A Project Report

On

"SMART EV SYSTEM"

Submitted in the partial fulfillment of the requirement for the award of degree

Of

BACHELOR OF ENGINEERING
(ELECTRONICS AND TELECOMMUNICATION ENGINEERING)

of
Savitribai Phule Pune University,Pune

Submitted by

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2023-2024

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CERTIFICATE

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is a bonafide student of this institute and the work has been carried out by him under the supervision of Prof. P.V.Taware and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the degree of Bachelor of Engineering(E and TC Engineering) during the year.2023 /24.

Date:
Place:- Dhangwadi.

Prof.P.V.Taware	Dr.T.M.Dudhane.	Dr.S.B.Patil.
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Examiner - I

Examiner - II

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It gives us great pleasure in submitting the project on. "SMART EV SYSTEM" I would like to take opportunity to thank my Internal Guide Prof. P.V.TAWARE for helping me out in selecting the topic and contents, giving valuable suggestions in preparation of project report and presentation I am also grateful to Prof. T. M. Dudhane, Head of Department of Electronics of communication Engineering RD's SCSCOE providing healthy environment and facilities in the department. He allowed us to raise our concern and worked to solve it by extending his coopetition time to time. Consist achievement requires boost on consistent interval basis. Management has given full support and boosted us to be consistent and achieve the target. Thanks to management for their support. I would like to be grateful to all my friends for their consistent support, help and Guidance..

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Abstract

This research focuses on the design and production of a smart electric vehicle that uses a controlled gyroscopic sensor and microcontroller to automatically transfer power from the internal system to the wheels and vice versa. The era of electric vehicles has only recently begun, but it will significantly expand the automobile industry to the point where modern fossil fuel vehicles will eventually become outdated. The fact that they are environmentally friendly and thus produce fewer harmful emissions is what matters most. The project's goal is to create a smart car that can switch its power transmission on its own. We have measured the system's slope angle using the gyroscope sensor for this purpose. We Designed PCB and used LED lights, an ESP32 with a Bluetooth module controller,MPU6050, Ultrasonic sensor, 200rpm DC Gear-motors,Relays, CPU fan, L293D IC and 12v battery. Next, a comparative analysis between the experimental and analytical results will be conducted, and finally, a result and conclusion will be determined..

Contents

Chapter 1

Introduction

An electric vehicle, commonly referred to as an EV, is propelled by one or more traction motors or electric motors. An electric vehicle can run on electricity from sources outside of the vehicle through a collector system, or it can run independently using an electric generator, solar panels, or battery to turn fuel into electricity. Road and rail cars, surface and underwater vessels, electric aircraft, and electric spacecraft are examples of electric vehicles (EVs). A vehicle that is powered by one or more electric motors and rechargeable batteries is known as an electric car. In the 1880s, the first useful electric vehicles were manufactured. Until the development of internal combustion engines, and especially electric starters, in the late 19th and early 20th centuries, electric cars were quite popular.

The year 2008 saw a rebirth in the production of electric vehicles because of advancements in battery technology, air pollution-related illnesses and deaths, and the goal of lowering greenhouse gas emissions. To encourage the introduction and mass market adoption of new electric vehicles, a number of national and local governments have established tax credits, subsidies, and other incentives for plug-in vehicles. These incentives are frequently contingent on the size of the battery, the vehicle's electric range, and the cost of purchase. Electric vehicles emit fewer emissions overall, are quieter, and have no tailpipe emissions when compared to internal combustion engine vehicles. A Reuters analysis of 29 global automakers conducted in January 2019 and updated in April found that automakers intend to spend $300billiononelectriccarsoverthenextfivetotenyears, with45$

Over traditional internal combustion engine vehicles, electric cars have a number of advantages. One of these is a notable decrease in local air pollution because they don't directly release pollutants like lead, various oxides of nitrogen, hydrocarbons, volatile organic compounds, particulates (soot), carbon monoxide, ozone, and carbon monoxide. Emissions from cities may be partially transferred to material transportation, production, and generation plants, depending on the manufacturing process and the source of the electricity needed to charge the car. The vehicle's efficiency and the emissions from the electricity source determine how much carbon dioxide is released. The emissions associated with grid electricity vary greatly based on your location, the accessibility of renewable energy sources, and the effectiveness of the fossil fuel-based generation that is utilized.

A gyroscope is a tool for angular velocity and orientation measurement or maintenance. It's a rotating wheel or disc where the spin axis, or axis of rotation, can take on any orientation on its own. The conservation of angular momentum states that when the mounting rotates, the orientation of this axis remains constant. There are other gyroscopes based on different principles of operation, like solid-state ring lasers, fiber optic gyroscopes, extremely sensitive quantum gyroscopes, and MEMS gyroscopes packaged in microchips found in electronic devices. Gyroscopes are used in inertial navigation systems, like the one in the Hubble Telescope, and inside the steel submerged submarine hull. Gyroscopes are utilized in gyro theodolites to maintain direction during tunnel mining because of their accuracy. Gyroscopes can be used to create gyrocompasses, which can be used as an inertial guidance system component or as a supplement to magnetic compasses in ships, aircraft, and spacecraft, as well as in general vehicles. Gyrocompasses can also be used to help stabilize bicycles, motorcycles, and ships. Smartphones and other consumer electronics frequently use MEMS gyroscopes.A single metal-oxide-semiconductor (MOS) integrated circuit chip houses a tiny computer known as a microcontroller, or MCU for microcontroller unit. It is comparable to a system on a chip (SoC), though less complex in terms of terminology; a SoC may have a microcontroller as one of its components. A microcontroller is made up of memory, programmable input/output peripherals, and one or more CPUs, or processor cores. Together with a tiny quantity of RAM, program memory in the form of optoelectric RAM, NOR flash, or OTP ROM is frequently present on chip. Unlike microprocessors, which are made up of discrete chips and are utilized in personal computers and other general-purpose applications, microcontrollers are intended for embedded applications. Microcontrollers are used in automatically operated products and devices, including power tools, toys, office equipment, appliances, implanted medical devices, remote controls, car engine control systems, and other embedded systems.

By acting as an additional pair of eyes—or, more accurately, ears—to keep an eye on the environment around the car, ultrasonic sensors greatly increase driver safety. The system warns the driver when it detects an object, which lowers the possibility of collisions. Furthermore, ultrasonic sensors come in very handy when parking. They are one of the primary sensors in parking assistance systems and measure the distance to obstacles, even in confined spaces. Once your car is parked, these sensors can scan the vehicles around it to determine whether it is positioned correctly. By doing this, you may be able to prevent problems like door dings and scratches and spare time and money on future repairs. When a car is moving slowly, ultrasonic sensors work best, which makes them perfect for backing into or out of a parking space. The function of these sensors in airbag deployment is one of their more intriguing safety features. They can decide whether it is safe to activate the airbags in a collision or whether doing so will result in more damage in minor collisions by precisely determining the positions of the driver and passengers. By doing this, the possibility of injuries from needless or risky airbag deployment is reduced.

Chapter 2

Literature Review

”Balancing fast flexible gyroscopic systems at low speed using parametric excitation” [1] Overcome the inability to detect the small response at low speed due to imbalance which is often below noise level.

”Effects of gyroscopic moment on the damage of a tapered roller bearing” [2] This paper investigated the effects of gyroscopic moment on the induction of side damage of the ring raceways and the rollers of a tapered bearing and proposed a design criterion to avoid the gyroscopic moment

”Comparative life cycle assessment of lithium-ion batteries for electric vehicles addressing capacity fade” [3] utilization of models of battery capacity fade to estimate the batteries service life for different conditions of use (charge/discharge).

”Overview of Electric Vehicles (EVs) and EV Sensors” [4] EVs are typically thought of as being composed of various subsystems. To enable an electric vehicle to function, each of these subsystems coordinates with the others. In EVs, a variety of technologies are used to ensure that every subsystem functions as a whole.

”Comprehensive Review on Electric Propulsion System of Unmanned Aerial Vehicles” [5]The results provide useful information to decision makers and public administrators for planning measures to modify the car fleet composition aiming to improve the urban air quality by Dhaval Joshi,Dipankar Deb and S.M. Muyeen

Chapter 3

Market survay

3.1 Determine Your Target Market:

Ascertain the target audience's psychographic and demographic traits. Who might use your system as a customer? Are they manufacturers of automobiles, suppliers of aftermarket services, or owners of electric vehicles? Select the approach you will use to carry out your survey. Online questionnaires, phone interviews, in-person interviews, focus groups, and/or a mix of these techniques are available as options. Think about the benefits and drawbacks of each strategy.

3.2 Create Inquiry Questions for Surveys:

Create survey questions that will give you the information you require. Make sure the inquiries are impartial, clear, and succinct. Ask prospective clients about their preferences, problems, willingness to pay, and knowledge of competing products. Administer the survey to your intended audience by putting your chosen survey methodology into practice. To get trustworthy insights, make sure you speak with a representative sample of prospective clients.

3.3 Examine Survay Information:

Choose the best sample size and technique for your survey. Think about things like your target market's size, your financial limitations, and the degree of confidence you want to have in the survey results. Common methods include convenience sampling, stratified sampling, and random sampling.After gathering survey replies, examine the information to find important trends, patterns, and insights. Examine the responses of respondents for recurring themes, and contrast them between various market segments or demographic groups.

3.4 Conclusions and Recommendations:

Conclude about the market demand, competitors, and prospects for your product or solution based on your analysis. Make wise choices and suggestions for your company's strategy using these insights. Consider working with a seasoned market research company to help you conduct your survey and analyze the results if you're not familiar with market research methodologies or need help with data analysis.

3.5 Competitive Analysis:

Competitive Analysis: Examine your rivals in addition to conducting consumer research. Determine the major competitors in the industry providing comparable products, then evaluate their advantages, disadvantages, pricing policies, and positioning in the market. You can use this information to distinguish your product from the competition and better understand your market.Provide rewards to promote survey takers. This could be free trials, gift cards, discounts on your product, or entries into a drawing for prizes. Offering incentives can boost survey participation and response rates.

3.6 Use Multiple Channels:

To reach a diverse audience, consider distributing your survey through a variety of channels. Think about making use of industry forums, email lists, social media sites, and pertinent online communities. To increase your reach, collaborate with groups or influencers in your target market. Divide up your survey participants according to pertinent factors like purchase history, location, psychographics, or demographics. Deeper insights into particular market segments and consumer preferences can be obtained by analyzing responses within various segments.

Chapter 4

Working And Specification

Our system's necessary goal is to automatically turn off the fan (a cooling system intended for the driver) when the car is started to travel on an incline in order to supply the tires with all of the power. The road's inclination angle determines the fan's on/off frequency and amplitude. Therefore, controlling is done so as to supply the wheels with the maximum amount of power when the slope is very steep. In a similar vein, the rear wheels receive the least amount of additional power when the slope is very mild. We designed our setup so that the gyroscopic sensor is mounted on the vehicle's frame. The vehicle alerts the micro-controller when it begins to travel on an incline. All of the power supply is deactivate the system mentioned above, transferring power to the fan and wheels simultaneously.

Ultrasonic waves are released by the sensor and return when they encounter an obstruction. The distance between the car and the obstruction is determined by timing the waves' return trip. The car stops in order to prevent a collision if the distance is less than a predetermined focused at the wheels because the micro-controller is configured to automatically cut off the power to the fan. Additionally, a setup is in place that allows the driver to threshold.Obstacles reflect the brief ultrasonic impulses that the ultrasonic sensors emit. After that, the echo signals are obtained and handled. The ultrasonic transducer, the primary component of an ultrasonic sensor, is housed within its plastic case. It is made up of an aluminum pot with a piezoceramic element contained in a diaphragm. The ECU transmits a digital signal to the sensor. Ultrasonic pulses are emitted as a result of the aluminum diaphragm oscillating with square waves for approximately 300µsec at a resonant frequency of roughly 48 kHz. After relaxing for about 900µsec (during which no sound can be received), the diaphragm vibrates in response to sound reflected from an obstruction.The piezoceramic element outputs these vibrations as analog signals, which are amplified and transformed into digital signals.

We have done our setup in such a way that, the frame of the vehicle has the gyroscopic sensor. When vehicle starts taking inclined path it sends signal to the ESP32. The ESP32 is programmed in such a way that it will automatically cuts off the power supplied to the fan, and all the power supply is concentrated at the wheels. There is also an arrangement made where the driver can turn off the above designed system so that power can be transferred to both fan and wheels.We have measured the system's slope angle using the gyroscope sensor for this purpose. We Designed PCB used LED lights, an ESP32 with a Bluetooth module controller. Next, a comparative analysis between the experimental and analytical results will be conducted, and finally, a result and conclusion will be determined.For this purpose, we have used the gyroscope sensor to measure the slope angle of the system. We used an ESP32 with a Bluetooth module controller, LED lights, and PCB design. The results of the experiment and the analytical results will then be compared, and ultimately a result and conclusion will be established.The MPU6050 is a widely used accelerometer gyroscope chip featuring a 16-bit measurement resolution and six axes of sense. It is highly well-liked in the do-it-yourself community due to its low cost and high sense accuracy. A lot of commercial products also have the MPU6050 installed. An inertial measurement unit, or IMU, is a device that combines an accelerometer and gyroscope. IMU sensors find extensive use in a multitude of applications, including robotics, satellites, spacecraft, drones, UAVs, smartphones, tablets, and many more. They are employed in flight control, orientation and position detection, motion tracking, and other applications.

Motion Sensing and Stability Control: Utilize MPU6050 to detect vehicle motion, acceleration, and tilt. Implement algorithms to ensure stability and control during maneuvers.

Obstacle Detection and Collision Avoidance: Integrate ultrasonic sensor to detect obstacles and objects in the vehicle's path. Provide real-time feedback to the driver and/or autonomous control system to avoid collisions.

Drive System Control: Use ESP32 to control the DC gear motor via the L293D motor driver IC. Enable bidirectional control for forward, reverse, and braking actions.

Battery Management: Monitor battery voltage and current to ensure optimal power usage and prevent over-discharge. Implement voltage regulation and charging control to maintain battery health.

Thermal Management: Employ the CPU fan to regulate temperature and prevent overheating of electronic components. Activate the fan based on temperature thresholds or user-defined settings.

User Interface and Feedback: Provide a user interface (e.g., LCD display, LEDs) to convey system status, warnings, and alerts. Incorporate audible feedback for critical events or emergency situations.

Safety Mechanisms: Include emergency stop buttons or switches for immediate system shutdown. Implement fault detection and recovery mechanisms to ensure safe operation.

Hardware Requirements: MPU6050, ultrasonic sensor, ESP32, L293D motor driver IC, DC gear motor, CPU fan, battery, power supply, connectors, mounting hardware.

Software Requirements: Firmware development for ESP32 using Arduino IDE or ESP-IDF. Algorithm implementation for motion sensing, obstacle detection, and motor control.

Integration and Testing: Integrate hardware components and develop software modules. Conduct thorough testing to verify functionality, reliability, and safety.

Documentation: Provide detailed documentation including system architecture, hardware schematics, software design, and user manual.

Compliance and Regulations: Ensure compliance with relevant safety standards and regulations for automotive electronics and electrical systems.

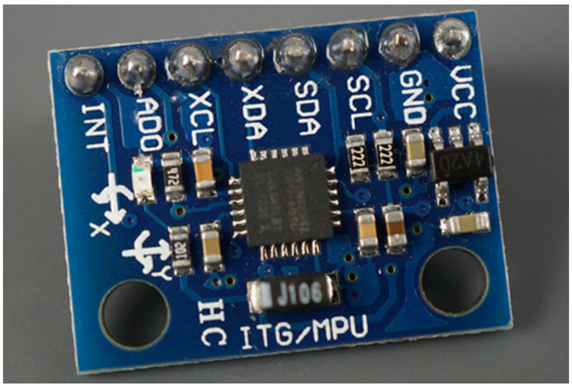
4.1 Components Used

4.1.1 ESP32:

ESP32 is a chip that provides Wi-Fi and (in some models) Bluetooth connectivity for embedded devices – in other words, for IoT devices. While ESP32 is technically just the chip, the modules and development boards that contain this chip are often also referred to as “ESP32” by the manufacturer. The ESP32 chip contains 520KB of RAM. While it’s sufficient for most projects, others may need more memory. To increase the capacity of the microcontroller, the manufacturer can add a memory chip to the board.

1. Data Acquisition and Monitoring: The ESP32 can be integrated with sensors to collect data about battery voltage, current, temperature, and other parameters. This data can be sent to a smartphone app or web interface for real-time monitoring and analysis. This helps in identifying potential issues and understanding EV performance.
2. User Interface and Control (limited): The ESP32 can be used to design a user interface for basic functions like Displaying battery level, charging status, and estimated range. Turning on/off auxiliary lights or accessories (non-critical systems only). Providing simple control over non-critical features (e.g., adjusting cabin temperature). It’s crucial to emphasize that the ESP32 should not be used to control critical systems like brakes, steering, or acceleration.

4.1.2 MPU6050:



MPU6050 is an IMU device that stands for Inertial Measurement Unit. It is a six-axis motion tracking device that calculates a three-axis accelerometer and three-axis gyroscope data. The MPU6050 module is a Micro ElectroMechanical Systems (MEMS) which consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motion related parameter of a system or object. The module also have two auxiliary pins which can be used to interface external IIC modules like an magnetometer, however it is optional. Since the IIC address of the module is configurable more than one MPU6050 sensor can be interfaced to a Microcontroller using the AD0 pin.

Functionality: The MPU6050 integrates a 3-axis gyroscope and a 3-axis accelerometer onto a single chip. This allows it to measure angular velocity and acceleration along three perpendicular axes. Communication Interface: The MPU6050 typically communicates with external microcontrollers or other devices via an I2C (Inter-Integrated Circuit) interface. This interface allows for easy integration with a wide range of microcontrollers and development boards. Measurement Range: The MPU6050 has configurable full-scale range settings for both the gyroscope and accelerometer. The gyroscope can typically measure angular rates from ±250 to ±2000 degrees per second, while the accelerometer can measure acceleration from ±2g to ±16g. Data Output: The MPU6050 provides raw sensor data outputs in the form of digital values. These values can be read and processed by a microcontroller to obtain information about the device's motion and orientation. Integrated Digital Motion Processor (DMP): The MPU6050 features a built-in Digital Motion Processor that can perform complex calculations and filtering on the raw sensor data. This can offload some processing tasks from the microcontroller, simplifying application development.

4.1.3 Relays 5v

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A relay is an electromechanical device that opens or closes a switch's contacts by means of an electric current. The single-channel relay module is much more than just a simple relay; it includes parts that facilitate connection and switching as well as indicators that indicate whether the module is powered and whether the relay is active.

Functionality: A relay is an electromechanical switch that is operated by an electrical signal. When the relay coil is energized with the appropriate voltage, it activates the switch contacts, allowing them to control the flow of current to another electrical circuit.

Operating Voltage: A 5V relay operates with a supply voltage of 5 volts DC. This means that the relay coil requires a 5V DC voltage to energize and actuate the switch contacts.

Applications: Relays are used in a wide range of applications where there is a need to control high-power or high-voltage circuits with a low-power signal. Some common applications of 5V relays include home automation systems, automotive electronics, industrial control systems, and electronic projects.

Switching Capacity: The switching capacity of a relay refers to the maximum voltage and current it can handle. It's important to choose a relay with appropriate ratings for your application to ensure reliable operation and safety.

Control Signal: To activate a 5V relay, you typically need to provide a 5V DC signal to the relay coil. This signal can come from a microcontroller, sensor, or other electronic circuitry.

Types of Relays: There are various types of relays available, including electromechanical relays, solid-state relays, and reed relays. Each type has its own advantages and limitations, so it's important to choose the right type for your specific application.

4.1.4 L293D Motor Driver IC

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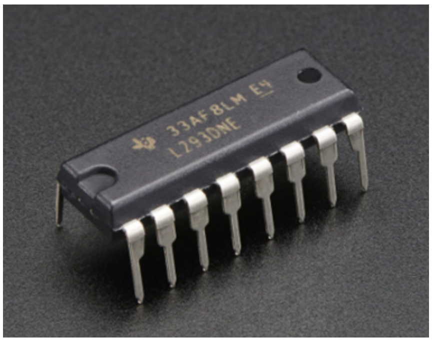

The most basic robot needs a motor to turn a wheel or carry out a specific task. Motors require more current than a microcontroller pin can normally produce, so you'll need a switch of some kind that can take in a small current, amplify it, and produce a larger current—which feeds the motor even more. A person referred to as a motor driver completes this entire procedure. That task is made easy with the L293D Motor Driver IC, which has been helpful in a number of applications with relative ease.

Functionality: The L293D is a quadruple high-current half-H driver designed to control the direction and speed of DC motors. It can drive two DC motors simultaneously in both forward and reverse directions. The L293D contains two H-bridge circuits, each capable of driving a single DC motor. An H-bridge is a configuration of transistors that allows a motor to be driven in either direction (forward or reverse) by controlling the polarity of the voltage applied to it.

Current Handling: The L293D can handle peak currents of up to 600 mA per channel (1.2 A for brief durations). This makes it suitable for controlling small to medium-sized DC motors commonly used in hobbyist projects. Logic Compatibility: The L293D is compatible with standard TTL (Transistor-Transistor Logic) and CMOS (Complementary Metal-Oxide-Semiconductor) logic levels, making it easy to interface with microcontrollers and other digital logic circuits.

Protection Features: The L293D includes built-in protection diodes to prevent damage from back electromotive force (EMF) generated by the motors when they are turned off. This helps to protect the IC and other components in the circuit. Control Inputs: The L293D has control inputs for each motor channel, allowing you to independently control the direction and speed of each motor. By applying different combinations of logic signals to these inputs, you can control the motor's behavior (e.g., forward, reverse, stop). Applications: The L293D is commonly used in various robotics, automation, and electronics projects where precise control of DC motors is required. It is often used in hobbyist projects such as robot cars, motorized platforms, and remote-controlled vehicles. Datasheet and Pinout: The datasheet for the L293D provides detailed information about its pinout, electrical characteristics, and recommended usage. It is important to consult the datasheet when designing circuits using the L293D to ensure proper operation and avoid damage to the IC.

4.1.5 DC Gear Motor 200rpm

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These motors are straightforward DC motors with shaft gears to achieve the best possible performance characteristics. Because their shaft passes through the middle of their gearbox assembly, they are referred to as center shaft DC geared motors. Numerous robotic applications and all-terrain robots can make use of this 12V DC Motor with 200RPM. These motors are easy to connect to wheels or any other mechanical assembly because they have a 3 mm threaded drill hole in the middle of the shaft.

A DC motor spinning at 200 revolutions per minute (RPM) indicates that the motor completes 200 full rotations in one minute. To calculate the angular speed () of the motor in radians per second, you can use the formula:

w = (2 * RPM) / 60

Where:

w is the angular speed in radians per second.

RPM is the revolutions per minute.

Substituting the given RPM value:

w = (2 * 200) / 60

w = 20.944 radians per second

This means that the motor rotates at approximately 20.944 radians per second.

4.1.6 Ultrasonic Sensor

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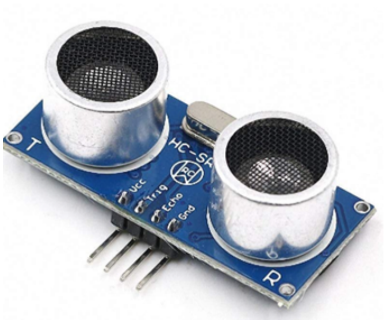


An ultrasonic sensor uses ultrasound, which moves through the air, to measure distances. The ultrasonic will return to the sensor if it encounters an object or obstruction along its path. Since they became widely available several decades ago, ultrasonic sensors have maintained a significant market share in the sensing industry due to their features, flexibility, and affordability.

Principle of Operation: Ultrasonic sensors work on the principle of sound waves. They emit a burst of ultrasonic waves (sound waves with frequencies above the human hearing range, typically around 40 kHz to 200 kHz) and then detect the echo reflected off an object. By measuring the time delay between the emission and reception of the sound waves, the sensor can calculate the distance to the object.

Transducer: The heart of an ultrasonic sensor is the transducer, which both emits and receives ultrasonic waves. The transducer can be made of piezoelectric material, which converts electrical energy into mechanical vibrations and vice versa.

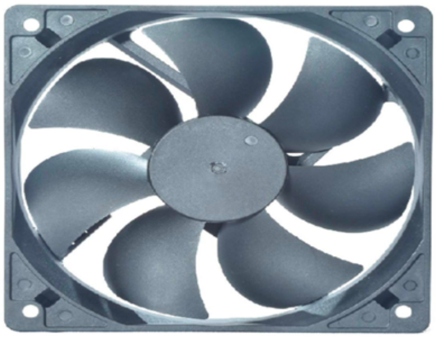
Distance Measurement: The distance to the object is determined based on the time it takes for the ultrasonic waves to travel to the object and back. This time is typically measured in microseconds (µs) or milliseconds (ms). The formula to calculate distance is often given as: Distance = (Time * Speed of Sound) / 2 Where: Time is the round-trip time taken for the ultrasonic waves to travel to the object and back. Speed of Sound is the speed of sound in air (approximately 343 meters per second at room temperature). The division by 2 is because the sound waves travel to the object and back.

Accuracy and Range: The accuracy and range of ultrasonic sensors can vary depending on factors such as sensor design, operating environment, and the characteristics of the objects being detected. Generally, ultrasonic sensors are effective for distances ranging from a few centimeters to several meters.

Applications: Ultrasonic sensors find applications in various fields, including: roximity sensing and obstacle detection in robotics, drones, and autonomous vehicles. Liquid level measurement in tanks and containers. Presence detection and counting in industrial automation. Parking assistance systems in automobiles. Distance sensing for security systems and access control.

Limitations: Ultrasonic sensors may have limitations in environments with high levels of noise or interference, as well as in environments with highly absorbent or reflective surfaces that can affect the propagation of sound waves.

4.1.7 CPU Fan



Understanding the Concept: A CPU fan is designed to circulate air and dissipate heat generated by the CPU. While it can move air effectively, it doesn't have the capability to cool air in the way that a traditional air conditioner does, which involves compressing and expanding refrigerant gases to absorb and release heat.

Modifying the Setup: To use a CPU fan as part of an air conditioning prototype, you would need to modify the system to incorporate some form of cooling mechanism. One approach could involve integrating a cooling element such as a Peltier device or a small refrigeration system. These components could provide cooling capabilities when combined with the air circulation provided by the CPU fan.

Design Considerations: When designing the prototype, you would need to consider factors such as power consumption, heat dissipation, and overall efficiency. CPU fans typically consume much less power compared to traditional air conditioning units, so ensuring sufficient cooling capacity while maintaining energy efficiency would be important.

Thermal Management: Effective thermal management is crucial for any cooling system. In the case of using a CPU fan for cooling, you would need to ensure proper airflow, heat sink design, and thermal interface materials to maximize heat transfer and cooling efficiency.

Testing and Evaluation: Once the prototype is assembled, it would need to be tested and evaluated under various conditions to assess its cooling performance, energy efficiency, and reliability. This would involve measuring temperature reduction, airflow velocity, power consumption, and other relevant parameters.

Safety Considerations: It's essential to prioritize safety when working with any cooling system prototype. Ensure proper insulation, electrical safety measures, and protection against overheating or other potential hazards.

Feasibility and Practicality: While using a CPU fan as part of an air conditioning prototype is an interesting concept, it's important to consider its feasibility and practicality compared to existing cooling technologies. Depending on the specific requirements and constraints of the application, alternative cooling solutions may be more suitable.

4.1.8 12v Battery

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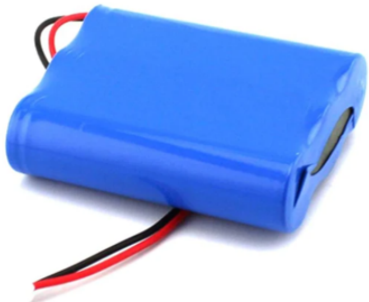


A battery pack made of multiple individual lithium-ion cells connected in series or parallel to provide a higher voltage or capacity, respectively, is called a rechargeable lithium-ion cell battery pack. This popular kind of rechargeable battery is utilized in energy storage systems, electric cars, and a variety of consumer electronics.

Voltage: A 12V battery typically provides a nominal voltage of 12 volts, although the actual voltage may vary depending on factors such as charge level, load, and temperature.

Chemistry: 12V batteries are available in various chemistries, including lead-acid, lithium-ion, nickel-cadmium, and nickel-metal hydride. Each chemistry has its own characteristics in terms of energy density, lifespan, and charging/discharging behavior.

Capacity: The capacity of a 12V battery is typically rated in ampere-hours (Ah) or milliampere-hours (mAh), indicating the amount of charge the battery can store and deliver. Higher capacity batteries can provide more energy and longer operating times.

Applications: 12V batteries are used in a wide range of applications, including automotive starting batteries, deep-cycle batteries for marine and RV applications, uninterruptible power supplies (UPS), solar power systems, electric vehicles, portable electronics, and more.

Charging: Charging a 12V battery typically requires a suitable charger designed for the specific battery chemistry. Overcharging or undercharging can lead to reduced battery performance and lifespan, so it's important to use the correct charging method and parameters.

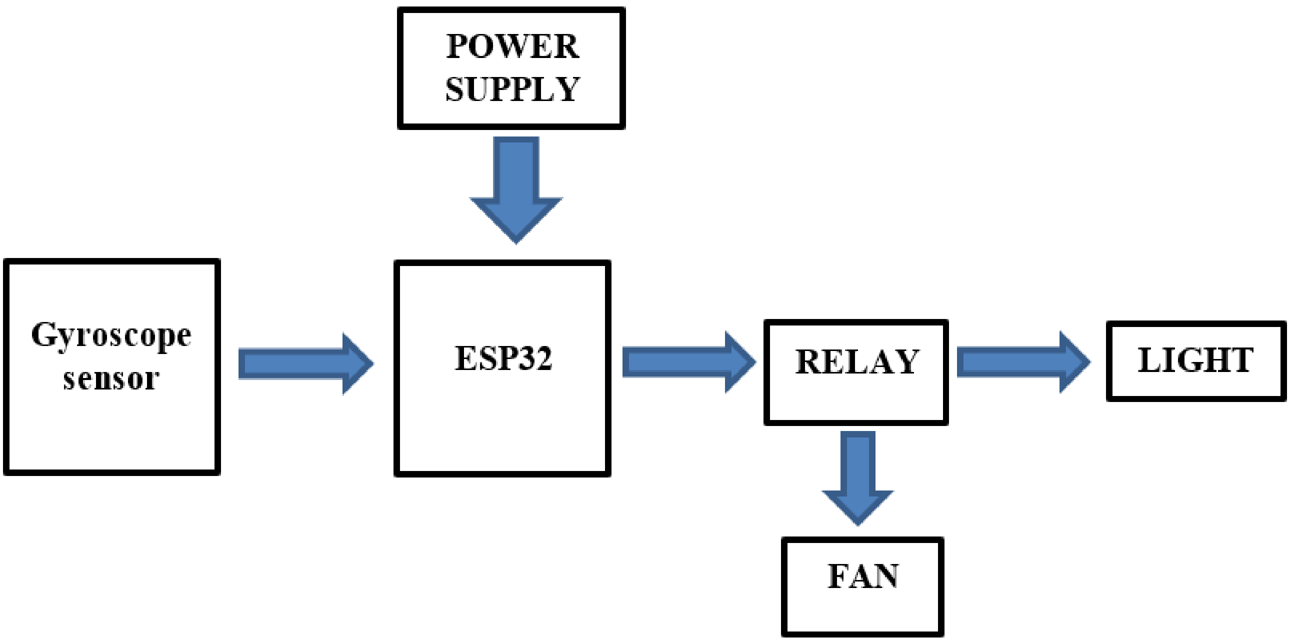
Maintenance: Depending on the battery chemistry, maintenance requirements may vary. Lead-acid batteries, for example, may require periodic topping up with distilled water, while lithium-ion batteries are typically maintenance-free.

Safety: It's important to handle and use 12V batteries safely, as they can present risks of electrical shock, fire, or chemical leakage if mishandled or damaged. Follow manufacturer recommendations for safe handling, charging, and disposal of batteries.

Environmental Considerations: Proper disposal or recycling of 12V batteries is essential to prevent environmental contamination. Many jurisdictions have regulations in place for the safe disposal and recycling of batteries, so be sure to comply with local regulations.

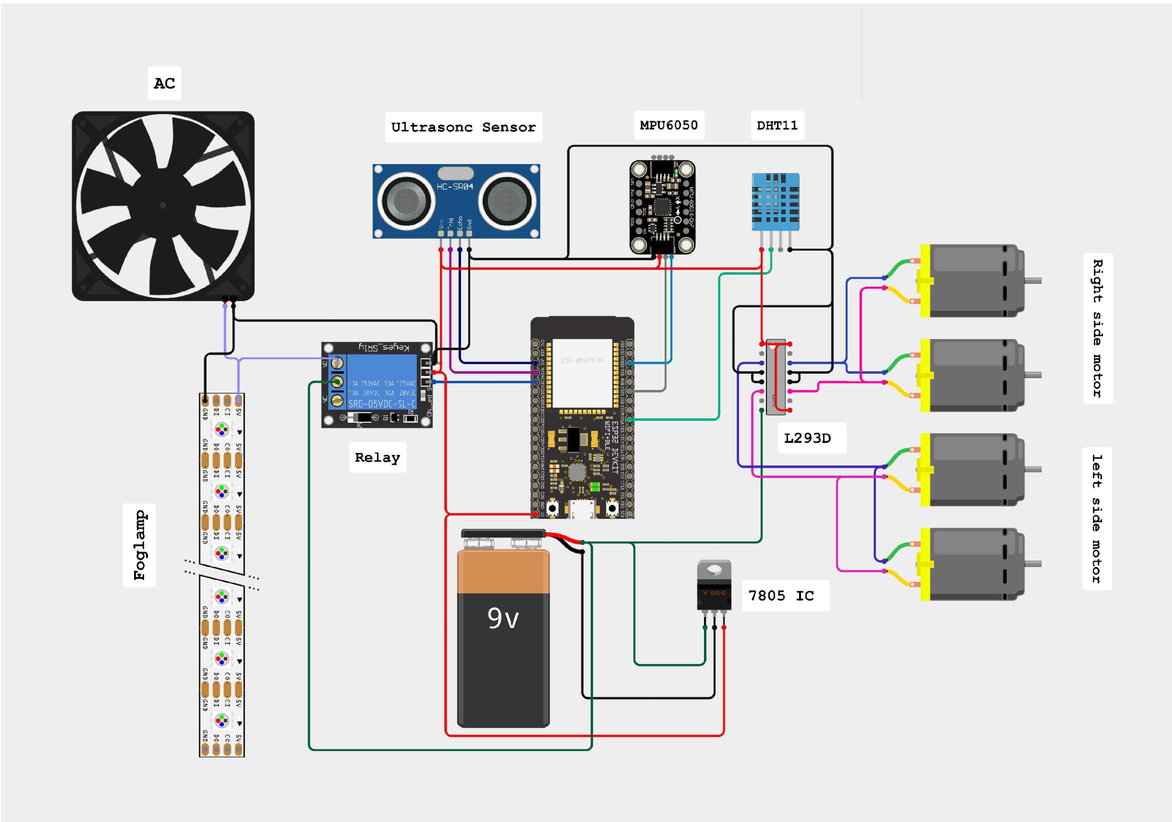
Chapter 5

BLOCK Diagram



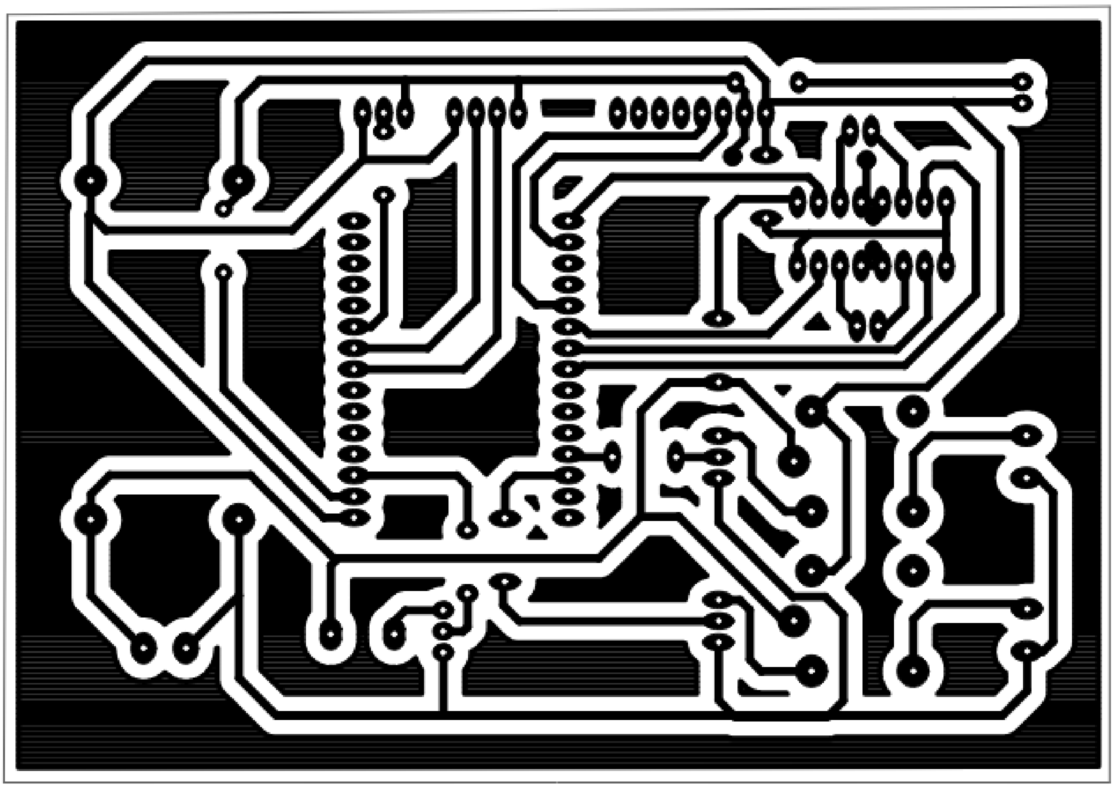
Chapter 6

Circuit Diagram



Chapter 7

PCB Diagram



Chapter 8

Analysis

8.1 Advantages

Regenerative braking: Implementing regenerative braking technology can help recharge the battery while driving downhill or decelerating, thus replenishing some of the power used by the air conditioner and reducing the overall strain on the battery.

Energy-efficient air conditioning: Utilizing more energy-efficient air conditioning systems can help reduce the power draw from the battery, thereby minimizing the impact on battery capacity, especially during uphill drives where power demands are higher.

Smart energy management: Implementing a smart energy management system that prioritizes power distribution based on driving conditions can help optimize energy usage. For instance, during uphill drives, the system could temporarily reduce non-essential power loads to ensure sufficient power for essential functions like driving and air conditioning.

Supplemental power sources: Integrating additional power sources, such as solar panels or kinetic energy recovery systems, can provide supplementary power to support the air conditioner and alleviate strain on the battery, particularly during uphill climbs.

Battery optimization: Employing advanced battery management systems to optimize battery performance and extend its lifespan can help mitigate the impact of increased power draw from the air conditioner during uphill driving scenarios.

Improved aerodynamics: Enhancing the vehicle's aerodynamics can reduce overall energy consumption, including the power required for air conditioning, thereby alleviating some of the strain on the battery during uphill drives.

Hybrid or electric powertrains: Transitioning to hybrid or electric powertrains can offer benefits such as improved efficiency and regenerative braking, which can help mitigate the impact of uphill driving on battery capacity and air conditioner power draw.

8.2 Disadvantages

Cost: Implementing advanced technologies such as regenerative braking, energy-efficient air conditioning, and hybrid or electric powertrains typically involves higher initial costs, which may make vehicles equipped with these features more expensive for consumers.

Complexity: Introducing additional systems for energy management and power supplementation can increase the complexity of vehicle design and maintenance. This complexity may result in higher repair and servicing costs, as well as potential reliability issues.

Weight: Integrating supplemental power sources or advanced energy management systems can add weight to the vehicle, which may negatively impact fuel efficiency and performance, especially during uphill driving.

Space constraints: Installing additional components such as solar panels or kinetic energy recovery systems may require extra space within the vehicle, potentially limiting passenger or cargo capacity.

Infrastructure: Transitioning to hybrid or electric powertrains may necessitate infrastructure upgrades to support charging stations, which could be costly and time-consuming to implement on a large scale.

Range anxiety: Electric vehicles (EVs) may suffer from range anxiety, particularly during uphill driving, as drivers may be concerned about depleting the battery charge before reaching their destination, especially in areas with limited charging infrastructure.

Technological limitations: Some advanced technologies, such as regenerative braking and energy-efficient air conditioning, may have limitations in certain driving conditions or climates, which could impact their effectiveness in mitigating power draw from the air conditioner during uphill driving.

Performance trade-offs: Optimizing energy management and power distribution may require trade-offs in vehicle performance, such as reduced acceleration or lower top speeds, which could affect driver satisfaction and competitiveness in the market.

8.3 Methodology

Problem Identification and Analysis: Define the specific challenges associated with uphill driving and air conditioner power draw. Analyze existing data and research on battery capacity reduction and power consumption patterns during uphill driving.

Requirements Gathering: Consult with automotive engineers, energy experts, and stakeholders to gather requirements for the system. Define performance criteria, including energy efficiency goals, battery capacity preservation targets, and user experience requirements.

Technology Research: Conduct a comprehensive review of existing technologies and solutions relevant to energy management, air conditioning efficiency, regenerative braking, and supplemental power sources. Evaluate the feasibility, cost-effectiveness, and compatibility of different technologies with the target vehicle platform.

Conceptual Design: Generate conceptual designs for the system based on the identified requirements and available technologies. Explore various integration approaches, including hardware components, software algorithms, and control systems.

Modeling and Simulation: Develop mathematical models and simulation tools to evaluate the performance of the proposed system under different driving scenarios, including uphill gradients, ambient temperatures, and battery states of charge. Conduct virtual testing and optimization to refine the design and identify potential areas for improvement.

Prototype Development: Build prototype hardware and software components necessary for implementing the system. Conduct bench testing and integration tests to validate the functionality and performance of individual system modules.

Real-World Testing: Install the prototype system in test vehicles and conduct field trials under controlled conditions, including simulated uphill driving scenarios. Collect data on energy consumption, battery performance, air conditioner efficiency, and user feedback.

Performance Evaluation: Analyze the data gathered from real-world testing to assess the effectiveness of the system in reducing power draw from the air conditioner during uphill driving. Compare performance metrics against predefined targets and benchmarks established during the requirements phase.

Iterative Improvement: Incorporate feedback from testing and performance evaluation to refine the system design and address any identified shortcomings or limitations. Iterate through the design-build-test cycle to incrementally improve system performance and reliability.

Deployment and Commercialization: Finalize the design of the system for mass production, considering factors such as cost, manufacturability, and scalability. Work with automotive manufacturers to integrate the system into new vehicle models or offer it as a retrofit option for existing vehicles. Develop marketing and communication strategies to promote the benefits of the system to consumers and stakeholders

Chapter 9

Source Code

```
#define BLYNK_TEMPLATE_ID "TMPL3vd4Ru4Mb"
#define BLYNK_TEMPLATE_NAME "Smart EV Car"
#define BLYNK_AUTH_TOKEN "7Nk7CpB6DdALwpwR0_B_LqQ48g1L44Qn"

// Comment this out to disable prints and save space
#define BLYNK_PRINT Serial

#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>

#define RELAY_PIN 15 // Pin for controlling the relay
#define TILT_THRESHOLD 12 // Tilt angle threshold

Adafruit_MPU6050 mpu;

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

char auth[] = BLYNK_AUTH_TOKEN;

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "C15";
char pass[] = "12345678";

int IN1 = 5;
int IN2 = 23;
int IN3 = 19;
int IN4 = 18;


BLYNK_WRITE(V0) { //move forward
  digitalWrite(IN2, param.asInt());
  digitalWrite(IN4, param.asInt());
  Serial.println("forward");
}
```

```
BLYNK_WRITE(V1) { //move backward
  digitalWrite(IN1, param.asInt());
  digitalWrite(IN3, param.asInt());
   Serial.println("backward");
}

BLYNK_WRITE(V2) { //turn left
  digitalWrite(IN2, param.asInt());
  digitalWrite(IN3, param.asInt());
   Serial.println("left");
}

BLYNK_WRITE(V3) { //turn right
  digitalWrite(IN1, param.asInt());
  digitalWrite(IN4, param.asInt());
   Serial.println("right");
}


void setup()
{
  // Debug console
   pinMode(RELAY_PIN, OUTPUT);
  Serial.begin(115200);
  while (!Serial)
    delay(10); // Wait for serial port to connect

  Serial.println("Adafruit MPU6050 test!");

  if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }
  Serial.println("MPU6050 Found!");
```

```
  mpu.setAccelerometerRange(MPU6050_RANGE_8_G);
  Serial.print("Accelerometer range set to: ");
  switch (mpu.getAccelerometerRange()) {
    case MPU6050_RANGE_2_G:
      Serial.println("+-2G");
      break;
    case MPU6050_RANGE_4_G:
      Serial.println("+-4G");
      break;
    case MPU6050_RANGE_8_G:
      Serial.println("+-8G");
      break;
    case MPU6050_RANGE_16_G:
      Serial.println("+-16G");
      break;
  }
  delay(100);

  pinMode(IN1, OUTPUT);
  pinMode(IN2, OUTPUT);
  pinMode(IN3, OUTPUT);
  pinMode(IN4, OUTPUT);

  //Blynk.begin(auth, ssid, pass);
  // You can also specify server:
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 8080);
  //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8080);
}

void loop()
{
  Blynk.run();

  sensors_event_t a, g, temp;
  mpu.getEvent(&a, &g, &temp);
```

```
  Serial.print("Acceleration X: ");
  Serial.print(a.acceleration.x);
  Serial.print(", Y: ");
  Serial.print(a.acceleration.y);
  Serial.print(", Z: ");
  Serial.print(a.acceleration.z);
  Serial.println(" m/s^2");

  // Calculate tilt angle (absolute value)
  float tiltAngle = abs(atan2(a.acceleration.x,
sqrt(a.acceleration.y * a.acceleration.y + a.acceleration.z * a.acceleration.z)) * 180 / PI);
  Serial.print("Tilt Angle: ");
  Serial.println(tiltAngle);

  // Check if tilt angle exceeds threshold
  if (tiltAngle > TILT_THRESHOLD) {
    // Turn off relay
    digitalWrite(RELAY_PIN, LOW);
    Serial.println("Relay turned off");
  } else {
    // Turn on relay
    digitalWrite(RELAY_PIN, HIGH);
    Serial.println("Relay turned on");
  }

  Serial.println("");
  delay(500);
}
```

Chapter 10

Result

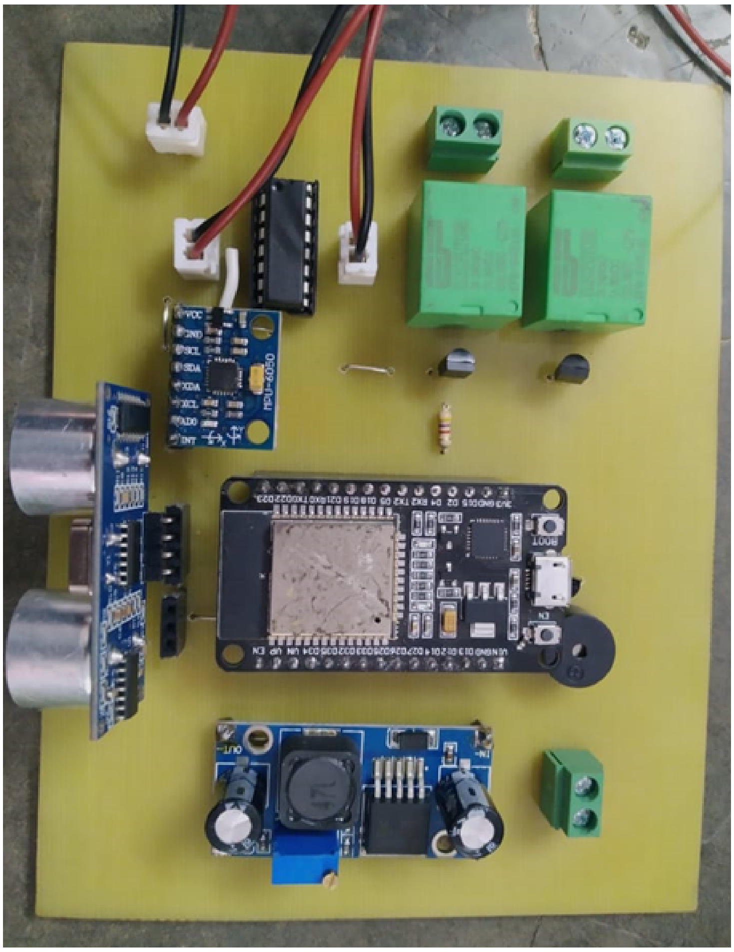


Fig. Result 1

Fig. Result 2

Chapter 11

Conclusion

Our smart electric vehicle system uses a gyroscope sensor to detect a 30-degree angle when driving on a uphill or slope. It then uses an ESP32 microcontroller to control that signal, causing secondary devices that use more power to turn off. Primary movers will receive all of the power, and power will be saved. In these System we can save battery power and increase a range of car while car on Driving Mode

Chapter 12

References

[1]"Balancing fast flexible gyroscopic systems at low speed using parametric excitation" Shachar Tresser, Izhak Bucher published by Mechanical Systems and Signal Processing 130 (2019) 452–46.

[2] "Effects of gyroscopic moment on the damage of a tapered roller bearing" Jing-Shan Zhao, Wentao Liu, Yun Zhang, Zhi-Jing Feng, Jun Ye, Qing-Bo Niu published by Mechanism and Machine Theory 69 (2013) 18-199.

[3]"Comparative life cycle assessment of lithium-ion batteries for electric vehicles addressing capacity fade" Pedro Marques, Rita Garcia, Luiz Kulay, Fausto Freire published by Journal of Cleaner Production 229 (2019) 78-e794.

[4] "Overview of Electric Vehicles (EVs) and EV Sensors" by Aviru Kumar Basu, Shreyansh Tatiya and Shantanu Bhattacharya (2019).

[5] "Parametric topology optimization of a MEMS gyroscope for automotive applications" by Mohammad Reza Solouk, Mohammad Hassan Shojaeefard, Masoud Dahmardeh.(2019).

[6] "Comprehensive Review on Electric Propulsion System of Unmanned Aerial Vehicles" by Dhaval Joshi,Dipankar Deb and S.M. Muyeen (2022).

[7]Battery Thermal Management System for Electric Vehicle Applications by S. Omar et al. (2017).

[8]High Voltage Boosting Converter Design for Electric Vehicles by M. A. Zamzam et al. (2020).

[9]Adaptive Control Strategies for Electric Vehicles in High Altitude Regions by L. Zhang et al. (2019).

[10]Aerodynamic Design of Electric Vehicles for High Altitude Operations by K. Gupta et al. (2018).