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Article Title: IoT-Based Automatic Breaking Control System for Electric Vehicles and Monitoring System

IoT-Based Automatic Breaking Control System for Electric Vehicles and Monitoring System

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ABSTRACT

Road traffic accidents claim a significant number of precious lives every day. The most frequent causes are driving errors and slow emergency service response. Any vehicle's braking system is always a crucial component. A difficulty or perhaps an accident might be brought on by faulty or late braking. Most accidents occur because the driver doesn't apply the brake quickly enough. This paper proposes an IOT-based automated breaking control system for EV vehicles and a monitoring system that applies the brake depending on the speed of the bike and any detected obstacles. An electric vehicle's battery monitoring and control system measures the battery's voltage and temperature. Sensors, a microprocessor, a Wi-Fi module, and a battery make up this system. The design is built using the cost-effective ATMEGA 328 microcontroller (Arduino UNO). It is an automatic braking system consists of Ultrasonic sensor. The barrier is discovered using the ultrasonic sensor, which sends it to the Arduino board, which receives the signals and controls the braking system. Data on voltage and temperature are sent to the microcontroller, and the battery data is subsequently sent over Wi-Fi to the Blynk application. The observation is done immediately by utilizing a Blynk app to monitor the metrics of the vehicle.

Keywords: IOT, Temperature Sensor, Voltage Sensor, Ultrasonic sensor, Blynk App.

1 Introduction

Electric vehicle (EVs) have gained popularity as an alternative to conventional fuel vehicles to reduce CO2 emissions and reliance on oil as global climate change is becoming more recognized as a serious environmental issue. However, because of EV charging, the power

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grid's general load profile will alter and the rate at which the facilities update their power will rise [1]. Electric vehicles (EVs) have long been seen as a practical way to reduce environmental pollution, especially when used in conjunction with decarbonized energy production. In particular, Path-following autos (AVs) with active safety features which primarily depend about the use of the brakes and guiding controls work as intended in some severely risky circumstances [2]. Eco-driving is thought of as an optimum control problem (OCP), a well-studied topic, where the road and traffic conditions are completely described on a planned route. Early studies used the assumption that human drivers would be behind the wheel and fully in charge of controlling vehicle speed and modifying their driving behavior for improved fuel efficiency [3]. Vehicle safety has been improved and the number of fatalities from collisions between vehicles has been demonstrated to decrease because to electronic stability control (ESC). [4-5]. Direct yaw moments are produced by controlling the momentum and braking force of each wheel. Since these systems provide precise wheel torque manipulation and frequently have superior range than electric vehicles (EVs) with individual wheel motors are easily incorporate TV controllers (TVCs). TV as well as the potential of producing the reference yaw moment by wheel torque distributions matching a variety of requirements, including energy efficiency, have both been extensively evaluated [6-7]. Energy savings can be achieved through the total improvement of tire and motor energy production [8]. The electric vehicle is a distinctive design with several benefits. The in-hub motor torques in each driving wheel is swiftly and independently regulated. Therefore, it goes without saying that an electric vehicle is a useful vehicle testbed to illustrate the individual or joint dynamics of control systems. Energy savings is achieved through the total optimization of motor power output and tire energy [9-10].

In this paper, a monitoring system and an IoT-based automated breaking control system for an EV vehicle are provided. The list that follows outlines the paper's structure: The most current work is described in Section II. The proposed paper is thoroughly described in Section III. Section IV presents the results. A conclusion is offered in Section V.

2 Recent Works

Xiaolin Ding *et al* (2020) [11] have proposed using an affordable inertial measurement unit, a global positioning system, and a Beidou navigation positioning module for four autonomously moving electric automobiles. The longitudinal auto speed estimator's accuracy and dependability are assessed using hardware-in-the-loop experiments under a range of driving conditions. The outcomes demonstrate its strong resilience, real-time performance, and estimation accuracy. The drawbacks include that sensor noise and bias frequently have an impact on how well kinematics-based estimation algorithms function.

Bo Wang *et al* (2019) [12] have suggested a several safety considerations around Large EVCS. It is explained how EVCS operators can assess electricity security utilizing the hierarchy of hazard control strategies. High charging capacity and increased efficiency are advantages. The

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suggested framework will give the EVCS controllers useful advice towards ongoing tracking and effective administration of the EVCS' everyday operations.

Duo Zhang *et al* (2018) [13] have described an ASM-FTC strategy for 4WID-EVs that has been newly developed to maintain the stability and acceptable performance of the vehicle. It is beneficial that precision and reach time both increased. The disadvantages are that the conventional SMC frequently has substantial chattering and significant control breakthroughs are needed to improve system robustness and responsiveness.

Dejun Yin *et al* (2019) [14] briefs that a wheel slip control approach integrated with electronic stability control for decentralized drive electric vehicles. The efficiency of the recommended wheel slip control systems was not significantly impacted by vehicle mass or driving resistance, which explains why the strategy is appropriate for transporting vehicles on an airplane. Through simulation using the one-wheel model, this benefit is demonstrated. HIL simulations shown how very practical it is to execute the suggested technique on actual cars. The drawback is that it difficult to calculate velocity when all four wheels are being driven. If the sensors malfunction, the suggested controller will inoperable. Sensors that are precise and dependable are necessary to guarantee the controller's dependability.

Ningyuan Guo *et al* (2021) [15] proposed a distributed drive supervisory control approach for electric automobiles that synchronizes the use of a dynamic control superior, handling-stability controller, energy efficiency controller, and synchronized torque allocator for performance in laterally safety, dealing with, and power effectiveness. The benefits of the method include comprehensive enhancements in vehicle control, lateral consistency and power financial system. The method is validated utilizing a range of activities. The drawbacks include the requirement to reduce the yaw moment produced in order to maximize energy efficiency, which might raise the risk of vehicle instability.

3 Proposed Work Explanation

Figure 1 shows the Automatic Breaking System's block diagram. The proposed approach is an IOT-based automatic breaking control system for an EV vehicle and a monitoring system. The system consists of Arduino Microcontroller, Battery, Relay, Load and Node MCU and Sensors like Temperature, Voltage and Ultrasonic sensors. This system's proposed approach calculates a real-time indication of the battery's voltage and temperature. The voltage sensor is used to monitor battery voltage in real-time. The ultrasonic sensor is utilized to detect obstacle and sends it to Arduino board receives the signals and controls the braking system. In order to measure the heat in the battery, a temperature sensor is employed. To monitor these battery parameters, microcontroller based system and Wi-Fi module is used. The data is sent to the IoT cloud using Node Mcu, where it is monitored before being sent to the blink application.

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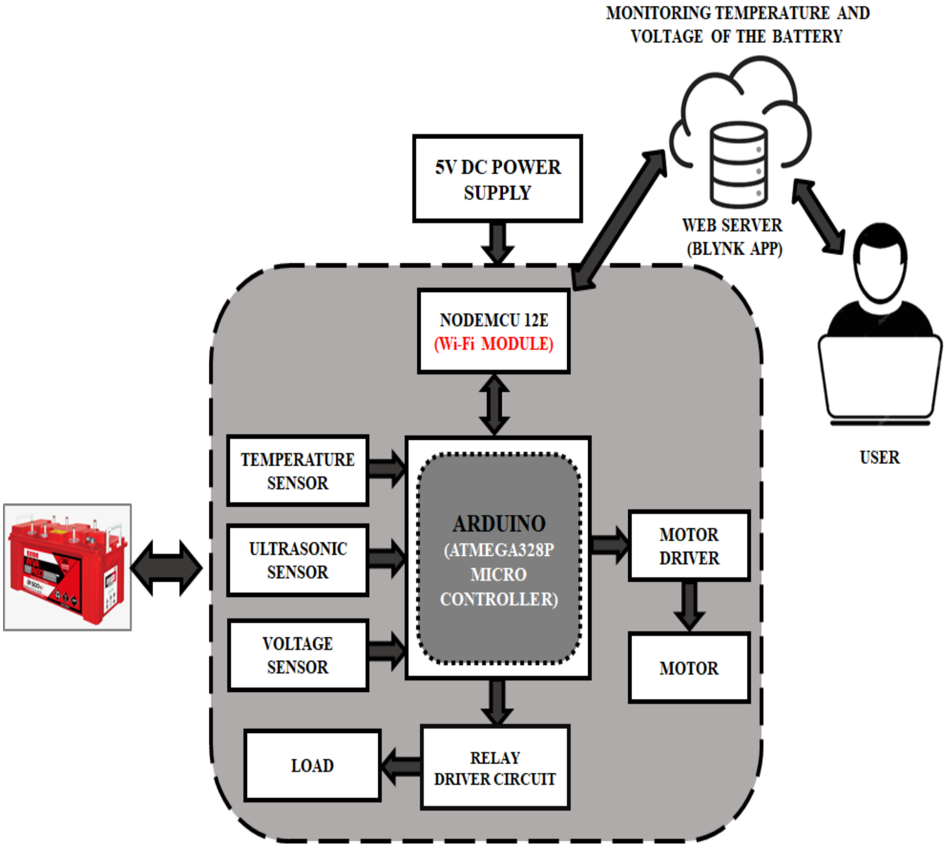

Figure 1: *Block Diagram for the Automatic Breaking System*

3.1 Arduino UNO

Arduino UNO is a microcontroller MCU platform with several I/O Pins for analog and digital operations as well as additional features like tiny memory storage. The Arduino UNO MCU's main component, the ATmega328, serves as the CPU unit. A member of the Arduino line is the Arduino UNO. One USB port on the Arduino UNO is utilized for power connections as well as uploading programming. Power connection choices include battery and main power. The pin diagram of Arduino configuration is displayed in Figure 2.

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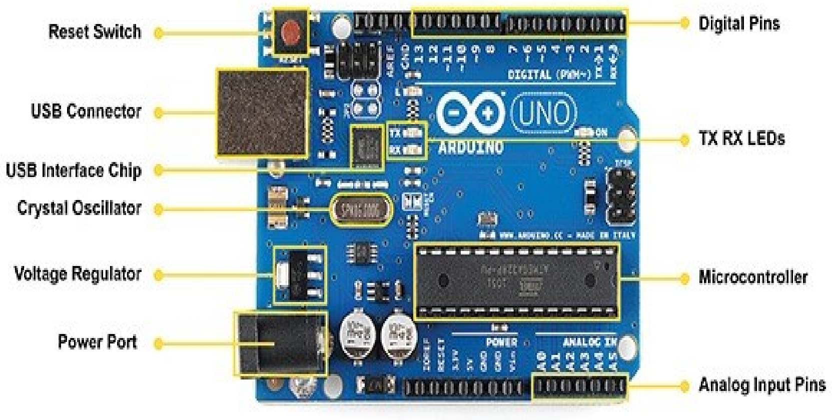

Figure 2: *Pin Diagram of Arduino*

3.2 NodeMCU ESP8266

Figure 3 shows the pin diagram of Node MCU. The Node MCU is an open-sourced program and hardware development environment based on the ESP8266, a relatively inexpensive System-on-a-Chip (SoC). A WLAN 802.11 b/g/n antenna, a 32-bit microcontroller unit, a 10 bit analog to digital converter, a TR switch, a power amplifier, a matching network PLL, regulators, and power management components are all included into the device. In various operating modes, Wi-Fi technology uses the 2.4 GHz band to improve WLAN performance.

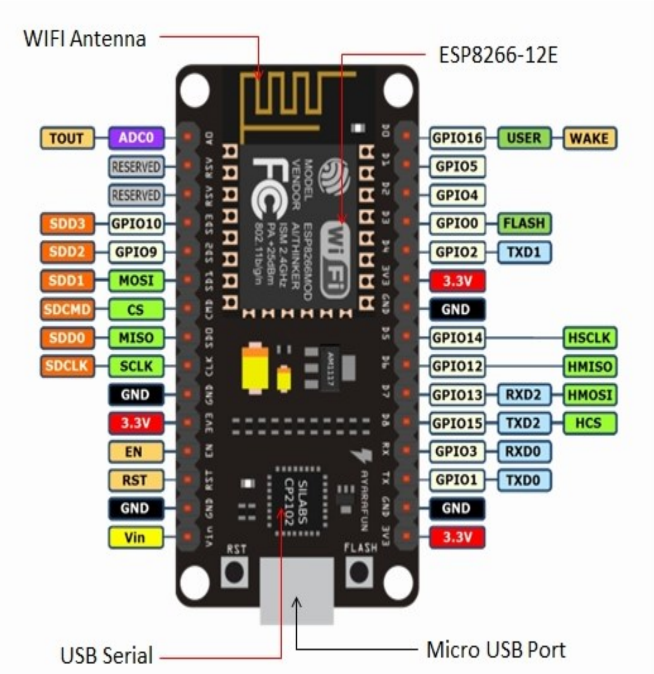

Figure 3: *Node MCU Pin diagram*

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3.3 Voltage Sensor

Figure 4: *Voltage Sensor*

Figure 4 provides Voltage Sensor. The resistive voltage divider circuit serves as the foundation for the voltage sensor module, a 0–25 DC voltage detecting device. After being shrunk by a factor of 5, it generates an analog output voltage that is equivalent to the input voltage signal. A simple but incredibly useful item called the Voltage Sensor Chip multiplies an input voltage by five using a potential divider.

3.4 DTH11 Sensor

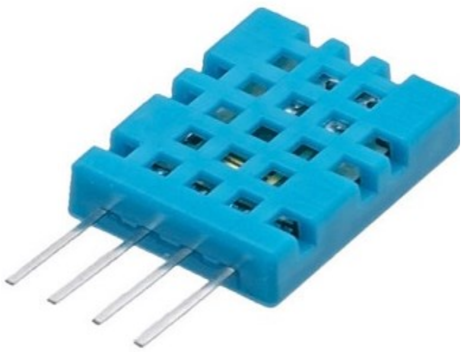

Figure 5: *DHT11 Sensor*

Figure 5 presents DHT11 Sensor. Easily installed and reasonably priced, the DHT-11 Digital Temperature and Humidity Sensor measures both temperature and humidity. It monitors the surrounding air using a thermistor and a capacitive humidity sensor, and it outputs a digital signal on the data port. The DHT11 is a low-cost digital sensor that measures temperature and humidity. For the DHT11 humidity and temperature sensor, there are both a sensor and a module available. This sensor may be distinguished from the module by a pull-up resistor and a power-on LED. The DHT11 is a relative humidity sensor.

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3.5 Ultrasonic Sensor

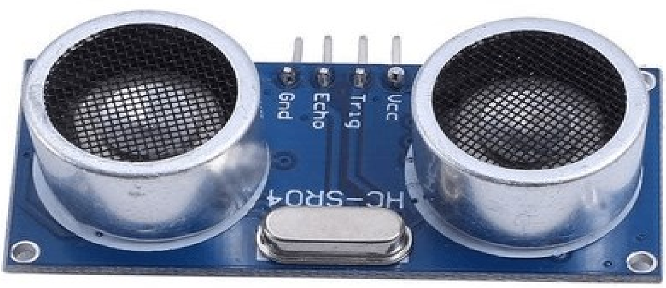

Figure 6: *Ultrasonic sensor*

Figure 6 gives Ultrasonic Sensor. An equipment called an ultrasonic sensor utilizes ultrasonic sound waves to determine how far away something is. To ascertain an object's proximity, an ultrasonic sensor emits and receives ultrasonic pulses from an amplifier. Ultrasonic sensors can detect things regardless of their color, surface, or composition.

3.6 Motor

Figure 7: *12V DC Motor*

Any of a group of rotating electrical devices known as DC motors transform electrical energy from direct current into mechanical energy. The majority of kinds rely on the magnetic field's forces. Nearly all varieties of DC motors have an internal electromechanical or electronic mechanism that enables periodic changes in the motor's current circulation polarity.

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3.7 Blynk App

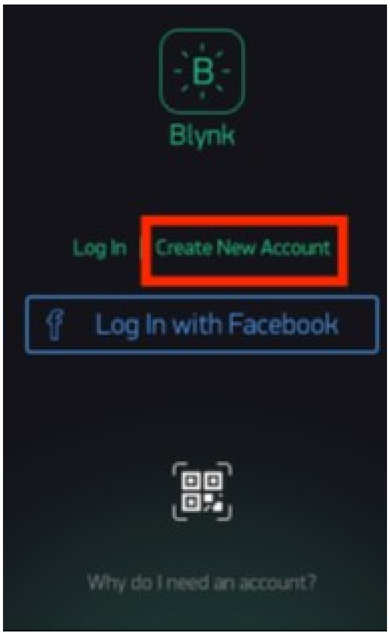

Figure 8: *BLYNK App*

The Internet of Things (IoT) platform Blynk allows Android and iOS mobile devices to manage Arduino, Raspberry Pi, and NodeMCU. With the use of this program, a graphical user interface (GUI) or human machine interface (HMI) is created by gathering and providing the right address on the widgets that are readily available. Using the Blynk library, it is possible to directly control ESP32 pins from a phone without writing any code. The Blynk app is displayed in Figure 8.

4 Results and Discussion

The stimulated result using an IOT-based monitoring system determines the temperature, voltage, and speed of the induction motor. Figure 9 represents the hardware view of an IoT-based automatic breaking control system and monitoring system for an EV vehicle. This integration includes a mechanical structure, an Arduino microcontroller, motors, sensors, and other electrical parts. It has been successful in developing a control system that uses an Arduino microcontroller and motors to regulate the movement and shape modification of this work. This technology helps avoid collisions between automobiles and human beings, or at the very least lessen the number of injuries that occur, because ultrasonic sensors can detect any type of obstruction. Develops an automated control strategy for this system by first defining the fundamental brake control issue using the braking system. It is beneficial to brake steadily and smoothly while also assessing this safety-critical car braking system.

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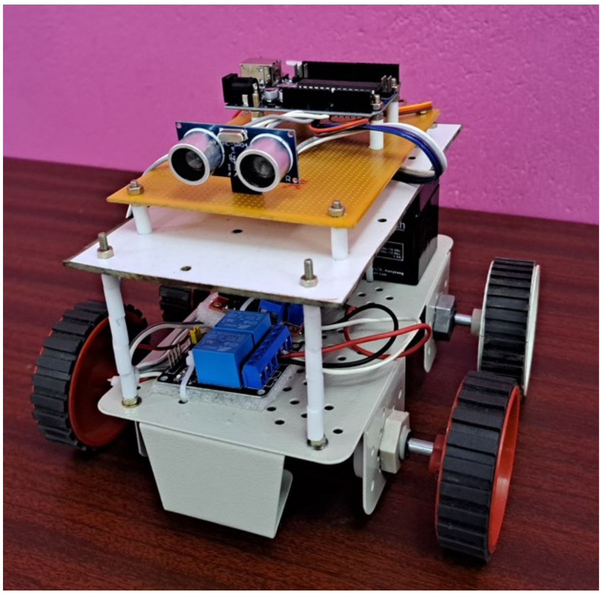

Figure 9: *Hardware View*

5 Conclusion

Electric vehicles will be becoming significantly more eco-friendly by saving the globe from global warming by reducing the greenhouse gases released by conventional automobiles. Electric vehicle depends entirely on the energy source from the battery. This paper presents an IoT based automatic breaking control system for an EV vehicle and a monitoring system. The voltage sensor is used to continuously check battery voltage. In order to measure the heat in the battery, a temperature sensor is employed. Wi-Fi module and a microcontroller-based system are utilized to monitor these battery parameters. While configuring the time for security, the Arduino microcontroller is connected to the relay to charge the battery. Using Node Mcu, the data is transmitted to the IoT cloud where it is monitored before being sent to the blink application.

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