# CHAPTER-1 INTRODUCTION

The agriculture sector is essential to India's economic and social development, with significant contributions to employment generation, food security, export earnings, and rural development. It employs around 50% of the country's workforce, contributes around 17-18% to GDP, and is the largest employer, providing livelihoods to millions of people. Additionally, it plays a vital role in ensuring food security and meeting the nutritional needs of the population and is a major contributor to the country's export earnings.

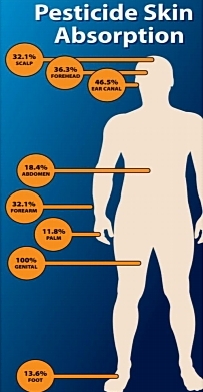
The existing pesticide sprayers in agriculture have a number of notable problems that can impact their effectiveness and sustainability. They may not be efficient in their application, which can result in uneven distribution of pesticides and ineffective pest control. Also, traditional sprayers often lack the necessary security features to prevent misuse or theft of pesticides, which can pose risks to both human health and security. These issues highlight the need for more advanced solutions, such as an IoT-based security system or pesticide sprinklers, which can address these problems and improve the overall effectiveness and sustainability of pesticide use in agriculture.

The use of pesticides in agriculture can have negative health effects on humans and the environment. Exposure to pesticides through inhalation, skin contact, or ingestion can cause various health problems, including acute poisoning, respiratory problems, cancer, birth defects, neurological disorders, and hormonal imbalances. Pesticides can also enter the food chain and accumulate in soil, water, and food, posing a risk to both humans and wildlife. Long-term exposure to low levels of pesticides can have a cumulative effect, increasing the risk of chronic diseases. To minimize the health effects of pesticides, farmers and pesticide handlers should follow safety guidelines, and governments should regulate the use of pesticides and promote sustainable agriculture practices.

Pesticides can be very harmful to human health. The chemicals in the pesticides can cause short-term or long-term health effects for humans. The short-term or acute effects include: Nausea, Dizziness, Diarrhea, Itching of the skin, Rashes, Blisters, Colds/Flu , etc.,Long-term or chronic health effects include: Tumors , Cancer , Damage to the brain or nervous system, Infertility , Damage to certain organs of the body such as kidneys, lungs or liver , etc.,

Pesticide sprinklers with IoT-based security systems are a new and innovative way to manage pest control and enhance crop growth in agriculture. With advancements in technology, traditional pest control methods have become less efficient and can cause harm to the environment. Therefore, it has become increasingly important to develop sustainable and eco-friendly solutions for pest management. A pesticide sprinkler with an IoT-based security system offers a smart and efficient approach to addressing this challenge. It uses IoT sensors to detect and analyze the growth of crops and the presence of pests and diseases. With this data, it can automatically trigger the spraying of pesticides and other chemicals only where and when necessary, which leads to precise and targeted application. Moreover, it can also send alerts to farmers if any issues are detected, such as malfunctioning or lack of pesticides, allowing them to take corrective actions in real-time. In short, the pesticide sprinkler with an IoT-based security system is a promising solution to improve the yield and quality of crops while minimizing the use of harmful chemicals and their impact on the environment.

The main motive of the project is to prepare a BOT that will be useful in the field of agriculture. Spraying pesticides is the main task in agriculture to save crops from pests and insects. Farmers nowadays are spraying pesticides manually, which causes many problems for the farmers. Usage of manual techniques can harm them, like lifting heavy tanks can cause harm to shoulders, skin diseases, and many more. India is agrarian economies and most of rural populations depend on agriculture to earn their livelihood. The farming methods at present are manual or semiautomatic with high involvement of laborers. In the recent years, the number of labor availability is reducing continuously along with increase in their wages. There is a requirement of higher productivity. Hence the device is to be designed which helps farmers to overcome the stated problem. Automated Robots can provide us the solution.



**1.1 LITERATURE SURVEY**

Literature survey is a crucial stage in project life cycle; therefore, its importance cannot be underestimated. The information collected through websites is properly analyzed to clearly understand the requirements. The purpose of this literature survey is to derive a new solution by understanding the failing and inadequacies of the present system. The survey is carried out in the initial stages of the work and the need of this application is determined. This chapter contains the study of different previous technologies and draw backs of the previous technologies. Comparison between the previous technology and the technology adopted in the work, comparison between previous designs and proposed design is also included in this chapter.

This paper present technique based on speech unit extraction and concatenation. For the former case, a two stage summarization method consisting of important sentence extraction and word based sentence compaction is investigated. This method are applied to the summarization of unrestricted-domain spontaneous presentation and evaluated by objective and subjective measures. It was confirmed that proposed methods are effective in spontaneous speech summarization.

**[1]** **K. Marapalli, A. Bansode, P. Dundgekar and N. Rathod, “AIGER An Intelligent Vehicle for Military Purpose”**

2021 7th International Conference on Advanced Computing and Communication Systems, Long range connection problem. Connection using Wi-Fi, Intelligent vehicle helped us to move in a remote area like tunnels and suspicious caves in the jungle. Can be improved by adding embedded night vision camera.

**[2] T. Akilan, S. Chaudhary, P. Kumari and U. Pandey, “Surveillance Robot in Hazardous Place Using IoT Technology”**

2020 2nd International Conference on Advances in Computing, Communication Control and Networking, Motion reduce the accuracy of the potage. Embedded system. Surveillance robot helped us to monitor the surrounding area around the military base. Can be improved by using stable camera holder or HD cameras.

**[3] J.Xiao et al., “Design of Ultrasonic Radar Detection System”**

2021 IEEE 15th International Conference on Electronic Measurement & Instruments Reduces the efficiency in long system. Embedded system. Radar system helped us to detect the intruder by sending ultrasonic sounds we can estimate the enemy location, Ultrasonic sensors and range of the sensors is less We can improve it by using high range sensors

**[4] Pratibha, R. Rajput, A. Yadav, A. S. Ansari, M. A. Husain and S. P. Singh, “Designing of Automatic Corridor Lighting System Using PIR Motion Sensor,”**

2021 International Conference on Control, Automation, Power and Signal Processing Number of PIR sensors should be increased to improve the efficiency. Embedded system using microcontroller. PIR sensors helped us to detect the motion or any suspicious activities around the military camp. PIR motion sensors is highly sensitive it can even detect the incest so the position of the sensors should be precise.

**[5] A. Ramkumar, T. Karthick, C. V. Kumar, S. Rajendran and K. Rajesh, “Design and Development of E-Vehicle with Phone Control”**

2021 Second International Conference on Electronics and Sustainable Communication Systems Missing camera and other equipment. Embedded system using microcontroller.E-vehicle or RC payload is used to control the payload through internet so that we can access it remotely. Can be embedded with other sensors and improved in performance.

**[6] An Attempt to Develop an IOT based Vehicle Security System** -This project provides a comparative analysis of the PIR with some other market competitors and introduces the microcontroller specification, features and programming details.

**[7] Design and Implementation of Remote Operated Robot Control System** **–** robots are the remotely controlled robots, equipped with a wireless PIR Sensors, batteries and four movable wheels. Two different PICs are used to remotely control of the wireless system and also to control the spy robot.

**[8] Microcontroller Based Security System With Intruder Position** –Themicrocontroller based security system with Intruder Position Display is a design, that applies automated security system. The sensors will receive the signal when the intruder is around, while the control program will translate the received signal from sensor to useful information about function of the system.

**[9] A. Kokovin, A. A. Evsikov, A. N. Sytin, S. U. Uvaysov and A. S. Uvaysova, “Design and Implementation of PIR sensors with Distributed Intelligence”**

2021 International Seminar on Electron Devices Design and Production (SED), 2021, This is the work they tried to design the system which is extended with distributed intelligences. The out come and the performance of this system is pretty average and the design can be considered to other project as well The main disadvantage of this system is its just a design we can improve it by embedding on some security system.

**[10] T. Yang, P. Guo, W. Liu and X. Liu, “Deep PIRATES: Enabling Deployment-Independent Supervised PIR-Based Localization,”**

2020 3rd International Conference on Mechatronics, Robotics and Automation (ICMRA), 2020, This is the most complex structured PIR based localization where the PIR is independent in the deep pirates enabling system The outcome of this work is not satisfactory it takes too much time to develop and it is complex to design This system is independent on its own we can improve it by embedding with the surveillance system.

**[11] M. Elimarteena and V. S. Nagaraju, “IOT Based Home Security System with PIR and Ultrasonic Detection Using Arduino”**

2021 5th International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2021, This is the system which is basically built using the arduino microcontroller and this detect the motion and the moment in the house. The outcome of the work is fascinating because they are using low level sensors they can be easy to implement and fast in execution. The main disadvantage of the work is it can detect the motion but it cannot recognize who or what so it can improved by installing camera to the system.

**[12] Fluorescence Data Resolved by Unfolded Partial Least-Squares:** In this proposed system a chemometric assisted spectofluorimeric method as been developed for detection of fluorescent pesticides like carbaryl, carbendavim, and thiabendazole in orange and banana. Methanol can be used for sample pre-treatment Emission excitation fluorescence matrices were obtained and resolved by using 2 second ‘order mitivariate calitration method. Tiss based on unfold pata east square combined with bilinearizaion for obtaining second order advantage, Determination of pesticides is ‘done in the presence of immer fier effect, background interaction, song. Spectral ‘overlapping. and unexpected components. The purpose ofthis approach isto develop a simple, sensitive, and selective system, stable for routine laboratory uses.

**[13] Sensor Integration Method:** ‘This method proposes a smart device to detect the quality and pesticide level of fruits and vegetables. In the proposed system, three methods are iterated to provide better effciency. Hence this device has three modules. First module detets the quality of fruits bys near IR sensor. Second module spot the antificaly ripened fruits using ethylene 288 sensor, Finally, third module detect pesticide residue content using conductivity sensor. The proposed system consists of raspberry pi infrared sensor, ethylene gas sensor, ‘conductivity sensor and LCD display Infrared signal is made to incident on frit and the reflected signal from fruit is visualized by software sig view. Ethylene sensor detects the ‘ethylene content in fruits and the conductivity sensor senses the pesticide residue level, oth the values are compared with threshold valve.

**[14] Using electronic nose In this procedure the measurement system (Electonic Nose) call B-NOSE,** which ‘consists of thee principal stages: concentration, measure and rest. The sensory system was ‘developed at the University of Pamplona and is composed of a matrix of 16 gas sensors of metalic oxides (TGS) (Gualdron etal. 2014). The sensors are chemical-esisitve, in the matrix of sensors we found 16 different references in order to have diversity of applications in the sensory system. In he test carried cut was determined the sensitivity of the sensors in each of the measures made on the basis of the compounds emit by the fut and the acquisition of the signal was developed on the basis of she measured variable in value of the conductance (1/R), where the resistance of the sensor (Rs) was measured in the light ‘of the parameters and operating characteristics (Oniz, Gualdron and Duran. 2015), Once ‘he measurements were acquired it was determined that the sensors react very well before the volatile compounds. In total 80 measures were obtained with the dry kin of fis, Which were upgraded in a sampling chamber in order to obtain the set of appropriate measures. The measures were stored in a computer and through a software provided with patter recognition algorithms.

**1.2 PROBLEM STATEMENT**

The existence of the pesticide in fruits and vegetables has been a growing worry in all over the world. This work tries to solve the problem by customer side. This pesticide may even cause serious health effects and disease like cancer.

The customer should get to know whether the selected fruits and vegetables are safe to

consume or not. The main aim of the work is to detect the level of pesticide in the sample, uses of pesticides have results in many problems including the human health, So as to scale

ack the lost and maintain the standard of fits and vegetables harvest pesticides were used, Today, the utilization of pesticides has increased significantly de tote growing population and therefore the demands ths population.

The high increase in community means more food must be produced and spreading of diseases more like. Pesticide use in commercial agriculture as led to a rise in fam prodtvity, s0 why the farmers use the pesticides. Several reports suggest that prime levels of pesticides in food can cause the expansion of diseases like cancer, kidney and lung ailments.

Children have developing organs, susceptible to catching infections. And diseases. The importance of food quality has become a significant issue thanks to the widespread use of pesticides. Once you consume a fruit, the pesticide residue goes into the body a they grind to a all and may cause you to sick. The consumers should get 10 understand whether the chosen fruits and vegetables are safe to consume,

To make sure the security of food for consumers and to guard consumer health, the monitoring of pesticide residues in food products must be pursued Hence, this problem can be technologically addressed through a IOT application Which determines the quality of fruit and vegetables. The chemical substances present in fruits and vegetables are determined using sensor enabled IoT technology. This will increase the digitalization process in India and world.

## OBJECTIVES:

* To reduce human effort in the agricultural field with the use of small machine.
* To perform all operations at single time, hence increases production and saves time.

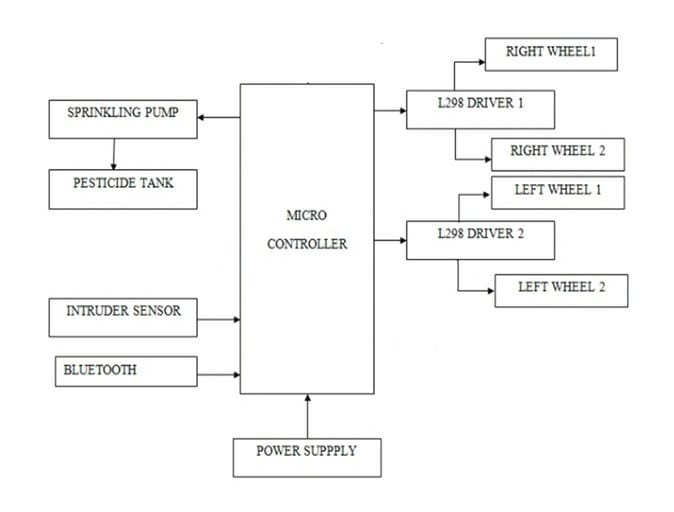
## 1.4 SCOPE OF THE PROJECT:

* It is used for applied liquid substances such as fertilizers and pesticides to plants during the crops growth cycle.
* The main scope spraying robot is to delivery an effective uniform dose of product to a target area in a safe and timely manner.

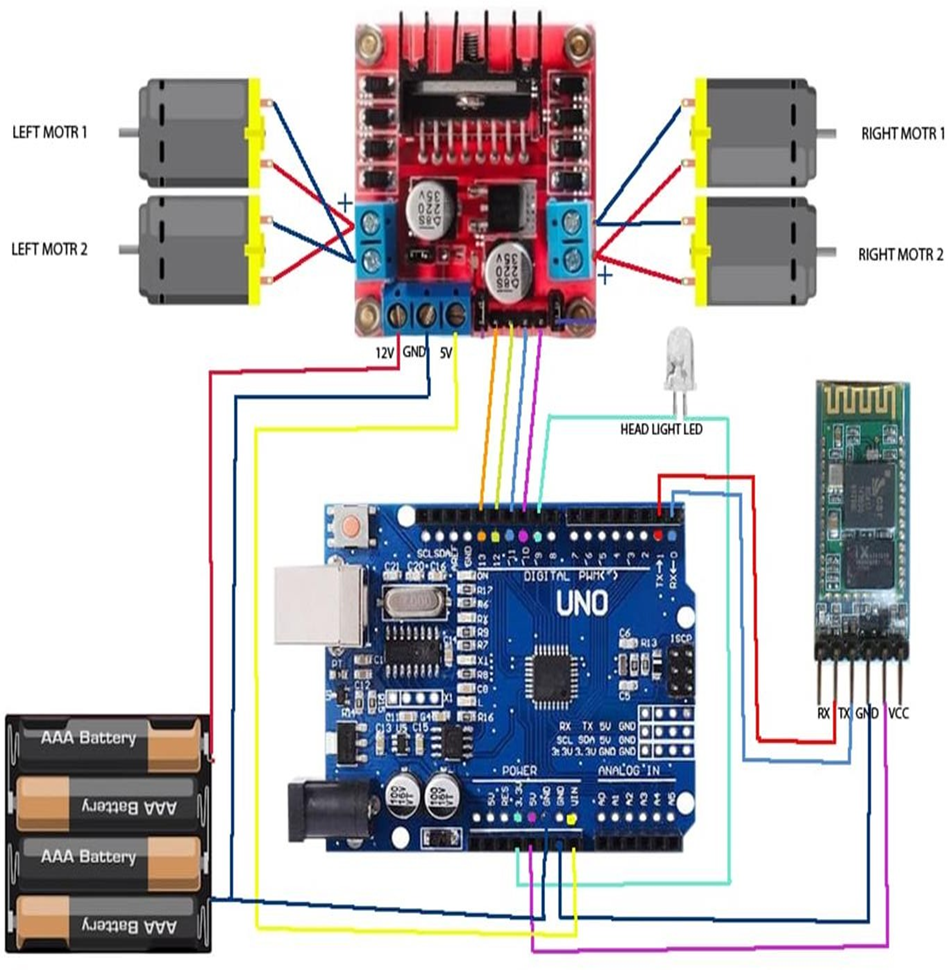
# CHAPTER-2

# METHODOLOGY

* The robot is made to travel in the farm and it is powered through batteries using a programming board and its direction controlled by Android application(blynk).
* The spraying of pesticides which can be done with the help of pesticide sprinkling pump and is periodically sprayed whenever the process is on the spraying angle is kept exactly at 180**֯**. And the length of the spraying mouth can be extended as much as we required.
* The system focused on the design, development and the fabrication of the agricultural robot with pesticide spraying system in addition to security system using IOT.
* The problems associated with the manual operated spraying machine are rectified and designed a new machine to overcome those problems.
* Selection of the motor is a major problem because it depends on the torque required and weight to be pulled, by using formals the motor has been selected. The battery selection also places an important role the required power is delivered to the system by the battery.
* The choice of materials for a vehicle is the first and most important factor for automotive design. In this we used Mild Steel bar alloy as a base material for chassis it will provide maximum strength and minimum deflection compared to other chassis material. Analyzed design of chassis is selected which has robust design and best suitable for agricultural works
* The selected Materials are fabricated by using permanent joints as well as temporary joints. All the components are fitted and connected as in electronic circuit.
* It is aimed more at an agricultural land by spraying long distance. The studies demonstrated that each stages have potential to be the most cost effective solution to perform well in agricultural land and there are two failure modes which the solar system may be experience. These two conditions which may require troubleshooting are Zero power output (no power), low voltage issue and solar panel defects.



**Fig 3.1 Block Diagram**



**Fig 3.2 Circuit Diagram**

### HARDWARE AND SOFTWARE REQUIREMENTS

#### **HARDWARE REQUIREMENTS**

PESTICIDE SPRINKLER WITH IOT BASED SECURITY is a project that requires both hardware and software so let’s see the hardware that this project needs The following hardware components are the requirements for making of the device. Each component and their description are given below:

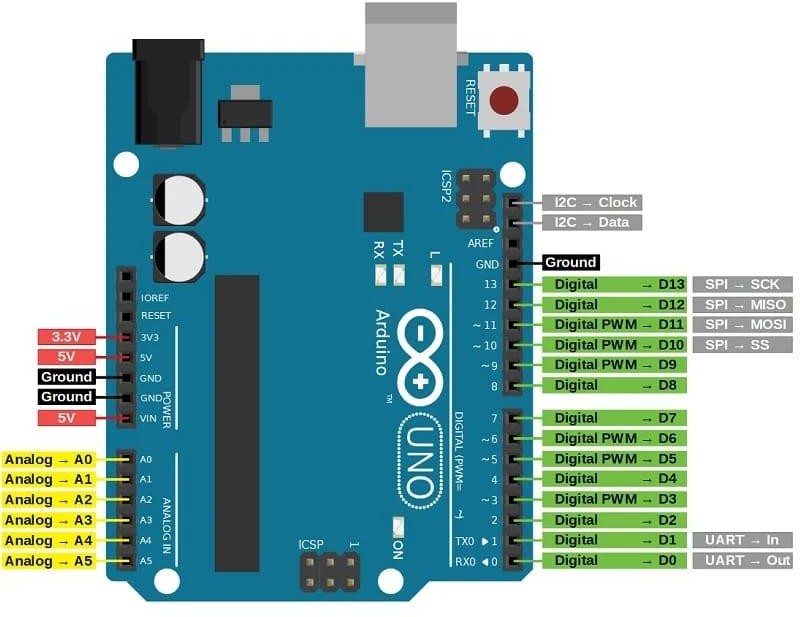
|  |  |  |  |
| --- | --- | --- | --- |
| **SL.NO** | **COMPONENT NAME** | **SPECIFICATION** | **NO. OF**  **COMPONENT** |
| 01 | Arduino Board | Atmega 2560 | 1 |
| 02 | PIR | Infrared sensor | 1 |
| 03 | CAR kit | --- | 1 |
| 04 | DC motor | ESP8266 | 1 |
| 05 | LN298N Motor drivers |  | 1 |
| 06 | FTDI Module | SPST reset switch | 1 |
| 07 | Jumpers | DS18B20 | 1 |

#### **Arduino Board:**

Arduino is a open-source hardware and software platform used to design and build electronic devices. The Arduino board consists of sets of analog and digital I/O (Input / Output) pins, which are further interfaced to bread board, expansion boards, and other circuits. Such boards feature the model, Universal Serial Bus (USB), and serial communication interfaces, which are used for loading programs from the computers.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.

It also provides an IDE (Integrated Development Environment) project, which is based on the Processing Language to upload the code to the physical board. The projects are authorized under the GPL and LGPL. The GPL is named as GNU (General Public License). The licensed LGPL is named as GNU (Lesser General Public License). It allows the use of Arduino boards, it's software distribution, and can be manufactured by anyone.



#### **Fig. Aurduino UNO**

**General Pin Functions**

* **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
* **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
* **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
* **3.3V**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
* **GND**: Ground pins.
* **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
* **Reset**: Typically used to add a reset button to shields that block the one on the board

#### **Special pin functions:**

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pin Mode(), digital Write(), and digital Read() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analog Reference() function.

**Serial** / [UART](https://en.wikipedia.org/wiki/UART): pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.

* **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
* [**PWM**](https://en.wikipedia.org/wiki/Pulse-width_modulation) (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analog Write () function.
* [**SPI**](https://en.wikipedia.org/wiki/Serial_Peripheral_Interface) (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
* **TWI** (two-wire interface) / [I²C](https://en.wikipedia.org/wiki/I%C2%B2C): pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.

**AREF** (analog reference): Reference voltage for the analog inputs.

#### **Specifications of Arduino:**

* + The operating voltage is 5V.
  + The recommended input voltage will range from 7v to 12V.
  + The input voltage ranges from 6v to 20V.
  + Digital input/output pins are 14.
  + Analog i/p pins are 6.
  + DC Current for each input/output pin is 40 mA.
  + DC Current for 3.3V Pin is 50 mA.
  + Flash Memory is 32 KB.

#### **CAR KIT**

This Three Wheel DIY Smart Robot Car Chassis Kit is the perfect mechanical platform for your robotics projects. All of the hardware and mechanical components needed to make your robot are included in this kit, including motors, wheels, chassis, nuts & bolts, and more. Simply connect your electronics (Arduino/Raspberry Pi and Motor Driver) and begin programming your robot. It has a big surface area with predrilled holes for installing sensors and electronics according to your needs. This robot chassis allows you to quickly prepare your mechanical platform. Instead of making your own chassis, you can focus your time and effort on programming your robot.

Wheeled Robots are the most common robots because they are simple to create, maintain, and operate. This kit is the simplest robot platform to construct and programme. Beginners and even experts can use this kit. This Two Wheel DIY Smart Robot Car Chassis Kit is less expensive, and it's easy to assemble, maintain, and programme. In comparison to the 3 wheeled Kit, our 4 wheeled Kit allows you to drive fast, carry more weight, and carry a larger load. This kit can be used to make line-following robots, obstacle-avoidance robots, maze solvers, Bluetooth controlled robots, fire fighting robot and other robots.



Fig. Car kit

#### **PIR SENSORS**

A passive infrared (PIR) sensor recognizes infrared light emitted from nearby objects. You may assume that ―passive‖ IR sensors mean these devices are less complicated than their active counterparts, but you’d be mistaken. A passive IR sensor’s functionality may be more difficult to understand.

PIR Sensor Functions

First, realize that everything — humans, animals, even inanimate objects — emit a certain amount of IR radiation. How much IR radiation they emit relates to the body or object’s warmth and material makeup. Humans can’t see IR, but we’ve designed electronic detection devices to pick up these signals. PIR sensors are used in thermal sensing applications, such as security and motion detection. They are commonly used in security alarms, motion detection alarms, and automatic lighting applications.

Passive infrared (PIR) sensors use a pair of pyroelectric sensors to detect heat energy in the surrounding environment. These two sensors sit beside each other, and when the signal differential between the two sensors changes (if a person enters the room, for example), the sensor will engage. That may mean it triggers an alarm, notifies authorities, or maybe turns on a floodlight. IR radiation focuses on each of the two pyroelectric sensors using a series of lenses constructed as the sensor’s housing. These lenses widen the device’s sensing area.



## Fig. PIR Sensor

#### **LN298 MOTOR DRIVER**

This is a high-power motor driver module for driving DC and stepper motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. It can control up to 4 DC motors, or 2 DC motors with directional and speed control. It is designed to provide bidirectional drive currents of up to 4A at voltages from 2.5 V to 46 V.

The L298N is an integrated monolithic circuit in a 15- lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver de-signed to accept standard TTL logic level sand drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the in-put signals .The emitters of the lower transistors of each bridge are connected together rand the corresponding external terminal can be used for the connection of an external sensing resistor. An additional Supply input is provided so that the logic works at a lower voltage.

#### **Features & Specifications**

Driver Model: L298N 2A

Driver Chip: Double H Bridge L298N Motor Supply Voltage (Maximum): 46V Motor Supply Current (Maximum): 2A Driver Voltage: 5-35V

Driver Current: 2A Maximum Power (W): 25W



# SOFTWARE REQUIREMENTS

#### **ARDUINO IDE**

Arduino is a type of computer software and hardware company that offers open-source environment for user project and user community that intends and fabricates microcontroller based inventions for construction digital devices and interactive objects that can sense and manage the physical world. For programming the microcontrollers, the Arduino proposal provides an software application or IDE based on the Processing project, which includes C, C++ and Java programming software. It also support for embedded C, C++ and Java programming software.



Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control the physical world. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated

development environment (IDE) based on the Processing project, which includes support for C, C++ and Java programming languages. An Arduino board consists of an Atmel 8, 16 or 32-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C serial bus so many shields can be stacked and used in parallel. Official Arduinos have used the mega AVR series of chips, specifically the ATmega8, ATmega168. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer. Currently, opti boot loader is the default boot loader installed on Arduino UNO.

**Blynk**

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. Blynk App: – It allows you to create amazing interfaces for your projects using various widgets which are provided.

Blynk Server:- It is responsible for all the communications between the smartphone and hardware.

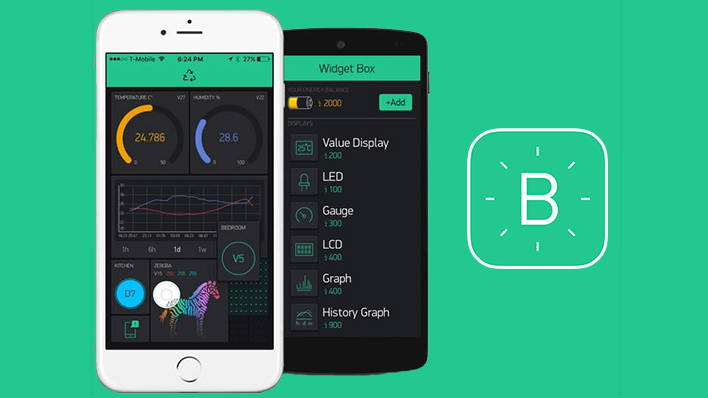
You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries:- It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands.

The process that occurs when someone presses the Button in the Blynk application is that the data will move to Blynk Cloud, where data magically finds its way to the hardware that has been installed. It works in the opposite direction and everything happens in a blink of an eye

The main focus of the Blynk platform is to make it super-easy to develop the mobile phone application. As you will see in this course, developing a mobile app that can talk to your Arduino is as easy as dragging a widget and configuring a pin. With Blynk, you can control an LED or a motor from your mobile phone with literally zero programming. This is actually the first experiment that I will demonstrate in this course.But don’t let this simplicity make you think that Blynk is only useful for trivial applications. Blynk is a robust and scalable tool that is used by hobbyists and the industry alike.

You can use it to monitor the soil humidity of your vegetable garden and turn on the water, or open up your garage door, with your phone. You can also use it to control smart furniture that can learn from your routines, or embed IoT and AI to traditional industrial products such as a boiler, or for improving the integrity and safety of oilfields. Blynk is free to use for personal use and prototyping. Their business model generates profits by selling subscriptions to businesses that want to publish Blynk-powered apps for their hardware products or services. Let’s take a closer look at each component of the Blynk Platform.



### Payload coding :

|  |  |  |  |
| --- | --- | --- | --- |
| #define ENA | 14 | // Enable/speed motors Right | GPIO14(D5) |
| #define ENB | 12 | // Enable/speed motors Left | GPIO12(D6) |
| #define IN\_1 | 15 | // L298N in1 motors Right | GPIO15(D8) |
| #define IN\_2 | 13 | // L298N in2 motors Right | GPIO13(D7) |
| #define IN\_3 | 2 | // L298N in3 motors Left | GPIO2(D4) |
| #define IN\_4 | 0 | // L298N in4 motors Left | GPIO0(D3) |

#include <ESP8266WiFi.h> #include <WiFiClient.h>

#include <ESP8266WebServer.h>

String command; //String to store app command state. int speedCar = 800; // 400 - 1023.

int speed\_Coeff = 3;

const char\* ssid = "NodeMCU Car"; ESP8266WebServer server(80); void setup() {

pinMode(ENA, OUTPUT); pinMode(ENB, OUTPUT); pinMode(IN\_1, OUTPUT); pinMode(IN\_2, OUTPUT); pinMode(IN\_3, OUTPUT); pinMode(IN\_4, OUTPUT); Serial.begin(115200);

// Connecting WiFi WiFi.mode(WIFI\_AP); WiFi.softAP(ssid);

IPAddress myIP = WiFi.softAPIP();

Serial.print("AP IP address: "); Serial.println(myIP);

// Starting WEB-server

server.on ( "/", HTTP\_handleRoot ); server.onNotFound ( HTTP\_handleRoot ); server.begin();

}

void goAhead(){ digitalWrite(IN\_1, LOW); digitalWrite(IN\_2, HIGH); analogWrite(ENA, speedCar); digitalWrite(IN\_3, LOW); digitalWrite(IN\_4, HIGH); analogWrite(ENB, speedCar);

}

void goBack(){ digitalWrite(IN\_1, HIGH); digitalWrite(IN\_2, LOW); analogWrite(ENA, speedCar); digitalWrite(IN\_3, HIGH); digitalWrite(IN\_4, LOW); analogWrite(ENB, speedCar);

}

void goRight(){ digitalWrite(IN\_1, HIGH); digitalWrite(IN\_2, LOW); analogWrite(ENA, speedCar);

digitalWrite(IN\_3, LOW); digitalWrite(IN\_4, HIGH); analogWrite(ENB, speedCar);

}

void goLeft(){ digitalWrite(IN\_1, LOW); digitalWrite(IN\_2, HIGH);

analogWrite(ENA, speedCar); digitalWrite(IN\_3, HIGH); digitalWrite(IN\_4, LOW); analogWrite(ENB, speedCar);

}

void goAheadRight(){ digitalWrite(IN\_1, LOW); digitalWrite(IN\_2, HIGH);

analogWrite(ENA, speedCar/speed\_Coeff); digitalWrite(IN\_3, LOW); digitalWrite(IN\_4, HIGH); analogWrite(ENB, speedCar);

}

void goAheadLeft(){ digitalWrite(IN\_1, LOW); digitalWrite(IN\_2, HIGH); analogWrite(ENA, speedCar); digitalWrite(IN\_3, LOW); digitalWrite(IN\_4, HIGH)

analogWrite(ENB, speedCar/speed\_Coeff);

}

void goBackRight(){ digitalWrite(IN\_1, HIGH); digitalWrite(IN\_2, LOW);

analogWrite(ENA, speedCar/speed\_Coeff); digitalWrite(IN\_3, HIGH); digitalWrite(IN\_4, LOW); analogWrite(ENB, speedCar);

}

void goBackLeft(){ digitalWrite(IN\_1, HIGH); digitalWrite(IN\_2, LOW); analogWrite(ENA, speedCar); digitalWrite(IN\_3, HIGH); digitalWrite(IN\_4, LOW);

analogWrite(ENB, speedCar/speed\_Coeff);

}

void stopRobot(){ digitalWrite(IN\_1, LOW); digitalWrite(IN\_2, LOW); analogWrite(ENA, speedCar); digitalWrite(IN\_3, LOW); digitalWrite(IN\_4, LOW); analogWrite(ENB, speedCar);

}

void loop() {

server.handleClient();

command = server.arg("State"); if (command == "F") goAhead();

else if (command == "B") goBack(); else if (command == "L") goLeft(); else if (command == "R") goRight();

else if (command == "I") goAheadRight(); else if (command == "G") goAheadLeft(); else if (command == "J") goBackRight(); else if (command == "H") goBackLeft(); else if (command == "0") speedCar = 400; else if (command == "1") speedCar = 470; else if (command == "2") speedCar = 540; else if (command == "3") speedCar = 610; else if (command == "4") speedCar = 680; else if (command == "5") speedCar = 750; else if (command == "6") speedCar = 820; else if (command == "7") speedCar = 890; else if (command == "8") speedCar = 960; else if (command == "9") speedCar = 1023; else if (command == "S") stopRobot();

}

### Camera coding:

#include "esp\_camera.h" #include <WiFi.h>

//

// WARNING!!! PSRAM IC required for UXGA resolution and high JPEG quality

// Ensure ESP32 Wrover Module or other board with PSRAM is selected

// Partial images will be transmitted if image exceeds buffer size

//

// Select camera model

//#define CAMERA\_MODEL\_WROVER\_KIT // Has PSRAM

//#define CAMERA\_MODEL\_M5STACK\_PSRAM // Has PSRAM//#define CAMERA\_MODEL\_ESP\_EYE // Has PSRAM

//#define CAMERA\_MODEL\_M5STACK\_V2\_PSRAM // M5Camera version B Has PSRAM

//#define CAMERA\_MODEL\_M5STACK\_WIDE // Has PSRAM

//#define CAMERA\_MODEL\_M5STACK\_ESP32CAM // No PSRAM

#define CAMERA\_MODEL\_AI\_THINKER // Has PSRAM

//#define CAMERA\_MODEL\_TTGO\_T\_JOURNAL // No PSRAM #include "camera\_pins.h"

const char\* ssid = "POCO";

const char\* password = "wwwwwwww"; void startCameraServer();

void setup() { Serial.begin(115200); Serial.setDebugOutput(true); Serial.println(); camera\_config\_t config;

config.ledc\_channel = LEDC\_CHANNEL\_0;

config.ledc\_timer = LEDC\_TIMER\_0; config.pin\_d0 = Y2\_GPIO\_NUM; config.pin\_d1 = Y3\_GPIO\_NUM; config.pin\_d2 = Y4\_GPIO\_NUM; config.pin\_d3 = Y5\_GPIO\_NUM; config.pin\_d4 = Y6\_GPIO\_NUM; config.pin\_d5 = Y7\_GPIO\_NUM; config.pin\_d6 = Y8\_GPIO\_NUM; config.pin\_d7 = Y9\_GPIO\_NUM; config.pin\_xclk = XCLK\_GPIO\_NUM; config.pin\_pclk = PCLK\_GPIO\_NUM; config.pin\_vsync = VSYNC\_GPIO\_NUM; config.pin\_href = HREF\_GPIO\_NUM; config.pin\_sscb\_sda = SIOD\_GPIO\_NUM; config.pin\_sscb\_scl = SIOC\_GPIO\_NUM; config.pin\_pwdn = PWDN\_GPIO\_NUM; config.pin\_reset = RESET\_GPIO\_NUM; config.xclk\_freq\_hz = 20000000; config.pixel\_format = PIXFORMAT\_JPEG;

// if PSRAM IC present, init with UXGA resolution and higher JPEG quality

// for larger pre-allocated frame buffer. if(psramFound()){

config.frame\_size = FRAMESIZE\_UXGA; config.jpeg\_quality = 10;

config.fb\_count = 2;

} else {

config.frame\_size = FRAMESIZE\_SVGA;

config.jpeg\_quality = 12;

config.fb\_count = 1;

}

#if defined(CAMERA\_MODEL\_ESP\_EYE) pinMode(13, INPUT\_PULLUP); pinMode(14, INPUT\_PULLUP);

#endif

// camera init

esp\_err\_t err = esp\_camera\_init(&config); if (err != ESP\_OK) {

Serial.printf("Camera init failed with error 0x%x", err); return;

}

sensor\_t \* s = esp\_camera\_sensor\_get();

// initial sensors are flipped vertically and colors are a bit saturated if (s->id.PID == OV3660\_PID) {

s->set\_vflip(s, 1); // flip it back

s->set\_brightness(s, 1); // up the brightness just a bit s->set\_saturation(s, -2); // lower the saturation

}

// drop down frame size for higher initial frame rate s->set\_framesize(s, FRAMESIZE\_QVGA);

#ifdefined(CAMERA\_MODEL\_M5STACK\_WIDE) || defined(CAMERA\_MODEL\_M5STACK\_ESP32CAM)

s->set\_vflip(s, 1);

s->set\_hmirror(s, 1); #endif

WiFi.begin(ssid, password);

while (WiFi.status() != WL\_CONNECTED) { delay(500);

Serial.print(".");

}

Serial.println(""); Serial.println("WiFi connected"); startCameraServer();

Serial.print("Camera Ready! Use 'http://"); Serial.print(WiFi.localIP()); Serial.println("' to connect");

}

void loop() {

// put your main code here, to run repeatedly: delay(10000);

}

availability of charging infrastructure. While there are now thousands of public charging stations across the United States, many areas still have limited charging options, which can make it difficult for EV owners to charge their vehicles when they are away from home.

Despite these challenges, the market for EVs is growing rapidly, driven by advances in technology, government incentives, and changing consumer preferences. As more people recognize the environmental and economic benefits of EVs, demand for these vehicles is likely to continue to grow, which will help to drive further innovation and investment in this important sector.

## History and Evolution of Electric Vehicles

Electric vehicles have a long and storied history that dates back to the early days of the automobile industry. In fact, the first cars were electric, rather than gasoline-powered. The first electric car was built in 1837 by Scottish inventor Robert Anderson, who used non- rechargeable batteries to power a small electric motor. However, it wasn't until the late 1800s and early 1900s that electric cars became more widely available, thanks to advancements in battery technology and the development of electric starter motors, which made it easier to start gasoline engines.

During the early years of the automobile industry, electric cars were a popular choice for urban transportation, especially among women, who preferred their quiet, clean operation and ease of use. However, the rise of gasoline-powered cars, which were cheaper and had longer ranges, eventually led to the decline of electric cars, which were seen as impractical and expensive.In the 1960s and 1970s, interest in electric vehicles began to grow again, as concerns about air pollution and energy independence led to renewed interest in alternative forms of transportation. This led to the development of several experimental electric vehicles, including the Henney Kilowatt and the Lunar Rover, which was powered by an electric motor and solar panels.During the 1990s, several major automakers began to develop electric vehicles for commercial use.

## BLOCK DIAGRAM :

Control signals



Battery

Controller

Motor

Wheels

Charger

## WORKING:

**Fig.3.1Block Diagram**

Most electric motorcycles and scooters today are powered by rechargeable lithium ion bateries, though some early models used nickel-metal hydride batteries. All electric scooters and motorcycles provide for recharging by plugging into ordinary wall outlets, usually taking about eight hours to recharge (i.e. overnight). The electricity is stored on board in a rechargeable battery, which drives one or more electric motors. Electric scooters (as distinct from motorcycles) have a step-through frame. The battery pack, which provides a source of electrical power. The most commonly available and affordable batteries are lead-acid flooded type. Next are the AGM (Absorption Glass Mat) sealed maintenance free batteries, a little more powerful and expensive. Then there are the more exotic batteries like Ni-MH and Li-ion; more difficult to find but light and longer lasting, maintenance free, and much more expensive. The new lithium batteries are showing some promise for EVs in the near future .

The charger which restores energy to the batteries (which may be mounted within the vehicle or at a special charging station at some fixed location).

The power controller, which regulates the flow of energy between the battery and the electric motor(s), controlled by an electronic throttle.One or more electric motors are present and their mechanical attachment to the driveline.

Power conductors connecting the battery, controller, and motor(s) along with the accessory aquipment to power auxiliary equipment such as power brakes and heating system. Control circuitry and equipment to allow control and interlocking of the various components and instrumentation specific to the operation and maintenance of the conversion of the system.



**Fig.3.2 Electric Vehicle**

## Breaking system :

The braking system in an electric vehicle (EV) works differently than in a traditional gasoline-powered vehicle. While the basic function of slowing down or stopping the vehicle is the same, the way it is achieved is different.In an EV, there are two types of braking systems: regenerative braking and mechanical braking.

### Regenerative Braking:

Regenerative braking is the primary method of braking in an EV. It works by using the electric motor to slow down the vehicle and convert the kinetic energy of the moving vehicle into electrical energy, which is then stored in the battery. This is accomplished by reversing the electric motor, turning it into a generator that produces electrical energy. The energy generated from the slowing vehicle is then fed back into the battery, increasing the vehicle's overall range.

Regenerative braking is more efficient than traditional mechanical braking since it recovers energy that would otherwise be lost during the braking process. However, it is not as effective at high speeds or when the battery is fully charged.

### Mechanical Braking:

Mechanical braking is used when regenerative braking alone is not sufficient to slow down or stop the vehicle. This can happen at higher speeds, during emergency braking situations, or when the battery is fully charged.Mechanical braking works in the same way as in traditional gasoline-powered vehicles. When the driver presses the brake pedal, a hydraulic system applies pressure to the brake pads, which then press against the rotors or drums attached to the wheels, slowing down or stopping the vehicle.In some EVs, the driver can choose between regenerative braking or mechanical braking by selecting different modes or settings. This allows the driver to tailor the braking performance to their driving preferences and the driving conditions.

Despite the many benefits of electric vehicles (EVs), there are still some drawbacks that may make them less suitable for certain drivers or situations. Here are some of the main drawbacks of EVs:

* Limited Range: EVs typically have a limited driving range compared to gasoline- powered vehicles, which can cause drivers to worry about running out of battery power while on the road. While the range is improving with advances in battery technology, long-distance travel may still require more planning and longer charging times.
* Charging Time: While home charging is convenient, public charging stations can take longer to charge the battery than it would take to refuel a gasoline vehicle. This can be a challenge for drivers who need to quickly recharge their vehicle.
* Higher Upfront Cost: EVs are often more expensive to purchase than gasoline vehicles due to the cost of batteries and other electric components. However, this cost is offset by lower operating costs over the lifetime of the vehicle.
* Limited Availability of Charging Infrastructure: While the availability of charging infrastructure is improving, it is not yet as widespread as gasoline refueling stations. This can be a concern for drivers who need to travel longer distances or who live in areas with limited charging options.
* Potential for Range Anxiety: Drivers of EVs may experience "range anxiety," or the fear of running out of battery power before reaching a charging station. This can cause stress and may limit the usefulness of an EV for certain drivers.

## Performance of electric vehicle:

The performance of an electric vehicle (EV) can be enhanced in several ways. Here are some common ways to improve the performance of an electric vehicle:

**Battery technology:** One of the most important factors that affect the performance of an electric vehicle is the battery technology. The range of the vehicle and the time it takes to charge depend on the battery technology. Improving the energy density of the batteries and reducing the charging time can significantly enhance the performance of an electric vehicle.

**Motor and power electronics:** The motor and power electronics play a crucial role in the performance of an electric vehicle. Upgrading the motor and power electronics can improve the acceleration, top speed, and overall performance of the vehicle.

Lightweight materials: The weight of the vehicle affects its efficiency and performance. Using lightweight materials such as carbon fiber and aluminum can reduce the weight of the vehicle and improve its performance.

**Aerodynamics:** The aerodynamics of the vehicle can affect its range and efficiency. Designing the vehicle to be more aerodynamic can reduce wind resistance and improve its performance.

**Regenerative braking:** Regenerative braking can capture the kinetic energy of the vehicle during braking and convert it into electrical energy to recharge the batteries. This can improve the range and efficiency of the vehicle.

Overall, improving the battery technology, motor and power electronics, using lightweight materials, designing the vehicle for better aerodynamics, and implementing regenerative braking can all contribute to enhancing the performance of an electric vehicle.

## User experience of electric vehicle

Electric vehicles (EVs) have become increasingly popular in recent years due to their many benefits, including lower emissions, lower operating costs, and a quieter ride. Here are some common user experiences associated with owning and operating an EV:

**Quiet Ride:** One of the most noticeable differences between an electric vehicle and a traditional gasoline-powered vehicle is the quiet ride. EVs produce little to no engine noise, providing a peaceful driving experience.

**Instant Torque:** EVs have instant torque, meaning that they can accelerate quickly and smoothly, providing a fun and exciting driving experience.

**Range Anxiety:** One of the biggest concerns for EV drivers is range anxiety, or the fear of running out of battery power while driving. While the range of EVs has increased significantly in recent years, it is important for drivers to plan their routes and charging stops accordingly.

**Charging:** EV owners will need to have access to charging infrastructure, either at home or at public charging stations. Depending on the type of charger used, charging times can range from a few hours to several hours.

**Cost Savings:** EV owners can save money on fuel costs, as electricity is often cheaper than gasoline. Additionally, EVs require less maintenance than traditional cars, leading to potential long-term cost savings.

**Environmental Benefits:** EVs produce fewer emissions than gasoline-powered vehicles, which can lead to a cleaner environment and reduced carbon footprint.Overall, the user experience of an electric vehicle can be very positive, but it is important to understand the unique aspects of owning and operating an EV, such as range anxiety and charging requirements. As the infrastructure for charging stations continues to expand and battery technology improves, the benefits of owning an electric vehicle will likely only continue to grow.

## Hardware Components :

* **Electrical Motor** Brushless DC electric motor (BLDC motors, BL motors) also known as electronically commutated motors (ECMs, EC motors) are synchronous motors powered by DC elicity via an inverter/switching power supply which produces an AC/bidirectional electric emFent to drive each phase of the motor via a clos ed loop controller. The controller times mutation (hence rpm) and creates current waveforms(hence torque). This context alternating current does not imply but does include a sinusoidal waveform, with nimal restriction on waveform; it must be periodic, and its frequency will determine motor and the waveform does affect how smooth the generated torque is as well as the motors efficiency at transforming electrical to mechanical energy. In a well-designed PMSM the air pp magnetic flux is spatial sinusoidal and the phase commutation currents are sinusoidal, ery degree out of phase.The motor structural

elements of a brushless motor system is typically permanent magnet synchronous motor, but can also be a switched reluctance motor, or induction motor.



Specifications :

**Fig. 3.3 Motor**

|  |  |
| --- | --- |
| Motor type | Brush non gear hub motor |
| Wattage | 301-400W |
| Design | Brushless |
| Voltage | 48V |

## Battery:



**Fig. 3.4 Lead Acid Battery**

The lead-acid battery was invented in 1859 by French physicist Gaston Planté and is the oldest ope of rechargeable battery. Despite having a very low energy-to-weight ratio and a low agy to volume ratio, its ability to supply high surge currents means that the cells have a elatively large power-to-weight ratio. These features, along with their low cost, makes it active for use in motor vehicles to provide the high current required by automobile starter motor.They are inexpensive compared to newer technologies, lead-acid batteries are widely used when

surge current is not important and other designs could provide higher energy ities. Large-format lead-acid designs are widely used for storage in backup power supplies el phone towers, high- availability settings like hospitals, and stand-alone power systems. For these roles, modified versions of the standard cell may be used to improve storage times redoce maintenance requirements. Gel-cells and absorbed glass-ma: batteries are common these roles, collectively known as VRLA (valve-regulated lead-acid) batteries.

Specifications:

|  |  |
| --- | --- |
| Product type | Lead acid battery |
| Nominal voltage | 12V |
| Length | 151mm |
| Width | 65mm |
| Height | 93mm |
| Capacity | 7.2AH |
| Maximum current | 2,1A |

## Electric bike throttle:



**Fig.3.5 Throttle**

Electric bike throttle operates in a very similar way many motorcycles (or scooters) operate. As soon as you engage the throttle button, the motor is powered on and it propels your eBike forward.Most electric bike throttles can be adjusted to different power outputs, allowing riders to choose how much power exactly do they need.This is also very useful at saving the battery and prolonging the range. However, when you're battling the hills, full power is often the best throttle mode to use.While some throttles offer a level-type mode to choose the power

output, others work in a pressure-sensitive mode. This means, the further you press the button, the more power you will receive on your eBike wheels.When you aren't using an eBike - the motor stays in the "idle" mode until you are ready to take advantage of its features.This also helps save the battery and ensure that the motor doesn't run at all times - which would relatively lessen the range of each

## Controller:

A controller is used to connect all electrical components of an e-bike together. Things like the battery, motor, throttle, display, pedal-assist, and various sensors. The controller basically acts as the "heart" for the e-bike.It takes energy from the battery and directs it to the motor.

By twisting the throttle, the user can regulate the power that is being sent to the controller, this, in turn, controls the speed of the e-bike.As a rule, all controllers have a sealed protective box, as they are placed open on a bicycle, however, some controllers are mounted inside of the frame and hidden away.

1. GREAT HEAT DISSIPATION: The 24v brushless motor controller shell is made of aluminium alloy with groove design, which can protect the inner circuit due to good heat dissipation feature to avoid thermal overloading.
2. SENSITIVE SPEED CONTROL: This Ebike Controller is a brushless motor controller, it can provide steady speed and sensitive control of braking and direction changes.
3. DURABLE TO USE: The wires and interfaces are durable, and ensure low malfunction of long time use.
4. EASY INSTALLATION: The interfaces have instruction labels on them for your easy installation. Suitable for electric bicycles, scooter, etc.



**Fig.3.6 Controller**

Specifications: 48V,1000W

## Charger:

The charger for an electric two-wheeler is a device that is used to charge the battery of the vehicle. The charger is typically a rectangular or box-shaped device that plugs into a standard electrical outlet.The charger is connected to the battery of the two-wheeler via a cable with a connector at the end that fits into a charging port on the vehicle. The charging port is usually located near the battery on the vehicle and is designed to fit the specific type of connector on the charger.The charger converts the AC (alternating current) electricity from the outlet to DC (direct current) electricity that can be stored in the battery of the two-wheeler. The charger also regulates the amount of electricity that is sent to the battery, ensuring that it is charged safely and efficiently.



**Fig.3.7 Charger**

Specifications :48V-20h

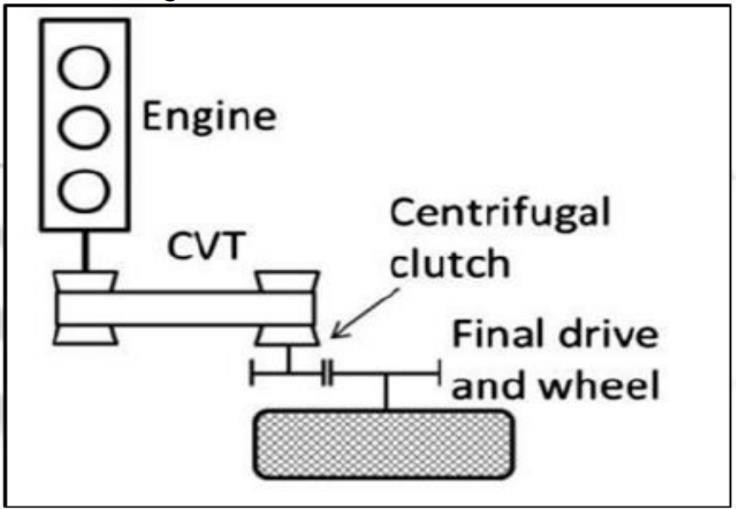
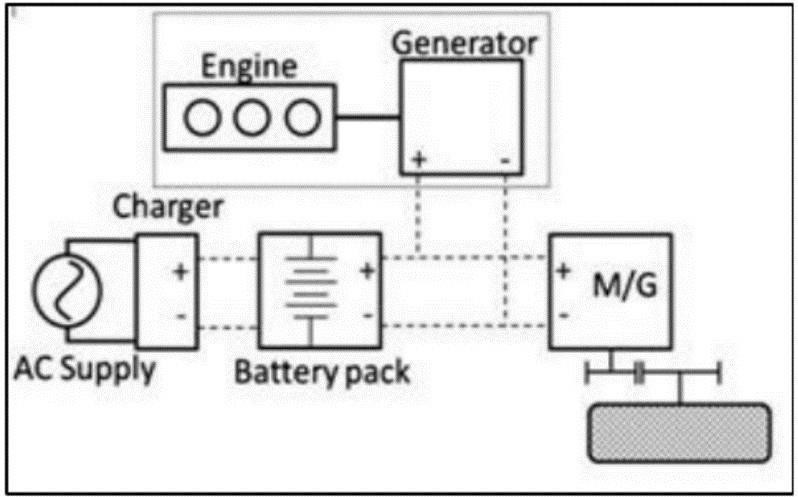
# CHAPTER - 4 HYBRID VEHICLE

A hybrid electric vehicle (HEV) is a type of vehicle that combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system. The electric system in an HEV is used to supplement the power generated by the ICE, improving fuel efficiency and reducing emissions’ use a variety of techniques to optimize fuel economy and minimize emissions. For example, the electric motor can provide additional torque to assist the ICE during acceleration, and can also act as a generator to recharge the battery during deceleration or braking. The ICE can also be turned off when the vehicle is stopped, and the electric motor used to power the vehicle in slow-moving traffic. HEVs come in several configurations, with the most common being the parallel hybrid, which uses both the ICE and electric motor to drive the wheels, and the series hybrid, which uses the ICE to generate electricity that powers the electric motor. There are also plug-in hybrid electric vehicles (PHEVs), which can be charged from an external power source and have a larger battery that allows them to operate in electric-only mode for a limited distance. Overall, HEVs are a popular choice for environmentally conscious consumers who want to reduce their fuel consumption and carbon footprint without sacrificing the convenience and performance of a conventional vehicle.

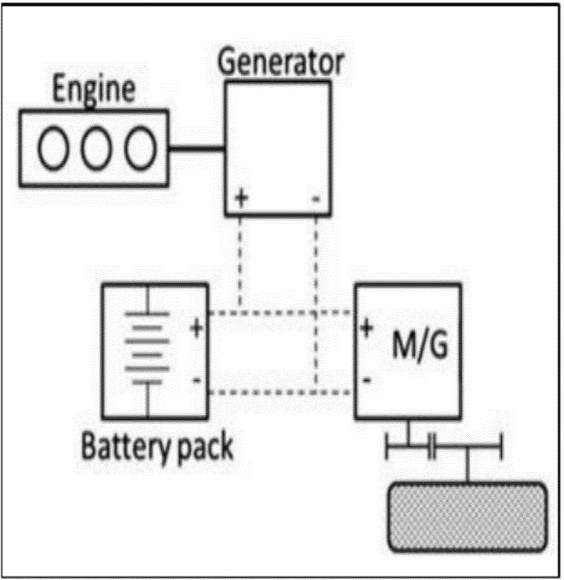
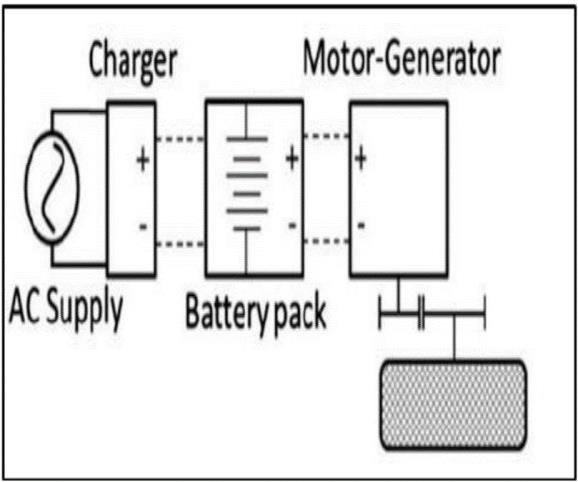
## Hybrid Electric Vehicles History

The competition between vehicles powered by electric and those powered by an internal combustion engine (ICE) is not a new scenario; this antagonism dates back to as early as the beginning of the 19th century. Between 1890 and 1905 ICEs, electric vehic1es (EV s), and steam powered cars 5 were all marketed in the United Kingdom and United States. EV s were the market leader in the United States at this time; mainly due to the works of electricity pioneers such as Edison and Tesla. The limiting range of EVs was not a big problem as the roads linking the cities were not particularly adequate forvehic1e transportation. It was evident that the use of batteries in automobiles was going to pose limitations in range and utility of EV s. Due to the energy advantages of petrol powered vehic1es over battery operation, petrol became the dominate energy source over the next 100 years, and is still leading the way today. At the time many automotive companies designed direct ICE vehic1es, but some tried to combine the advantages of the electric vehic1e with those of an ICE vehic1e by creating a hybrid of the two.

The first ever REV was built in 1898, and there were several automotive companies who were selling REV s in the early 1900s. The production of HEV s did not last the course of time due to significant problems with them. Henry For initiated the mass production of combustion enginevehic1es; making them widely available and affordable within the $455 to $911 price range (H» 375€ to 750€ with prices taken from the current American dollar to Euro conversion rate). In contrast, the price of the less efficient EV s continued to rise. During 1912, an electric roadster sold for $1,732 (1 ,425€ ), whilst gasoline car sold for $547 (450€ ) as illustrated by About Inventors. Another problem was the requirement for a smooth coordination between the engine and the motor, which was not possible due to the use of only mechanical controls. Since these early attempts, there has been a rise in the concern for global warming, a continual rise in fuel prices, and the threat of oil reserves dry in gup altogether. This handled to interest in more efficient and environrnentally means of transport again, particularly in the area of HEV. With advances in battery technologies and onboard computer systems, the option of a plausible HEV has become reality, and a number of models from the likes of Honda (Civic and Insight) and Toyota (Prius) have been available now since 2000. There have been a number of prospective designs and REV shave been growing ever since the inclusion of them onto the world market in 2000.



**Fig: 4.1 Series Plug In Hybrid Electric Vehicle Fig: 4.2 Conventional Vehicle**

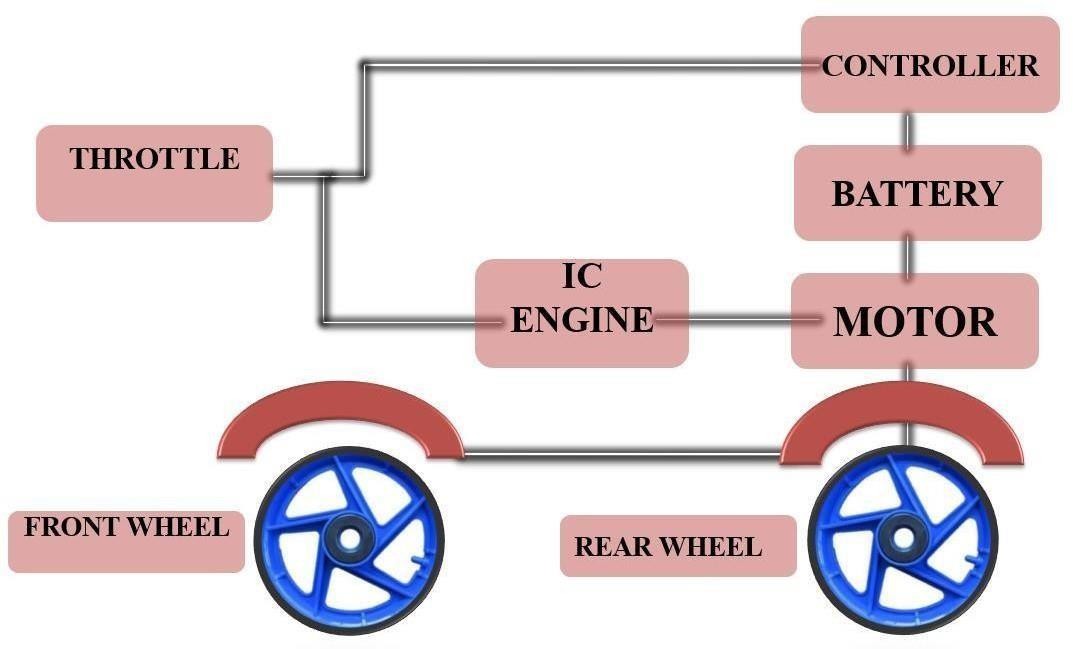
 

**Fig: 4.3 Series Hybrid Electric Vehicle Fig: 4.4 Pure Electric Vehicle**

A hybrid-electric-vehicle is an automobile which relies not only on gasoline but also on electric power source. In HEV, the battery supplies power during slow-speed conditions. While on highways or gradient scale, the IC engine drives he vehicle alone. Hybrid electric vehicles consists of an electric hub-motor, inverter, battery as electric drive source and an IC engine with transmission connected as latter drive. It is to achieve better fuel efficiency and reduce toxic emissions. It has great advantages over the previous used IC engine that is driven only from gasoline. This hybrid combination makes the vehicle dynamic in nature and provides its owner a better fuel economy and lesser environmental impact over conventional automobiles. The basic design consists of a dc power source battery. The battery is connected to inverter that is fed to a BLDC motor that works on AC. The motor is attached to the front wheel of the two wheeler vehicle. As the motor rotates the connected wheel also rotates, thus, leading to whole vehicle motion. At slow speeds this driving-mode is selected. The next part comprises of an IC engine. This is connected to the transmission and thus, the vehicle moves. A conventional gasoline powered two wheeler is modified with attachable hybrid electric kit. In which, a BLDC hub-motor is fixed at the front wheel of the vehicle. Along with the rear wheel of the vehicle is powered by the IC engine which is available as the stock custom. Four lead-acid batteries are connected in series connection in order to sum up the total voltage output to the requirement of the electric motor. Batteries are connected to the motor by which the power will be transferred via a controller which receive the varying volt from 1-4 V from the throttle which is placed on the left handlebar of the vehicle. The apparent in the right handle bar. The throttle placed on the left handle bar is actually a thumb throttle used to increase or decrease t he voltage supply to the electric hub-motor in turn increasing or decreasing the vehicle speed

respectively. Charging of those batteries can be done via the direct plug-in option or the regenerative braking way. Regenerative braking is possible when the vehicle is only running on the IC engine and the electric motor is rotating idling. Regenerative braking charges the batteries when the magnetic flux is produced in the motor during the vehicle running on IC engine.

## BLOCK DIAGRAM



**Fig: 4.5 Block Diagram Of Hybrid Vehicle**

## METHODOLOGY

The motor is attached to the rear wheel of the two-wheeler vehicle. Now the vehicle rim starts to spin over the axis body for rotation of wheel. As the motor rotates the attached wheel rotates too, leading to vehicle motion. In petrol mode engine will supply the power to the rear wheel and it energize the ignition coil and operate the motor. The rider can control the speed by means of accelerator handle. In this mode BLDC motor will be in ideal position. This mode can be activatedwhen we require high power.

## WORKING PRINCIPLE

Fully electric mode: Batteries in this mode feed the electric motor through the power electronics (inverter) which controls the electric current and turn direct current into an alternative current. The motor is completely detached from the ICE when it is electrically driven. The power produced by motor is finally transmitted by a transmission system to the wheels. The latter mechanism is quite similar to that of the conventional cars, except that the transmission ratio remains constant. This is rooted in the fact that electric vehicles do not require multi-speed transmission, because the electric motor produces a consistent amount of torque at any given RPM while the internal combustion engine requires multiple gears with definite ratios for power output. It is noteworthy that ICEs only generate efficient power at certain RPM ranges. However, EV manufacturers calculate gear ratios to maximize effectively for the electric motor without having to switch through gears. There is resistance between the electrons of the atoms moving in the wires between the e1ectric motor and the battery, and through the electric motor itself.

Produced magnetic fields incur friction in the metal laminations making up the magnetic circuit with the electric motor. There is mechanical friction between every mechanical moving part of the system, including, chains and bearings. As mentioned previously the by-product of friction is heat, and the higher the frictional force the greater the resultant heat. The consequence of the sum of the frictional losses, determines the overall efficiency of the vehicle. The efficiency of HEVs is greater than that of conventional vehicles in the respect that REV scan reclaim energy which would once have been lost through regenerative braking. The inertia of the vehic1e is the fundamental factor in being able to reclaim the energy back in to the batteries. Instead of using the full potential of the brakes of the vehicle, REVs allows the linkages back to the electric motor such as the drive shafts, and chain transfer the torque from the wheels back to the electric motor shaft. Electric motors can transfer electrical energy into mechanical energy and back again, and in both cases can be achieved very efficiently. The way in which electricity is reproduced is through the magnets on the shaft of the motor moving past the electric coils of the stator in the motor, passing the magnetic fields of the magnets through the coils. Electrical energy is then fed back into the battery, in tum charging up the hybrid battery pack. There are two forms of regenerative braking which are parallel regenerative breaking and series regenerative breaking; this is not related to parallel and series configured REV. The forms are dependent on how many wheels are being used to reclaim the energy. The most common approach in vehicles is that the back wheels are the only wheels reclaiming energy. Energy is still lost in this case through the front whee1s as before through minor

heat dissipation, unless they are somehow connected back to the electric motor. The other key determinant factor is the battery state-of-charge (SOC) and how hard the energy is being driven back into the battery.

## HARDWARE COMPONENTS

* + 1. BLDC Motor
    2. Motor controller
    3. Batteries
    4. IC Engine
    5. Electric charging cable

## BLDC motor

Brushless DC electric motor (BLDC motors, BL motors) also known as electronically commutated motors (ECMs, EC motors) are [synchronous motors](https://en.wikipedia.org/wiki/Synchronous_motor) powered by [DC electricity](https://en.wikipedia.org/wiki/Direct_current) via an [inverter/](https://en.wikipedia.org/wiki/Inverter_(electrical))switching power supply which produces an [AC/](https://en.wikipedia.org/wiki/Alternating_current)bi-directional electric current to drive each phase of the motor via a closed loop controller. The controller times commutation (hence rpm) and creates current waveforms (hence torque).

In this context alternating current does not imply but does include a [sinusoidal waveform,](https://en.wikipedia.org/wiki/Sinusoid) with minimal restriction on waveform; it must be periodic, and its frequency will determine motor rpm, and the waveform does affect how smooth the generated torque is as well as the motors efficiencyat transforming electrical to mechanical energy. In a well-designed PMSM the air gap magnetic flux is spatial sinusoidal and the phase commutation currents are sinusoidal, ninety degrees out ofphase.

The motor structural elements of a brushless motor system is typically [permanent magnet](https://en.wikipedia.org/wiki/Permanent_magnet_synchronous_motor) [synchronous motor,](https://en.wikipedia.org/wiki/Permanent_magnet_synchronous_motor) but can also be a [switched reluctance motor,](https://en.wikipedia.org/wiki/Switched_reluctance_motor) or [induction motor.](https://en.wikipedia.org/wiki/Induction_motor) Brushless motors may be implemented as [stepper motors](https://en.wikipedia.org/wiki/Stepper_motors) as well; however, the term "stepper motor" tends to be used for motors with a radically different design and controlled with an open loop (hence the controller cannot detect when the stepper does not step due to too high shaft load; there is no shaft position sensor).



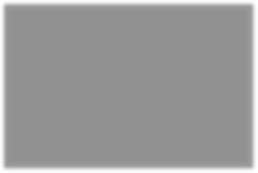
**Fig: 4.6 250W BLDC Motor**

They are frequently stopped with the rotor in a defined angular position while still producing torque. A well design power supply/controller/PMSM can also be held at zero rpm and finite torque. Two key performance parameters of brushless DC motors are the [motor constants](https://en.wikipedia.org/wiki/Motor_constants) Kt (torque constant) and Ke (BEMF constant also known as speed constant Kv = 1/Ke

The SI units Kt and Ke are the same.

## Motor controller

A motor controller is a device or group of devices that serves to govern in some predetermined manner the performance of an [electric motor.](https://en.wikipedia.org/wiki/Electric_motor) A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and [faults .](https://en.wikipedia.org/wiki/Fault_(power_engineering))



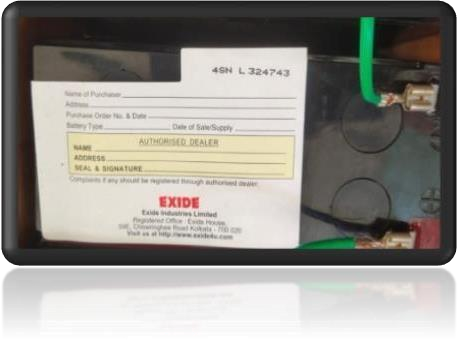
**Fig: 4.7 Motor Controller**

Motor controllers can be manually, remotely or automatically operated. They may include only the means for starting and stopping the motor or they may include other functions. An electric motor controller can be classified by the type of motor it is to drive such as [permanent magnet,](https://en.wikipedia.org/wiki/Permanent_magnet) [servo,](https://en.wikipedia.org/wiki/Servomechanism) series, separately excited, and [alternating](https://en.wikipedia.org/wiki/Alternating_current) [current.](https://en.wikipedia.org/wiki/Alternating_current) A motor controller is connected to a power source such as a battery pack or power supply, and control circuitry in the form of analog or digital input signals.

## Batteries

The lead-acid battery was invented in 1859 by French physicist [Gaston Plante](https://en.wikipedia.org/wiki/Gaston_Plant%C3%A9) and is the oldest type of [rechargeable battery.](https://en.wikipedia.org/wiki/Rechargeable_battery) Despite having a very low energy-to weight ratio and a low energy to volume ratio, its ability to supply high [surge currents](https://en.wikipedia.org/wiki/Surge_current) means that the cells have a relatively large [power-to-weight ratio.](https://en.wikipedia.org/wiki/Power-to-weight_ratio) These features, along with their low cost, makes it attractive for use in motor vehicles to provide the high current required by [automobile starter motors.](https://en.wikipedia.org/wiki/Automobile_self_starter)

As they are inexpensive compared to newer technologies, lead-acid batteries are widely used even when surge current is not important and other designs could provide higher [energy densities.](https://en.wikipedia.org/wiki/Energy_density)



**Fig: 4.8 Batteries of 12V 22Ah**

Large-format lead-acid designs are widely used for storage in backup power supplies in [cell phone](https://en.wikipedia.org/wiki/Cell_phone) towers, high-availability settings like hospitals, and [standalone](https://en.wikipedia.org/wiki/Stand-alone_power_system) [power systems.](https://en.wikipedia.org/wiki/Stand-alone_power_system) For these roles, modified versions of the standard cell may be used to improve storage times and reduce maintenance requirements. Geocells and [absorbed](https://en.wikipedia.org/wiki/Absorbed_glass-mat) [glass-mat](https://en.wikipedia.org/wiki/Absorbed_glass-mat) batteries are common in these roles, collectively known as [VRLA (valve-](https://en.wikipedia.org/wiki/VRLA_battery) [regulated lead-acid) batteries.](https://en.wikipedia.org/wiki/VRLA_battery)

|  |  |
| --- | --- |
| **Product Group** | **Lead acid battery** |
| Manufacturer | B . B . Battery |
| Manufacturer number | BP7.2-12 |
| Nominal voltage | 12V |
| Length | 151mm |
| Width | 65mm |
| Height | 93mm |
| Rechargeable | Yes |
| Battery type | Maintenance free , leak proof. |
| Capacity | 7.2AH |

## IC Engine

IC engine is a heat engine where the combustion of fuel occurs with an oxidizer in a combustion chamber that is an integral part of the working fluid flow circuit.

* + Two stroke single cylinder
  + 69.9CC
  + Maximum power: 3.5bhp@5000RPM
  + Fuel capacity: 4L
  + Natural Air cooled



Fig: 4.9 Two Stroke IC Engine

The vast majority of vehicles (passenger cars and commercial vehicles) which are sold today are equipped with internal combustion engines. In this article we are going to describe how a Two- stroke internal combustion engine wo rks. An internal combustion engine is classified as a heat engine. It’s called internal because the combustion of the air-fuel mixture occurs inside the engine, in a combustion chamber, and some of the burned gases are part of the new combustion cycle.

A two-stroke (or two-stroke cycle) engine is a type of internal combustion engine that completes a power cycle with two strokes (up and down movements) of the piston during one power cycle, this power cycle being completed in one revolution of the crankshaft. A Two-stroke engine requires four strokes of the piston to complete a power cycle during two crankshaft revolutions. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring atthe same time. Two-stroke engines often have a high power-to-weight ratio, power being availablein a narrow range of rotational speeds called the power band. Two-stroke engines have fewer moving parts than four-stroke engines.

## Electric charger

An EV connector is a cable that connects your bike to the charging point.

* + Charger: 48V/3A
  + Input AC: 180-240V AC, 50HZ
  + Output DC: 58.8V, 3A

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**Fig: 4.10 Electric Charger**

## BRAKING SYSTEM OF AN HYBRID VEHICLE

Regenerative braking is a mechanism found on most hybrid and full-electric vehicles. It captures the kinetic energy from braking and converts it into the electrical power that charges the vehicle’s high voltage battery. Regenerative braking also slows the car down, which assists the use of traditional brakes. In a conventional braking system, a car slows down due to friction between the brake pads and rotors. But this system is highly inefficient when it comes to conserving energy. Nearly all of the kinetic energy propelling your car forward is lost as heat when you apply the brakes. That’s a lot of wasted energy! Regenerative braking solves this problem by recapturing upwards of 70% of the kinetic energy that would otherwise be lost during braking. The amount of energy recovered depends on your car model and driving behavior.

HOW DOES REGENERATIVE BRAKING PROVIDE ELECTRICITY?

Regenerative braking turns kinetic energy into electricity by reversing the process that drives the car forward. In electric cars, the drivetrain is powered by a battery pack that powers a motor (or motors), creating torque–rotational force–on the wheels. In other words, electrical energy from the battery becomes mechanical energy that spins the wheels. With regenerative braking, the energy from your spinning wheels is used to reverse the direction of electricity - from the electric motor(s) to the battery. All you have to do is remove your foot from the accelerator or, in some cases, press the brake pedal to activate regenerative braking. The electric motor not only acts as an electric generator, but it also helps slow your car down because energy is consumed by the wheels as they rotate the shaft in the electric motor.

EXTENDED RANGE POSSIBILITIES FOR EVS

Capturing braking energy and sending it right back to your EV’s battery pack can extend your driving range. Estimations show that regenerative braking can potentially add hundreds of miles of electric driving range throughout the year. That means less time spent charging and more time getting where you need to go. When charging stations are still far and few between in many areas, every mile counts. Plus, when you plug into the electric grid less often, you help reduce emissions from coal and gas-powered electricity suppliers.

### BETTER FUEL EFFICIENCY FOR HYBRIDS

While hybrids still have internal combustion engines under the hood, they’re designed to use their electric motor as much as possible. Regenerative braking helps keep the battery pack charged, so drivers don’t have to rely on their engines as often, helping them reduce fuel consumption and save money.

However, the problem is also improving with newer regenerative braking systems. In more recent car models, you may not notice a difference in stopping power at all.The braking system in this HV is using drum brakes. A drum brake is a brake that uses friction caused by a set of shoes or pads that press outward against a rotating cylinder-shaped part called a brake drum. The term drum brake usually means a brake in which shoes press on the inner surface of the drum. When shoes press on the outside of the drum, it is usually called a clasp brake. Where the drum is pinched between two shoes, similar to a conventional disc brake, it is sometimes called a pinch drum brake, though such brakes are relatively rare. When the brakes are applied, brake fluid is forced under pressure from the master cylinder into the wheel cylinder, which in turn pushes the brake shoes into contact with the machined surface on the inside of the drum. This rubbing action reduces the rotation of the brake drum, which is coupled to the wheel. Hence the speed of the vehicle is reduced. When the pressure is released, return springs pull the shoes back to their rest position.

## COMPONENTS OF BRAKING SYSTEM

* backing plate
* brake drum
* shoe
* wheel cylinder
* various springs and pins.

## Backing plate

The backing plate provides a base for the other components. The back plate also increases the rigidity of whole set-up, supports, protects the housing from foreign materials like dust, debris andalso absorbs the torque reactions that is why back plate is also termed as "Torque Plate. Since all braking operations exert pressure on the backing plate, it must be strong and wear-resistant. Levers for emergency or parking brakes, and automatic brake-shoe adjuster were also added in recent years.

## Brake drum

The brake drum is generally made of a special type of cast iron that is heat conductive and wear- resistant. It rotates with the wheel and axle. When a driver applies the brakes, the lining pushes radially against the inner surface of the drum, and the ensuing friction slows or stops rotation of the wheel and axle, and thus the vehicle. This friction generates substantial heat.

## Brake Shoes

Brake shoes are typically made of two pieces of steel welded together. The friction material is either riveted to the lining table or attached with adhesive. The crescent-shaped piece is called the Web and contains holes and slots in different shapes for return springs, hold-down hardware, parking brake linkage and self adjusting components. All the application force of the wheel cylinder is applied through the web to the lining table and brake lining. The edge of the lining tablegenerally has three “V"-shaped notches or tabs on each side called nibs. The nibs rest against the support pads of the backing plate to which the shoes are installed. Each brake assembly has two shoes, a primary and secondary. The primary shoe is located toward the front of the vehicle.

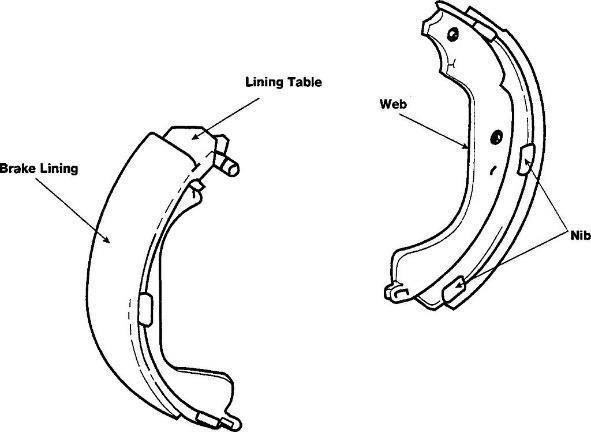


Fig: 4.11 Brake Shoe Assemlby

## Wheel cylinder

One wheel cylinder operates the brake on each wheel. Two pistons operate the shoes, one at each end of the wheel cylinder. The leading shoe (closest to the front of the vehicle) is known as the primary shoe. The trailing shoe is known as the secondary shoe. Hydraulic pressure from the master cylinder acts on the piston cup, pushing the pistons toward the shoes, forcing them against the drum. When the driver releases the brakes, the brake shoe springs restore the shoes to their original (disengaged) position. The parts of the wheel cylinder are shown to the right.

# CHAPTER 5 CONCLUSION

HEV is a vehicle that uses two sources of power- Engine and battery. For low power application battery drive is used whereas for high power application where power requirement is very high engine is used. Engine drive is most efficient at high-speed drive. Thus, HEVs both mode of operation occurs at their maximum efficiency. But in engine low speed operation is not efficient. Its high-speed mode is only efficient. Therefore, it gives twice the mileage given by a normal vehicle. As this hybrid vehicle emits 50% less emission than normal vehicle it plays an important role for reducing pollution to certain extent without compromising with efficiency. Thus, it is most efficient in urban areas mainly in high traffic where engines are least efficient as the energy from engine is being wasted away and creates pollution. The adoption of new development standards is becoming increasingly dependent on creating HEV technologies due to the demands placed on power generation and the need to minimize fossil fuel consumption. The evolution of hybrid electric vehicles already offered solutions to the electric vehicle market. In order to have a lesser dependency on the increased price of fuel and to operate a more environmentally friendly vehicle the technology of HEVs would more than help to satisfy these requirements. The adoption of new development standards is becoming increasingly dependent on creating HEV technologies due to the demands placed on power generation and the need to minimize fossil fuelconsumption.

**RESULT AND DISCUSSION**

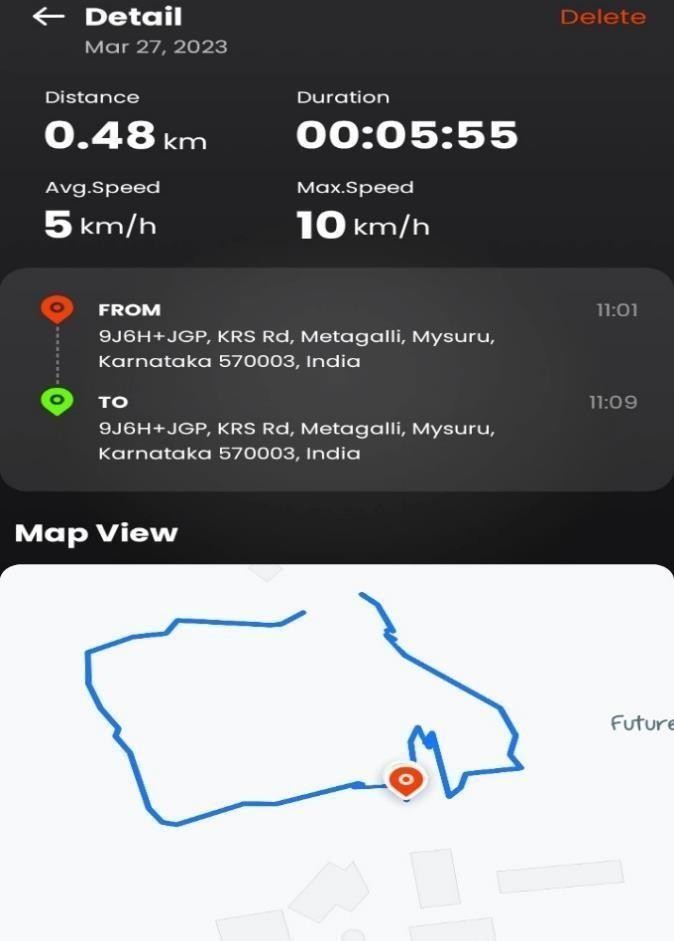
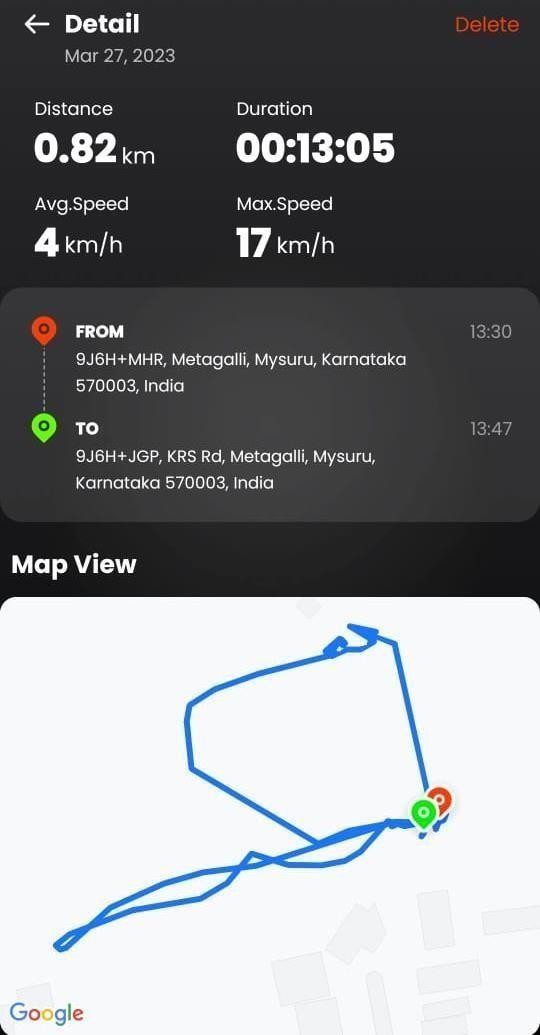
Hybrid electric vehicles (HEVs) combine a internal combustion engine with an electric motor and battery system, providing a more efficient and environmentally friendly alternative to traditional vehicles. The main benefits of HEVs include, Improved fuel efficiency, HEVs use less fuel than traditional vehicles, as the electric motor helps to power the car and reduce the reliance on the gasoline or diesel engine. This leads to lower emissions and savings on fuel costs.

Reduced emissions, HEVs emit less harmful pollutants and greenhouse gases than traditional vehicles, which is better for the environment and human health. Regenerative braking, HEVs use regenerative braking to capture energy normally lost during braking, which is then stored in the battery and used to power the electric motor. This further improves fuel efficiency and reduces emissions. Smooth and quiet driving, The electric motor in an HEV provides a smoother and quieter driving experience compared to traditional vehicles, as it reduces the need for the engine to work as hard. Overall, HEVs provide a practical and efficient alternative to traditional vehicles, offering lower emissions, improved fuel efficiency, and a smoother driving experience.



**Fig: 5.1 Hybrid Electric Vehicle**

|  |  |  |
| --- | --- | --- |
| **Mode of propulsion** | **Range in KM** | **Description** |
| Electric mode | 20 | For single charge, it can run for around 20km range. |
| Engine mode | 35 | 35km per litter will be achieved |
| Combinational mode | 55 | During combinational mode of operation, that a vehicle can run around 55km. |



**Fig: 5.2 Performance Analysis done By Speedometer App**

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# Enhancement Electric Vehicle Into Hybrid Electric Vehicle

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