot present.

## 2.2 ADVANTAGES & DISADVANTAGES:

**Advantages of smart parking system implementation:**

The smart parking system is considered beneficial for the car park operators, car park patrons as well as in environment conservation.

For the car park operators, the information gathered via the implementation of the Smart Parking System can be exploited to predict future parking patterns.

Pricing strategies can also be manipulated according to the information obtained to increase the company's profit.

In terms of environment conservation, the level of pollution can be reduced by decreasing vehicle emission (air pollutant) in the air.

This can be attributed to the fact that vehicle travel is reduced.

As fuel consumption is directly related to vehicle miles travelled, it will be reducing as well.

There is a minimal staff requirement if it is used by known parkers.

It is possible that the retrieval time is lower than the combined driving/parking/walking time in conventional ramped parking structures.

The number of vehicles parked illegally by the roadside which leads to traffic congestion is also reduced as it is absorbed into the car parks.

Most importantly, traffic congestion can be reduced.

All this would eventually lead to convenience for the patrons.

**Disadvantages of smart parking system implementation:**

There is a greater construction cost per space (but this may be offset by the chance for lesser land costs per space and the system manufacturers say that the operating and maintenance cost will be lower as compared to a conventional ramped parking structure).

Use of redundant systems will result in a greater cost.

It may be a bit confusing for unfamiliar users.

It is not recommended for high peak hour volume facilities.

There may be a fear of breakdown (How do I get my car out?).

There is an uncertain building department review and approval process.

It requires a maintenance contract with the supplier.

## 2.3 PROPOSED SYSTEM:

Apart from the existing systems this project has a few add-ons like the smart payment system.

The smart payment system is implemented in the effort to overcome the limitation of the conventional payment methods by revamping the payment method via parking meter and introduce new technologies. This is because the conventional method causes delay and inconvenience for the patrons as they have to deal with cash.

It also reduces maintenance and staffing requirement for payment handling purposes as well as traffic control. In general, the Smart Payment System consists of contact method, contactless method and mobile devices.

While the contact method involves the use of smart cards, debit cards and credit cards, the contactless method involves the use of contactless cards, mobile devices as well as Automated Vehicle Identification (AVI) tag whereby RFID technologies are utilized.

As contact methods requires contact of the cards with parking meter or payment machines in the facility, the latter offers more convenience to the patrons.

Parking meters have now been improvised with technologies which revolutionize the payment system via implementing various improvements such as the acceptance of various types of cards such as credit card, debit cards and smart cards. It also incorporates other technologies such as having solar power source and wireless connectivity.

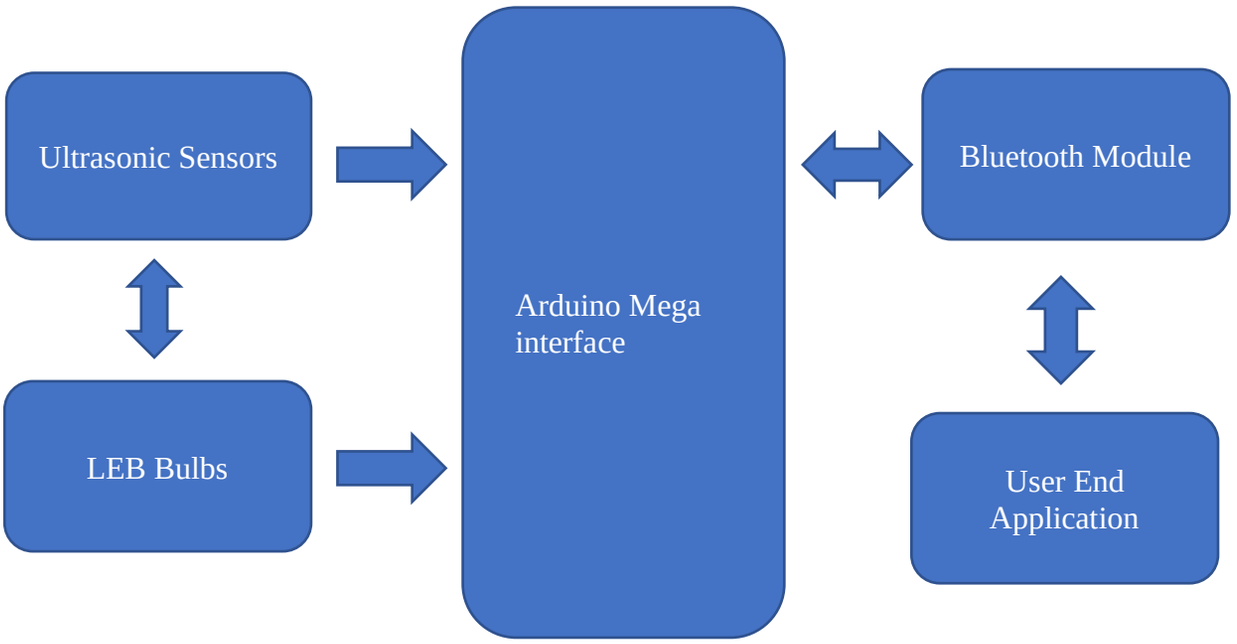



**Fig –** *Framework of Proposed System*

# 3. TECHNOLOGIES USED:

## 3.1 ARDUINO:

In 2005, the first ever Arduino board was built by Massimo Banzi and a few others in the Interactive Design Institute in Ivrea, Italy. The Arduino is an open source microcontroller-based development board. It is low cost and allows even a beginner to do amazing things in electronics. It is possible to connect the Arduino to all kinds of motors, sensors and other devices and an easy to learn programming language can be used to program how the new creation works.

## 3.2 ULTRASONIC SENSOR:

The ultrasonic sensor produces high-frequency sounds waves and analyses the echo which is then received back by the sensor. Furthermore, it measures the time interval between sending the signal and the echo to regulate the distance to an object. These sensors can detect almost anything and are also very good for detecting transparent objects. It detects objects of any material, aggregate state, colour or transparency. (ATC Automation Limited, 2012)

## 3.3 SERVO MOTOR:

The servo motors have been widely used for a long time and are practically and effectively used in many applications. They are very small but can take in a lot and they are also very energy efficient. Because of that, they can be used to manage remote-controlled or radio-controlled toy cars, robots and airplanes. They can be used in food services, pharmaceutics, robotics and many more fields. The way the work is the following – the servo circuitry is built inside the motor unit and has a shaft capable of being positioned, which is often fitted with a gear, the motor is managed with an electric signal which establishes the amount of movement of the shaft. (Frances Reed, 2014)

## 3.4 BLUETOOTH MODULE:

The HC-05 module is a very easy to use Bluetooth SPP (Serial Port Protocol) module that was designed for transparent wireless serial connection setup. It can be said to be either master or a slave. The HC-05 module requires 3.3V power

with 3.3V signal levels. The Bluetooth module will be used to send data to an android application. (iteadstudio.com, 2010)

## 3.5 MIT APP INVENTOR:

MIT App Inventor is an open source web application. It allows users to create an Android application. The app inventor replaces the complex language of text-based coding into a visual drag and drop building blocks. The app inventor can be used even by inexperienced users to create basic and fully functional app. The MIT App Inventor was provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT) and the inventors are Mark Friedman and MIT Professor Hal Abelson.

# 4. PROJECT DESIGN SPECIFICATIONS AND IMPLEMENTATION:

## 4.1 ARDUINO SPECIFICATION:

As mentioned before, an Arduino is the main device that was used in this project. The specifications of Arduino Mega 2560 are shown in table below.

| | |
|---|---|
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limit) | 6-20V |
| Digital I/O Pins | 54 (of which 15 provide PWM output) |
| Analog Input Pins | 16 |
| DC Current per I/O Pin | 20 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 256 KB of which 8 KB used by bootloader |
| SRAM | 8 KB |
| EEPROM | 4 KB |
| Clock Speed | 16 MHz |
| LED_BUILTIN | 13 |
| Length | 101.52 mm |
| Width | 53.3 mm |
| Weight | 37 g |

Table 1. Arduino specifications

## 4.2 ULTRASONIC SENSOR SPECIFICATION:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The module includes ultrasonic transmitter, receiver and control circuit.

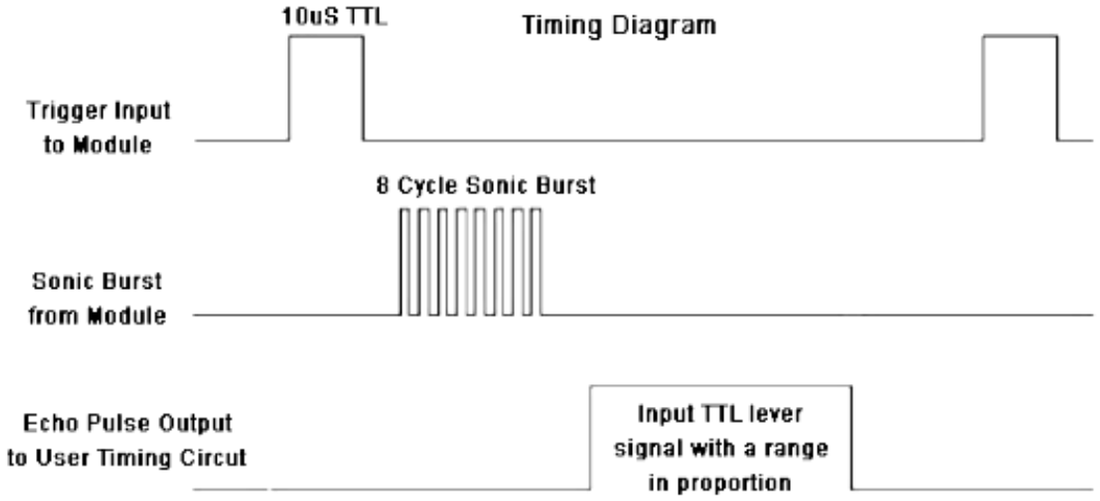
The wire connecting is as following:

- 5V Supply
- Trigger Pulse – Input
- Echo Pulse – Output
- 0V – Ground

Electric parameters:

| | |
|---|---|
| Working Voltage | DC 5 V |
| Working Current | 15mA |
| Working Frequency | 40Hz |
| Max Range | 4m |
| Min Range | 2cm |
| Measuring Angle | 15 degrees |
| Trigger Input Signal | 10µs TTL pulse |
| Echo Output Signal | Input TTL lever signal and the range in proportion |
| Dimension | 45*20*15mm |

Table 3. Ultrasonic sensor specifications




The ultrasonic sensor module works on the natural phenomenon of ECHO of sound. A pulse is sent for about 10µs to trigger the module. After which the module automatically sends 8 cycles of 40 KHz ultrasound signal and checks its echo. The signal after striking with an obstacle returns back and is captured by the receiver. Thus the distance of the obstacle from the sensor is simply calculated by the formula given as:

Distance = (time x speed)/2

It is divided by 2 because the time is the total time it took to reach the obstacle and return back. Thus the time to reach obstacle is just half the total time taken.

## 4.3 SERVO MOTOR SPECIFICATION:

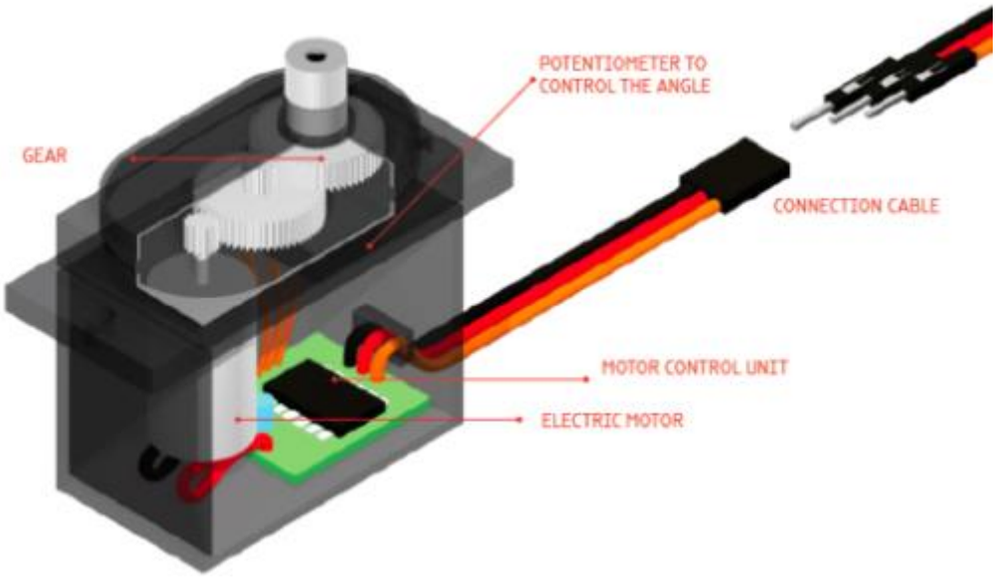



**Figure 10. Servo motor specifications**

- Weight: 9 g
- Dimension: 22.2 x 11.8 x 31 mm approx.
- Stall torque: 1.8 kgf·cm
- Operating speed: 0.1 s/60 degree
- Operating voltage: 4.8 V (~5V)
- Dead band width: 10 µs
- Temperature range: 0 ºC – 55 ºC

  Connector pinouts:

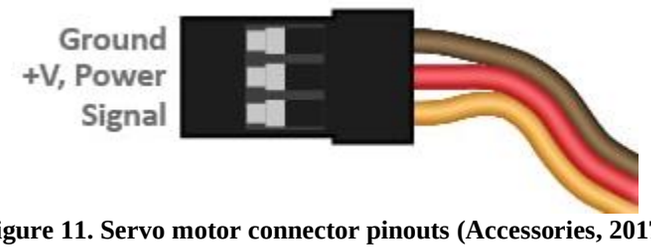
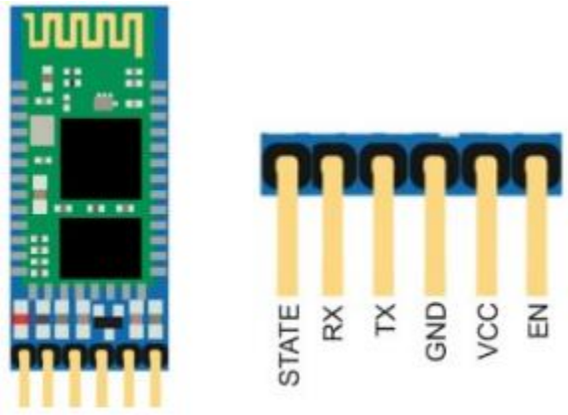



**Figure 11. Servo motor connector pinouts (Accessories, 2017)**

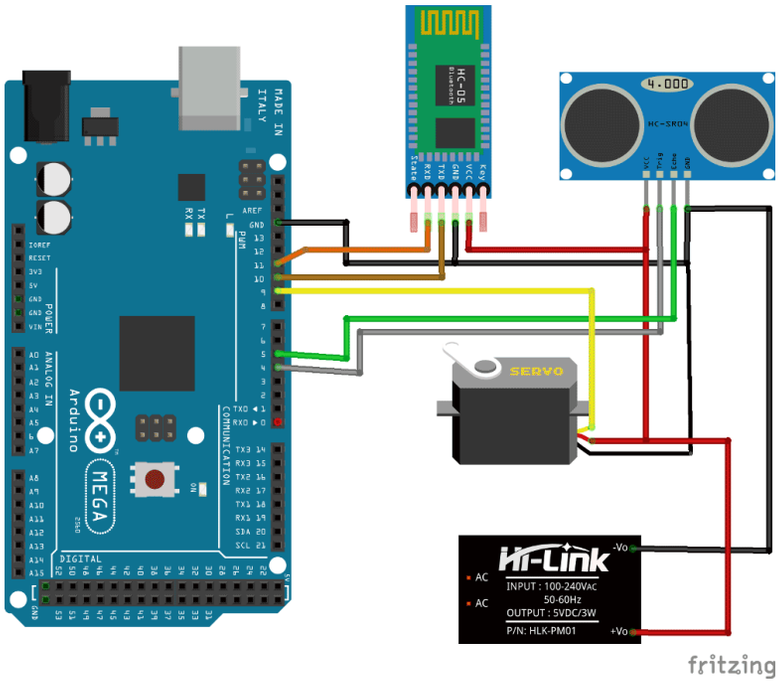
## 4.4 BLUETOOTH MODULE SPECIFICATION:

- HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.
- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector
- Default Baud rate: 38400, Data bits: 8, Stop bit: 1, Parity: No parity, Data control: has.
- Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:”0000” as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.
- Bluetooth module pins:




**Bluetooth module pins**

## 4.5 ELECTRICAL WIRING DIAGRAM:




## 4.6 ANDROID APPLICATION:

An Android App was built using MIT App Inventor. The picture below represents exactly how the Android application looks like. It provides the user with information on how many parking spaces are available, if any. If a particular parking space is taken, the green space will turn red.

## 4.7 IMPLEMENTATION:

The swift parking system can be implemented covered parks, open parks and also street side parking. The smart parking system will have a Bluetooth module that lets the user connect with mobile using the application that stores information about the parking status in the slots. There will be act as heart of the modules which stores the information about the number of parking slots, availability status.

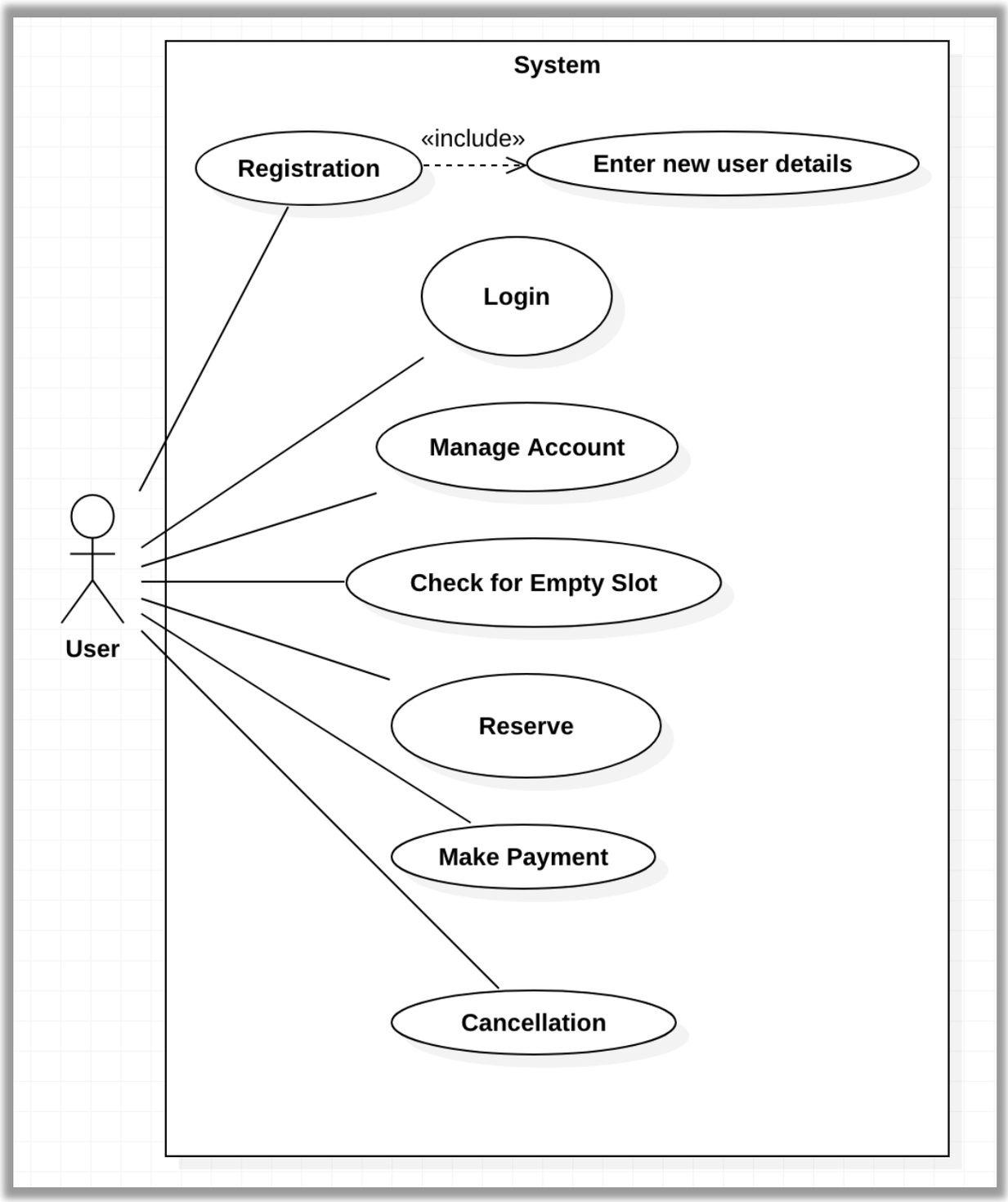
The functionalities of the components of automated parking system project are as follows:

1. **The Application:** This maintains the information about the parking slots and its availability
2. **Arduino Mega:** This will act as the microcontroller for the project and all the other sensors will connected to it
3. **Ultrasonic sensors:** It will be used to sense the presence of vehicle in the parking slots for a certain distance.
4. **LED Bulbs:** These help in showcasing the status of the slot present, where **RED LED** represents a filled slot and **GREEN LED** represents an empty slot.
5. **User device:** This is the mobile phone which can be used by the user to get the availability of parking slots directly

**Major steps involved**

1. The Ultrasonic Sensors and led bulbs should be placed in the appropriate places to clearly cover all the parking slots
2. The parking slots should be appropriately numbered to mark them on the system
3. These marked points will act as the control points and will be integrated as slots in the application
4. Then the setting will be saved and the Arduino will be programmed to display the data online accordingly in the application.

## 4.8 UML DIAGRAM:



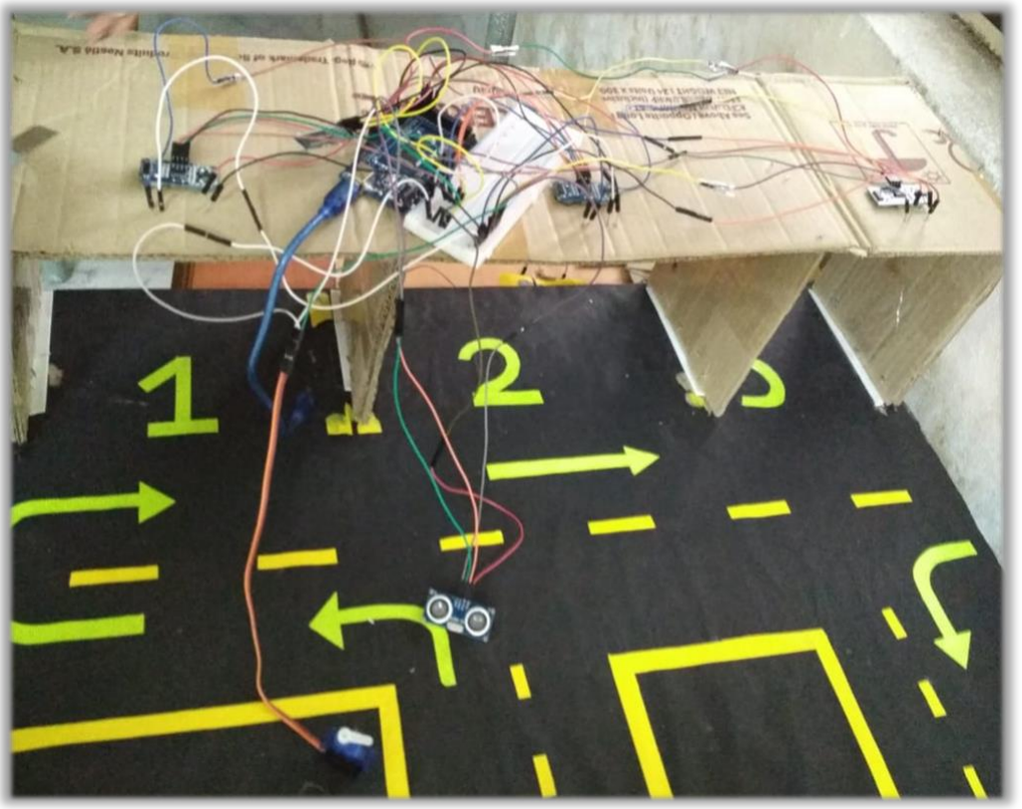
# 5. RESULTS:

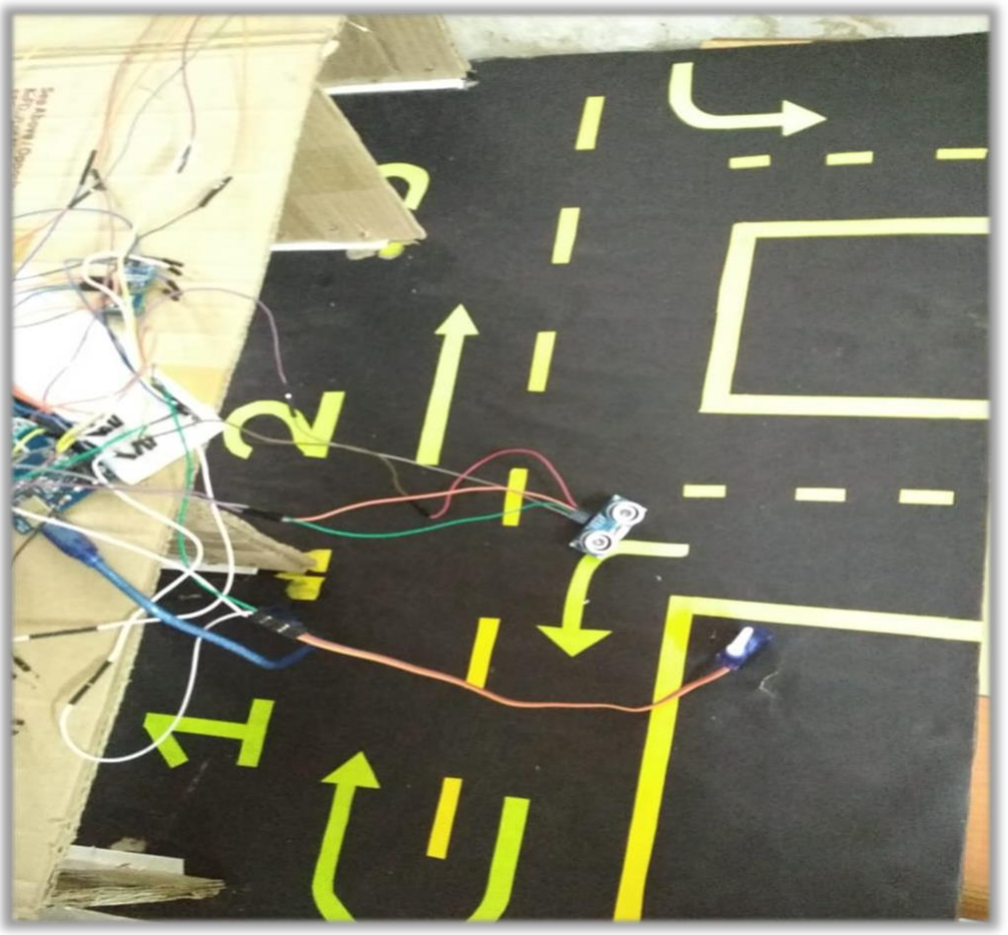
## 5.1 DISCUSSION ON RESULTS

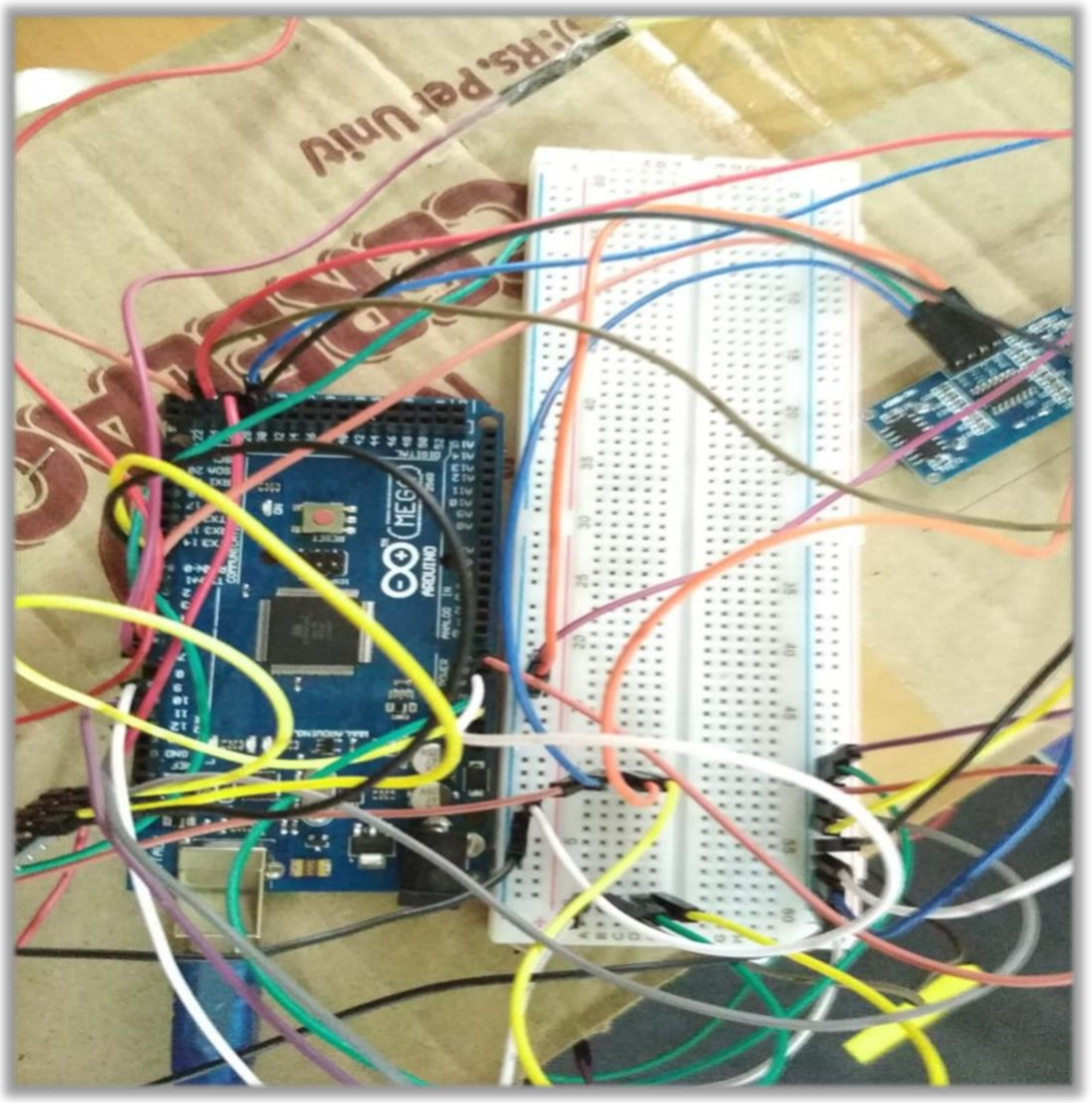
Smart parking facilitates the problems of urban liveability, transportation mobility and environment sustainability. Smart Parking technology is used for enhancing the productivity levels and the service levels in operations. It also benefits in terms of lowering operating costs and increases revenues and facility value. Proposed system has developed from traditional servicing channels like toll-booth and parking attendants. It involves the use of Ultrasonic sensor, Arduino Mega, Bluetooth Module.

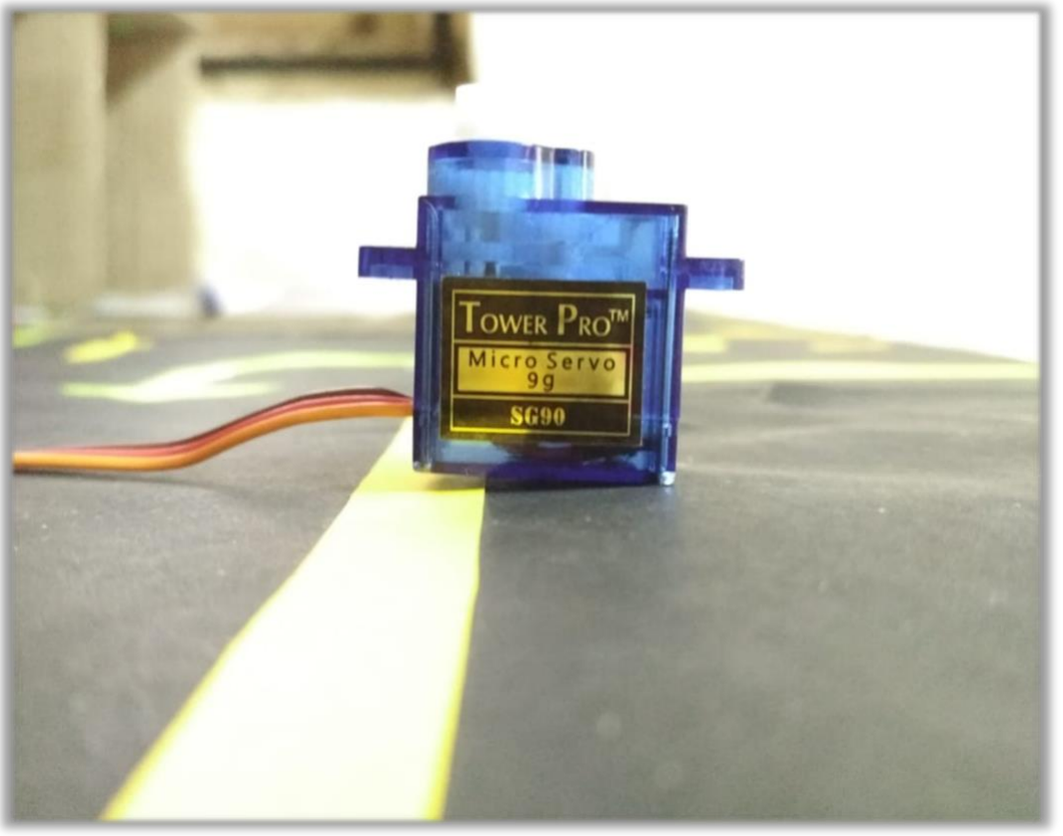
This module integrates the hardware, software and connectivity that enable objects to be sensed and remotely controlled through the app for booking. Such integration allows users to monitor available and unavailable parking spots that lead to improved efficiency, accuracy and economic benefit.

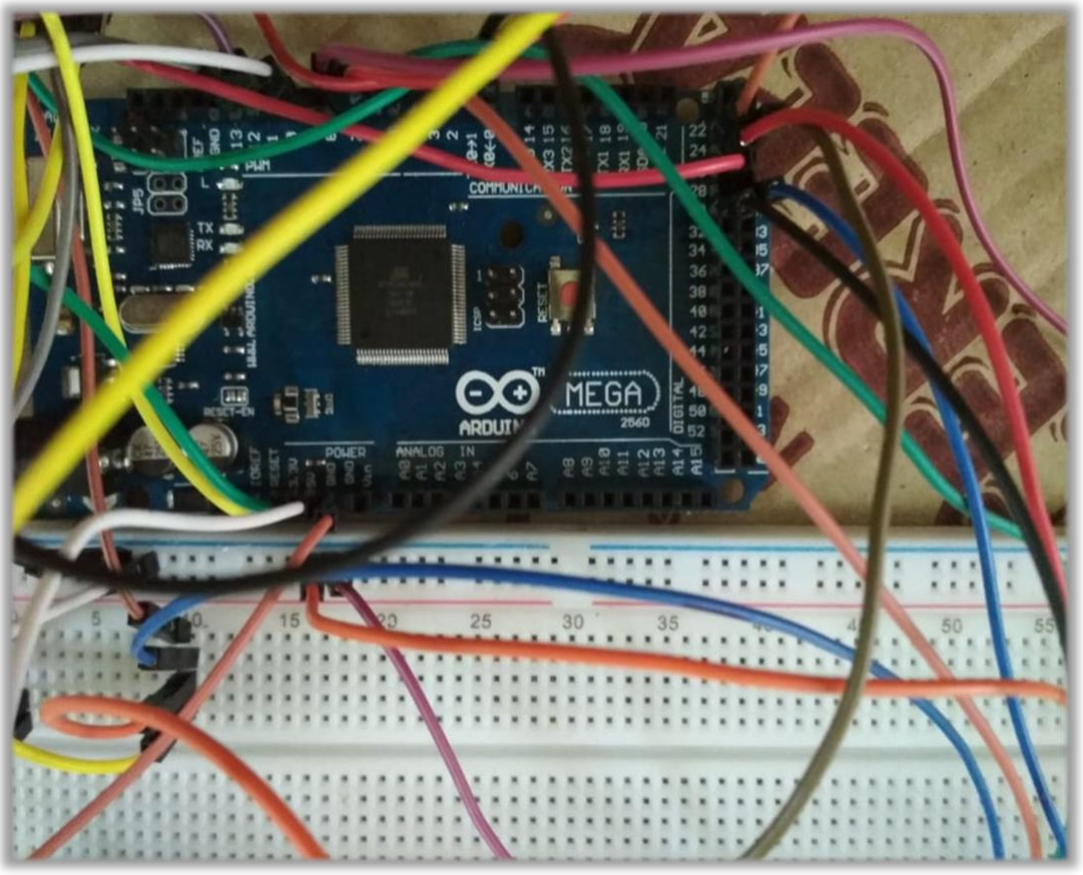
## 5.2 SCREENSHOTS

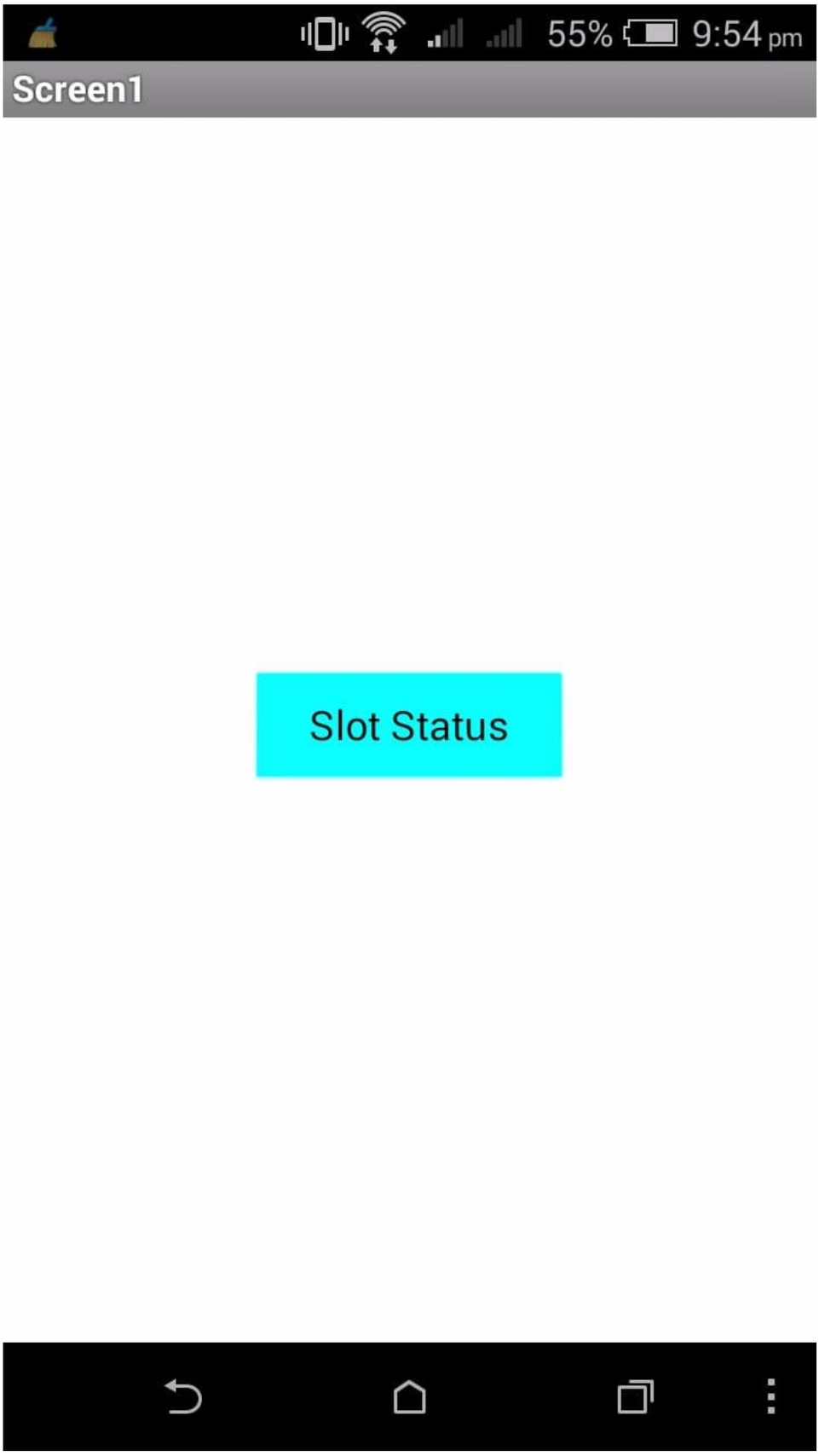


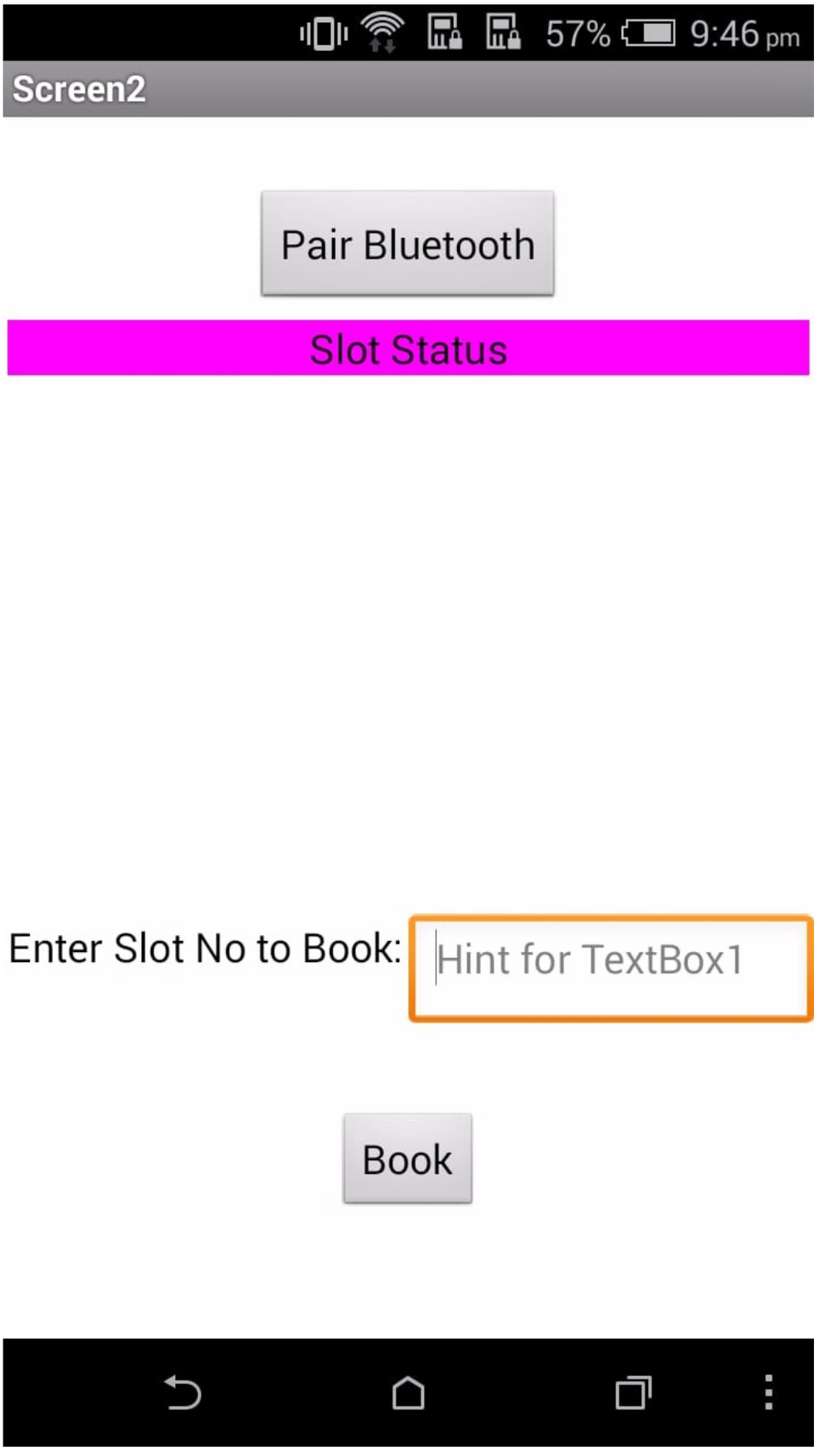





TOWER PRO™
Micro Servo
9g
SG90


MEGA
2560
POWER
ANALOG IN
DIGITAL
PWM
TX
RX
RESET


55% 9:54 pm
Screen1
Slot Status


57% 9:46 pm
Screen2
Pair Bluetooth
Slot Status
Enter Slot No to Book:
Hint for TextBox1
Book

# 6. CONCLUSION AND SCOPE FOR FUTURE ENHANCEMENTS:

The project will achieve hardware and software development. The hardware is defined as the mechanical building of the whole project, such as the building of the main body of the project, the brackets that will hold the LED's and sensors, the enclosure box for Arduino and some electrical devices and wires which will be achieved. An Arduino Program will be achieved which is based on C programming language. An Android Application will be achieved using MIT App Inventor 2, which is an open-source web application originally provided by Google.

What the project will not achieve which can be considered as a future enhancement is the fact that the data published on the Android Application is only available if the user is connected to Bluetooth module. Also, when the barrier goes up there is specific amount of time before the barrier goes down. If this car park was implemented in real life, for safety reasons extra sensors must be used to prevent a car from being hit.

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# GLOSSARY

[1] **Connected Devices**: Components that make up the Internet of Things. Many have built-in sensors and/or actuators and collect data to help users or other devices make informed decisions and monitor or affect outside events.

[2] **Internet of Things (IoT)**: A network of objects (such as sensors and actuators) that can capture data autonomously and self-configure intelligently based on physical world events, allowing these systems to become active participants in various public, commercial, scientific, and personal processes.

[3] **Arduino:** It's an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world.

[4] **Jump Wire:** (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

[5] **Breadboard:** A **breadboard** is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. Because the solderless breadboard does not require soldering, it is reusable.

[6] **LED BULBS:** A **light-emitting diode** (**LED**) is a two-lead semiconductor light source, where the longer one acts as anode and the shorter one as cathode. It is a p–n junction diode that emits light when activated.

[7] **HC-SR04:** Also termed as **Ultrasonic Sensor.** The **HC-SR04** ultrasonic sensor uses sonar to determine distance to an object. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1" to 13 feet.

[8] **BLUETOOTH HC-05 MODULE:** It's an easy to use **Bluetooth** SPP (Serial Port Protocol) **module**, designed for transparent wireless serial connection setup.

[9] **SERVO MOTOR:** Tiny and lightweight with high output power. **Servo** can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any **servo** code, hardware or library to control these **servos**.

[10] **ARDUINO IDE:** The **Arduino** integrated development environment (**IDE**) is a cross-platform application (for Windows, macOS, Linux)

# APPENDIX

1) Make Connections of Ultrasonic sensor, Bluetooth Module and Arduino Mega as shown in the above fig.

2) Initialize all trigger and echo pins of ultrasonic sensors

3) Initialize Serial Communication between Bluetooth Module and Arduino Mega using the below Statement:

```
Serial.begin(9600)
```

4) Specify the Predefined distance in the code to detect whether the car is present in a slot or not

5) Now Read each Ultrasonic sensor value and compare these values with the predefined distance.

6) If the predefined distance is less than the distance read from ultrasonic sensor then it indicates that the car is present in the slot. This can be shown as below:

```
if (dist[0] < dist_threshold) {

Serial.print("11"); // slot 1 is occupied

Serial1.print("11");

Serial.print('\n');

digitalWrite(led1R,1);

digitalWrite(led1G,0);
```

```
}
```

7) If the predefined distance is less than the distance read from ultrasonic sensor then it indicates that the car is present in the slot. This can be shown as below:

```
else {
Serial.print("10"); // slot 1 is free
Serial1.print("10");
Serial.print('\n');
digitalWrite(led1R,0);
digitalWrite(led1G,1);
}
```

8)The status of Slots can be shown in app using Bluetooth connectivity