



## SMART CAR PARKING USING WI-FI AND BLYNK APP

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### ABSTRACT

This paper describes a design of effective information system that can monitor the vehicle condition in traveling, detect the accident of the vehicle and accidents due to excessive alcohol consumption, collision of two vehicles due to negligence or a sleepy driver and theft detection system. A prototype of smart parking that allows drivers to effectively find the vacant parking spaces is also been designed and implemented in this paper. By periodically learning the parking status from the sensor networks deployed in parking lots, the drivers are allowed to access this information with their personal communication devices and exactly know which parking slots are vacant. This particular application uses internet of things for accessing the information with their mobile phones. This system has the potential to simplify the operations of parking systems, as well as alleviate traffic congestion caused by parking searching and would definitely make people follow the traffic rules and ensure safety. The developed system is reliable, low cost and user friendly.

**Keywords:** Smart vehicle, Smart parking, Node MCU, GSM Module, IR Sensors, Arduino IDE.

### 1. INTRODUCTION

A Smart vehicle is an automobile with advanced electronics<sup>[1]</sup>. One of the major challenges of the vehicles these days is to prevent the accidents caused due to collision of vehicle and obstacle or due to alcohol consumption or due to drowsiness of the drivers and to prevent the air pollution in real-time. Vehicle accident is the paramount thread for the people's life which causes a serious wound or even dead. The automotive companies have made lots of progress in alleviating this thread, but still the probability of detrimental effect due to an accident is not reduced. For this purpose, we developed a Smart Vehicles equipped with various types of sensors that detects an accidental situation and sends alert message to the contacts specified using GSM Module. This system also alerts the owner of the vehicle when an attempt of theft IOT Based Smart Vehicle and Smart Parking System is made by sending a message using GSM module. Although it is a demonstration of intelligent vehicle technologies, this requires some changes in the existing highway infrastructure to implement such a system. This helps in better functioning and increases the efficiency<sup>[2]</sup>. While they will certainly benefit from modernized transport networks, they are ultimately being designed to make informed decisions about any kind of environment or climate they find themselves in. In other words, like humans except, it's fair to say, far better. So, there seems a definite need for a smart vehicle in the increasing population now a day. This smart vehicle must have various facilities that make driving much easier.

In the current era, we are facing a new problem of parking of vehicles. It is a major problem in urban cities. The problem is more tough because of continues growing number of vehicles. We know that one million vehicles are being used every day. In this paper, we propose an automatic and real-time system for automated car parking <sup>[18]</sup>.

IoT refers as any physical thing that is connected to internet or exchanging information or data between internet and physical device. NODE MCU is an open source IoT platform used in smart parking. It is used for building digital devices and interactive objects that can sense and control physical devices. Our smart parking will be implemented using Arduino IDE and NODE MCU to connect parking area with BLYNK app. By using our automated parking system, a user can save much time for searching free parking space. An infrared sensor has to be employed in each slot to check that a particular plot is vacant or not. Searching smart parking system helps people to search parking space accessible with the ease of IoT automation by supplying parking slot free information <sup>[19]</sup>.

In this implementation, four IR sensors have been used in the parking slots. The IR sensor is switched on when a vehicle is parked in that particular slot and remains off when the slot is empty. The Blynk app is installed in the mobile and an authentication token is sent to the mail which is updated in the program. A new project is created in the Blynk app and LED's are used to indicate if the slot is empty or occupied. When the parking slot is occupied, the IR sensor is switched on and automatically the LED in the app gets switched off and vice versa

[20].

## 2. ARDUINO (ATMEGA328)

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing online.



**Figure 1** Arduino Uno Board

Arduino board designs use a variety of microprocessors and controllers as shown in figure1. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++

[21].

## 3. NODE MCU (ESP8266)

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enable these objects to

connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure <sup>[15]</sup>.

The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities [14].

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi System on Chip with CPU frequency of 80 MHz and the upload speed is 115200. The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer as shown in figure2. It is an Open-source, Interactive, Programmable, low cost, Simple, Smart, WI-FI enabled module [23].

Configuring and programming the board

1. Download the driver from the link from the website
2. Download Arduino IDE.
3. Start Arduino and open Preferences window.



**Figure 2** Node MCU Board **Figure 3** Wi-Fi Connection Program Executions

4. Enter `http://arduino.esp8266.com/stable/package_esp8266com_index.json` into Additional Board Manager URLs field.
5. Open Boards Manager from Tools. Enter esp8266 into the search field to install ESP8266 platform Go to Tools > Board menu, and then select your ESP8266 board.

6. Upload Using: Serial

CPU Frequency: 80 MHz

Flash Size: 4M

Upload Speed: 115200

PORT: Select Assign Port Only.

7. To check the ESP8266 upload the Wi-Fi connect code on to the board. This program will connect your ESP to a Wi-Fi and print its IP address on your Arduino serial monitor as shown in figure3. You need to modify your ssid and password

```
const char* ssid = "YOUR WI-FI NETWORK NAME";const char* password = "YOUR WI-FI
PASSWORD"
```

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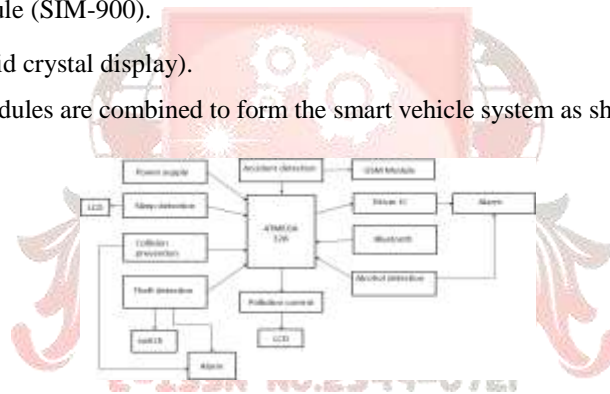
The NODE MCU is connected to the Wi-Fi and to the Blynk app on the author's phone by writing the authentication token in the program. The programming is done in the Arduino IDE software. The empty parking slots are visible in the app on any smart phone by scanning the QR code generated from the author's mobile. All the sensors are connected to the mobile by Internet of things and the data is automatically updated in the app which makes parking easier and time saving <sup>[17]</sup>.

#### 4. HARDWARE REQUIREMENTS OF SMART VEHICLE SYSTEM

The smart vehicle system consists of the following hardware:

- Ultrasonic sensor.
- Vibration Sensor.
- Eye Blink Sensor
- IR sensor.
- Alcohol Sensor (MQ2) and Gas Sensor (MQ6).
- Motor Driver(L293D)
- Bluetooth Module (HC-05).
- GMS Module (SIM-900).
- LCD (Liquid crystal display).

All the hardware modules are combined to form the smart vehicle system as shown in the figure4.



**Figure 4** Block diagram of Smart Vehicle System

##### 4.1. Ultrasonic sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves as shown in figure5. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object <sup>[7]</sup>. To find the distance to the object, simply divide the round-trip distance in half <sup>[9]</sup>.

$$\text{Distance} = 0.5 * \text{Speed of sound} * \text{time taken}$$



Figure 5 Hc-Sr04 Ultrasonic Sensor



Figure 6 Vibration Sensor

The ultrasonic sensor is used to find the distance between the vehicle and an obstacle. The distance is measured in cms. We have set the threshold level to 10 cm in order to prevent the collision of the vehicle. The ultrasonic sensor is connected to the engine of the vehicle and a buzzer. Whenever the distance between the vehicle and an obstacle falls below 10 cm, the vehicle is automatically stopped in order to prevent the collision and a buzzer is activated to alert the driver <sup>[7]</sup>.

#### 4.2. Vibration Sensor

Vibration sensor is used originally as vibration switch because of its high sensitivity; it is sensitive to environment vibration, and generally used to detect the ambient vibration strength as shown figure6. When module did not reach the threshold in shock or vibration strength, output gets high level and when external vibration strength exceeds the threshold, output gets low level. Small digital output can be directly connected to the microcontroller, for the microcontroller to detect low level, thereby to detect the ambient vibration. Small digital output can directly drive the relay module, which can be composed of a vibration switch <sup>[3]</sup>. The vibration sensor switch features an adjustable potentiometer, a vibration sensor, and a LM393 chip to give an adjustable digital output based on the amount of vibration. The potentiometer can be adjusted to both increase and decrease the sensitivity to the desired amount. The module outputs a logic level high (VCC) when it is triggered and a low (GND) when it isn't. Additionally there is an onboard LED that turns on when the module is triggered <sup>[4]</sup>. Usually at any angle switch is ON state, by the vibration or movement, the rollers of the conduction current in the switch will produce a movement or vibration, causing the current through the disconnect or the rise of the resistance and trigger circuit. The characteristics of this switch is usually general in the conduction state briefly disconnected resistant to vibration, so it's high sensitivity settings by IC, customers according to their sensitivity requirements for adjustments<sup>[7]</sup>. Single-roller type full induction trigger switch. When no vibration or tilt, the product is ON conduction state, and in the steady state, when a vibration or tilt, the switch will be rendered instantly disconnect the conductive resistance increases, generating a current pulse signal, thereby triggering circuit.

The vibration sensor is used in accident detection system. The output obtained from the vibration sensor is in terms of frequency. We have set the threshold value to 3000 for an accident to occur. The vibration sensor is connected to the alarm circuit, switch and a GSM module. The vibration sensor measures the disturbances occurred in the vehicle and if the value read crosses the threshold, an accident might have occurred to the vehicle. If the driver is safe he can turn ON the switch indicating he is alright so that the

message will not be sent otherwise, if the switch remains in OFF position a message will be sent to the specified contacts saying that this particular vehicle has met with an accident<sup>[3]</sup>.

#### 4.3. Eye Blink Sensor

This Eye Blink sensor is IR based. The Variation Across the eye will vary as per eye blink. If the eye is closed means the output is high otherwise output is low. This is used to know the eye whether it is in closing or opening position. This output is given to logic circuit to indicate the alarm. This can be used for project that involves controlling accident caused due to drowsiness. If there is no eye lid movement found for the certain period of predetermined i.e. time greater than the human eye blinking time then consider an event called “blink”, for which the set of operations will be followed. Here, in this project we need to set time as 5 or 10 second or above it, as “blink event” is different from “common eye blinking”.

The eye blink sensor is the developed IR sensor as shown in figure7. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the reflected

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infrared rays of eye. If the eye is closed means the output of IR receiver is high otherwise the IR receiver output is low<sup>[5]</sup>.



Figure 7 Eye Blink Sensor



Figure 8 IR Sensor



Figure 9 Gas Sensor

The output of the eye blink sensor is a digital value (0 or 1). The sensor reads “1” if eye remains closed and it reads “0” if eye is open. We have calculated the time interval for closing and opening of the eye by using the function “millis ()”. We have set the threshold time to 20000ms. If the driver closes his eyes or the sensor reads 1 for more than the threshold time it means the driver is drowsy and alarm is activated to wake him up, a message is also displayed in the LCD screen saying “you are sleepy. Wake up!!”<sup>[5]</sup>.

#### 4.4. IR Sensor

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure8. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo coupler or Opto Coupler. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined. It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier and an LED. IR LED emits infrared light. The Photodiode detects the infrared light. An Op-amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement<sup>[6]</sup>.

The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation

from the IR LED will fall on the IR receiver. Hence there is a line of sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

In the Smart Vehicle system IR sensor is used for the purpose of theft detection. The circuit consists of an IR sensor and a switch connected to the power supply. Whenever the switch is on, this circuit gets turned on. Now if an intruder enters the car, the presence of the person is detected by the IR sensor, the alarm is activated and also a message “An intruder has entered your car!!” will be sent to the mobile number specified. When the user himself wants to use the vehicle, he can turn the switch OFF, so that the circuit remains OFF i.e., the power supply to the circuit will be cut<sup>[3]</sup>.

#### 4.5. Alcohol sensor (mq2) and Gas sensor (mq6)

Alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple; all it needs is one resistor<sup>[8]</sup>. Alcohol Sensor (MQ2) module is suitable for detecting H<sub>2</sub>, LPG, CH<sub>4</sub>, CO, Alcohol, Smoke or Propane. The sensitivity of the sensor can be adjusted by potentiometer<sup>[7]</sup>.

A gas sensor is a device that detects the presence of gases in an area, often as part of a safety system as shown in figure9. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut

down. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals [10].

In the Smart Vehicle System, alcohol sensor is used to prevent the accidents caused due to drunken drivers. In order to start the vehicle the driver must take the breathe test, which calculates the amount of alcohol present in his body. Similar to gas sensor, the units of the output of alcohol sensor are also ppm. So we set the threshold of the alcohol sensor to 450ppm, above which indicates the driver has consumed alcohol. If the value is within the threshold limit, then the driver can start the vehicle. If it exceeds the threshold then he won't be able to start the vehicle i.e., the input from the Bluetooth controller will not be sent to the motor driver<sup>[8]</sup>. In the smart vehicle system, gas sensor is used for the detection of harmful emission of gases from the exhaust of the vehicle. The units of the output from gas sensor are ppm, we set the threshold to 400ppm, so if the value of the sensor exceeds the threshold, then a message “harmful emission! Get your car checked!!” is displayed on the LCD indicating the harmful emission of gases<sup>[11]</sup>.

#### 4.6. Motor Driver (L293D)

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. It means that you can control two DC motor with a single L293D IC. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.

There are two Enable pins on l293D as shown in figure10. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to

high and for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch [2].

There are 4 input pins for L293d, pin 2, 7 on the left and pin 15, 10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1. In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor [1].

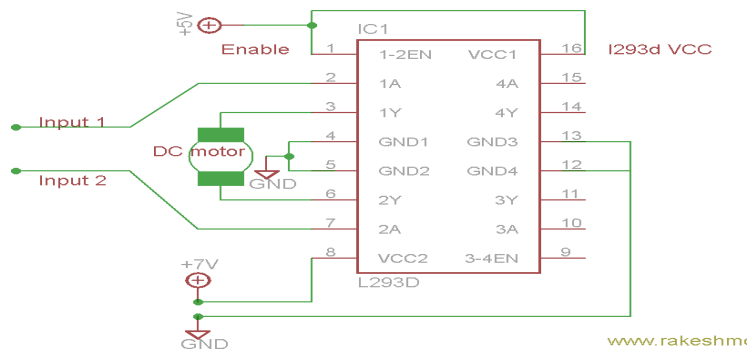


Figure 10 Circuit Diagram for L293d Motor Driver IC Controller

The motor driver is connected to the Bluetooth app and wheels of vehicle. The data is sent from the Bluetooth Arduino controller app through serial communication. The input to the motor driver is given from the Arduino for the movement of the vehicle. The motor driver is also connected to different sensors in order to stop the vehicle if the value from the sensors goes beyond the threshold level specified [2].

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4.7. Bluetooth Module HC-05

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol), designed for transparent wireless serial connection setup as shown in figure11. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication by default the factory setting is SLAVE .This serial port Bluetooth module is fully qualified Bluetooth V2.0+ EDR (Enhanced Data Rate) 3Mbps modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature)



[1].

Figure 11 Blue Tooth Module Hc-05 Figure 12 connection of HC-05 to Arduino

The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC [1].

#### 4.8. Arduino Bluetooth Controller

Arduino Bluetooth Controller Device Application is to allow you to control various electrical devices up to eight devices and independently controlled. Use Android Bluetooth mobile device to remote control your device with Serial TTL Bluetooth Module and Arduino board as shown in figure 12. The Android device would be a remote control for any micro-controller with a Bluetooth module. Run the app, search for your Bluetooth module and connect. Once you are connected you will be able to send your own commands to your Arduino board using the keyboard or some fancy buttons.

As the module HC-05, Arduino and motor driver are already interfaced with each other, now we need to connect the Arduino Bluetooth controller app in our mobile phone to this Bluetooth module via same Bluetooth. One can control the vehicle through the Arduino Bluetooth controller app by giving desired instructions which are already defined by the user [2].

#### 4.9. GSM Module

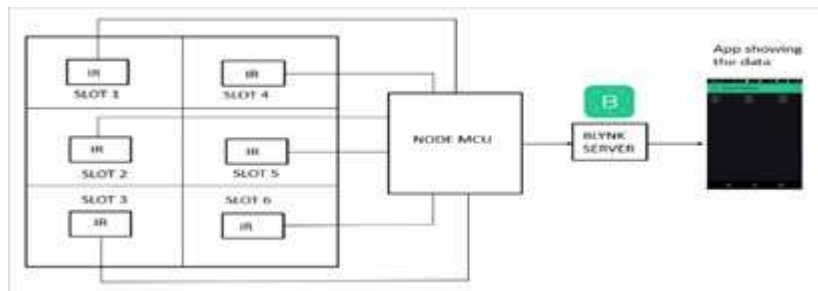
GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands [9]. The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The interface consists of the following pins:

#### 4.10. Connection of LCD to Arduino

LCD modules form a very important part in many Arduino based embedded system designs. So the knowledge on interfacing LCD module to Arduino is very essential in designing embedded systems. This section of the article is about interfacing an Arduino to 16x2 LCD. JHD162A is a 16x2 LCD module based on the HD44780 driver from Hitachi. The JHD162A has 16 pins and can be operated in 4-bit mode [12]. In the Smart Vehicle system LCD is used for the purpose of sleep detection as well as pollution check. When the driver is sleepy, it is indicated by the alarm and a message "You are sleepy! Wake up!!" is displayed and when the gases emitted from the exhaust of the car crosses the threshold, then a message "Harmful emission! Get your car serviced!!" is displayed on the LCD screen [12].

## 5. HARDWARE AND SOFTWARE REQUIREMENTS OF SMART PARKING SYSTEM

Smart parking system block diagram as shown in figure14. It consists of following hardware:



- IR Sensors

**Figure 14** Block diagram of Smart parking system

- NODE MCU(ESP8266)
- Arduino IDE
- BLYNK App

### 5.1. IR Sensors

IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. An infrared sensor circuit is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time <sup>[16]</sup>. This circuit comprises of the following components: LM358 IC IR transmitter and receiver pair, Variable resistors, LED.



**Figure 15** IR Sensor Module

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Smart parking model as shown in figure16. The IR Sensor is switched on and off according to the presence of the vehicle. When IR Sensor is off it means vehicle is not present and is indicated by switching on the respective LED in the Blynk app as shown in figure17. When IR Sensor is on it means vehicle is present in the slot and is indicated by turning off the LED in the Blynk app. This makes it easier to park the vehicles



without searching for an empty slot <sup>[19]</sup>.

**Figure 16** Smart Parking Model

**Figure 17** Indication in the Blynk app

### 5.2. Node MCU (ESP8266)

An open-source firmware and development kit that helps you to prototype your IoT product within a few Lua script lines. The input from the IR Sensors is taken by the NODE MCU. The NODE MCU is connected to the Wi-Fi. After taking the values from IR Sensors they are automatically updated in the Blynk app by the connection of Wi-Fi. The sensor values are automatically updated in the app through the Wi-Fi connection and authentication token <sup>[12]</sup>.

The Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus [13].

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-

1.0 saved sketches with the extension .pde. Arduino IDE is software which is used to program different boards by installing different libraries. It can be used to program NODE MCU (ESP 8266) by selecting the Node MCU 1.0 (ESP 12-E Module) and including the library #include "ESP8266 Wi-Fi.h". The baud rate also has to be set to 115200 to monitor the output of the sensors in the serial monitor <sup>[12]</sup>.

### 5.3. Blynk app

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5mins. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the IoT <sup>[15]</sup>. Blynk app and server as shown in figure 18 and 19.

Getting started with Blynk

In order to use Blynk app we would need:

- Hardware that works with Blynk. Check the full list of supported hardware.
- If your hardware doesn't have connectivity on board, you can use shields like Ethernet, WI-Fi, GPRS and many others. Blynk also works over Bluetooth and USB.

The following steps are to be followed:

1. Download the Blynk app for android or OS.
2. Get the auth token:

- Create a new account in Blynk App.
  - Create a New Project. Then choose the board and connection you will use. After the project was created, we will send you Auth Token over email.
  - Check your email inbox and find the Auth Token.
3. Install the Blynk library. Blynk library should be installed manually, the following steps should be followed:
- Download the latest release .zip file. Unzip it. You will notice that archive contains several folders and several libraries.
  - Copy all these libraries to your\_sketchbook\_folder of Arduino IDE. To find the location of your\_sketchbook\_folder, go to top menu in Arduino IDE: File -> Preferences (if you are using Mac OS - go to Arduino → Preferences)
4. Create your first example sketch code.
- Choose Your board (for example: Arduino UNO)
  - Choose your connection (Wi-Fi, Bluetooth and USB.)

Now, the connection is established between the board and the Blynk app<sup>[15]</sup>.



**Figure 18** Blynk App **Figure 19** Blynk Server

5. Paste the auth token:
- In the example sketch, find this line: `char auth[] = "YourAuthToken";`
  - Change it with your Auth Token (it should be in your email inbox after you created the Project in the Blynk app. `char auth[] = "53e4da8793764b6197fc 44a673ce4e21";`
  - Flash the code to your hardware.

#### 5.4. Working of the system

There are four IR Sensors being used in the system. The IR Sensors are placed in each slot. The IR Sensors detect the presence of the vehicle by transmitting the IR radiations by the Transmitter. The IR Sensors detect "1" when there is a vehicle and detect "0" when it is empty. Simultaneously in the Blynk app a new project is created by the author and LED's are used to detect the empty and occupied slots. After a new project is created by the author a QR code is generated which is displayed at the entrance of the parking. When the people enter the parking zone, they need to scan the QR code from their mobile and then the data about the slots is automatically updated to know which slot is empty and which is occupied. This application solves the problem of parking during busy days by knowing the empty slots prior to parking the vehicle<sup>[15]</sup>.

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6. RESULTS

The working of the model “Smart vehicle and Smart parking system” which consists of sleep detection of the driver with an alarm, Accident detection with an SMS alert, Anti-Theft system, Pollution control by automobiles, Alcohol level detection and smart parking of the automobiles has been checked and the following results have been produced. Results of Sleep Detection as shown in figure 20.



Figure 20 a) Output of Eye blink Sensor b) Serial Monitor Output of Eye blink  
Note: The drowsy driver is waken up by the alarm and a message in the LCD. Results for



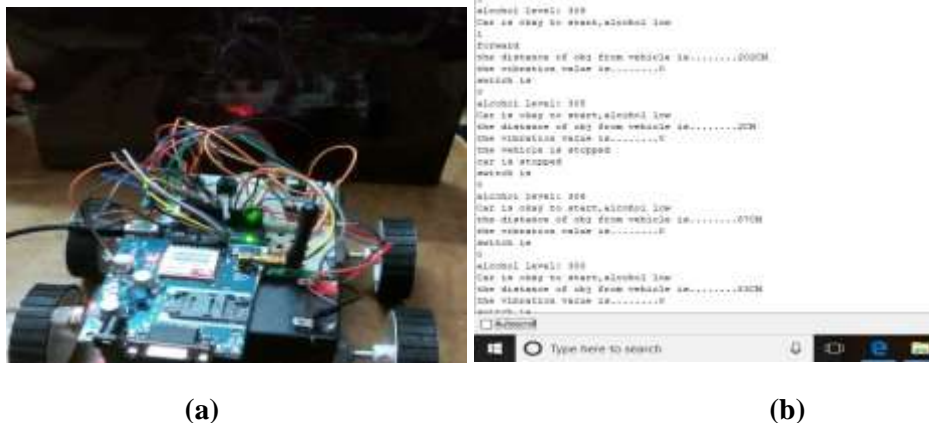
harmful emission check as shown figure 21.

Figure 21 a) Output of Gas Sensor b) Serial monitor Output of Gas Sensor

Note: There is a gas sensor near the exhaust which gets active when the emissions are above a certain level. The owner is made aware that he should get his car checked by printing a message on the LCD screen

Note: When the distance between the vehicle and obstacle is less than 10 cm, it is automatically stopped and an alarm is activated to alert the driver.

Results for collision prevention as shown in figure 22 and 23.



**Figure 22** a) Obstacle at <10cm from the vehicle b) 2 cm distance from object the vehicle is stopped

Results for accident detection as shown in figure 24, 25 &26.



**Figure 24** Accident Detection by Sensing Vibrations in the vehicle



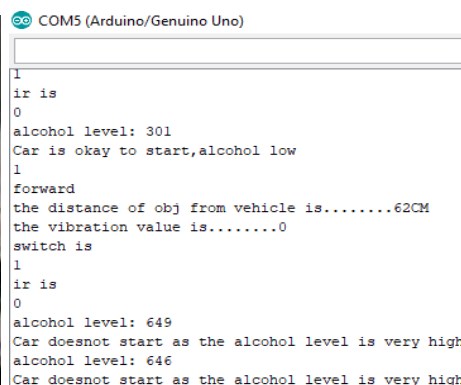
**Figure 25** Monitor when vibration goes beyond the threshold **Figure 26** SMS Sent from GSM Module

Note: When the vibration value goes beyond the threshold, the vehicle is automatically stopped. An SMS is sent if the driver does not push the button. If the button reads 1 the SMS is not sent.

Results for alcohol sensor as shown in figure 27 and 28.



**Figure 27** Alcohol Input



**Figure 28** Alcohol Level Goes Beyond Threshold Note:

An input should be given to the alcohol sensor before starting the vehicle. If the Alcohol consumption level is beyond the threshold it will not start.

Results for theft detection as shown in figure 29, 30 and 31.

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Figure 29 Theft detection by IR sensor detecting 1 Figure 30 message is sent when switch &IR read 1

Note: The theft detection circuit is activated by turning ON the switch. When the switch is ON and IR reads 1 an SMS is sent to the owner and alarm is activated.

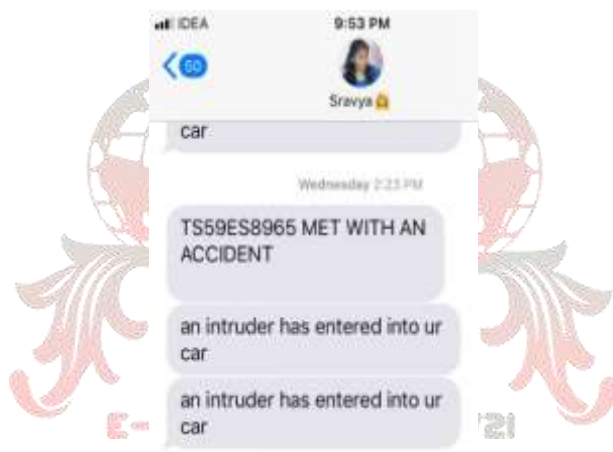


Figure 31 SMS sent from GSM during an attempt of theft

Interfacing of Bluetooth and motor driver as shown in figure 32 and 33.



Figure 32 Bluetooth App settings Figure 33 Motor Driver rotates the wheels as per instruction in the App

Note: According to the characters given in the app, the vehicle is moved in such a way. Results for Smart parking as shown in figure 34 and 35.



**Figure 34** slot 2 occupied**Figure 35** Output in the App and serial monitor

Note: The updates of the empty and occupied slots are automatically updated in the app by scanning the QR code.

## 7. CONCLUSION

In this paper, a smart vehicle system is developed which ensures the safety of the driver and prevents the causes for the accidents. Security in travel is primary concern for everyone. This paper describes a design of effective information system that can monitor the vehicle condition in traveling. It can also be used to detect the accident of the vehicle using a vibration sensor which sends a message upon the occurrence of the accident. It keeps a check on the emission of excess gases from the exhaust of the vehicle, accidents caused due to excessive alcohol consumption, collision of two vehicles due to negligence or a sleepy driver is prevented. There is also a theft detection system provided inside the vehicle.

A smart parking system which works on the concept of IoT is also presented. Thus, by using this we can easily find the empty parking slot for our car. This can reduce the time spent and mess created in order to find an empty parking slot in very large lots. A parking solution can greatly benefit both the user and the lot owner.

## FUTURE SCOPE

The smart vehicle system can be modified by adding the feature of sending the location of occurrence of the accident by including the GPS module. Thus the ambulance can reach the site of the accident within no time.

The smart parking system can also be modified by interfacing google maps in the app so that by specifying the area in the map, one can automatically find the available parking areas in that location. We can also include slot reservation facility so that a parking slot can be booked beforehand. The implementation of a smart vehicle and smart parking solution would surely be a great investment for any city government or a company.

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