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Full Length Article

Iot Based Automatic Breaking Control System For Ev Vehicle And Monitoring System

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Abstract
Electric vehicles (EV) are getting more and more popular in today's society as a result of rising petrol prices. An IoT based automated breaking Control system for EV vehicles is proposed in this paper, together with a monitoring system. An EV'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. It is built using the affordable microcontroller. It has an ultrasonic sensor and works as an automated braking system. The controller receives the data sent by the ultrasonic sensor, which is used to identify obstacles, and uses them to regulate the brake mechanism. Voltage, temperature, and battery data are passed to the microcontroller, which subsequently sends them over Wi-Fi to the Blynk application. It is suggested that the parameters of the EV be monitored immediately using a Blynk app.

Keywords: *Electric Vehicle (EV), IoT, Automated Braking System, Ultrasonic Sensor, Battery Monitoring, Blynk Application, Obstacle Detection, Real-Time Monitoring, Embedded Systems, Smart Safety System.*

INTRODUCTION

Electric vehicle (EVs) have gained popularity as an alternative to conventional fuel vehicles to reduce CO_2 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 grid's general load profile will alter and the rate at which the facilities update their power will rise. 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. Eco-driving is thought of as an optimum control problem (OCP), a wellstudied 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 . 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). 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. 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.

Existing System

The existing braking control systems in electric vehicles (EVs) generally rely on manual driver input or basic automatic features such as anti-lock braking systems (ABS) and electronic stability control (ESC).These systems do not fully leverage the capabilities of IoT for real-time data collection and advanced analytics. Monitoring is often limited to on-board diagnostics without comprehensive remote tracking and predictive maintenance capabilities.

PROPOSED SYSTEM

The proposed IoT-based automatic braking control system for EVs integrates advanced sensors, real-time data processing, and internet connectivity to enhance vehicle safety and performance. This

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system autonomously adjusts braking based on real-time environmental conditions and vehicle dynamics, significantly improving response times and accuracy. Additionally, the monitoring component provides continuous, remote tracking of vehicle status, allowing for predictive maintenance and alerts, thereby improving overall vehicle reliability and safety

Project Description

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called "firm ware". The desktop/laptop computer is a general purpose computer. You can use it for a variety of applications such as playing games, *word* processing, accounting, software development and so on. In contrast, the software in the embedded systems is always fixed listed below:

Embedded systems do a very specific task, they cannot be programmed to do different things. . Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property. Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low.

Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity.

Application Areas

Nearly 99 per cent of the processors manufactured end up in embedded systems. The embedded system market is one of the highest growth areas as these systems are used in very market segment- consumer electronics, office automation, industrial automation, biomedical engineering, wireless communication, data communication, telecommunications, transportation, military and so on.

Consumer appliances:

At home we use a number of embedded systems which include digital camera, digital diary, DVD player, electronic toys, microwave oven, remote controls for TV and air-conditioner, VCO player, video game consoles, video recorders etc. Today's high-tech car has about 20 embedded systems for transmission control, engine spark control, air-conditioning, navigation etc. Even wristwatches are now becoming embedded systems. The palmtops are powerful embedded systems using which we can carry out many general-purpose tasks such as playing games and word processing.

Office Automation:

The office automation products using embedded systems are copying machine, fax machine, key telephone, modem, printer, scanner etc.

Industrial Automation:

Today a lot of industries use embedded systems for process control. These include pharmaceutical, cement, sugar, oil exploration, nuclear energy, electricity generation and transmission. The embedded systems for industrial use are designed to carry out specific tasks such as monitoring the temperature, pressure, humidity, voltage, current etc., and then take appropriate action based on the monitored levels to control other devices or to send information to a centralized monitoring station. In hazardous industrial environment, where human presence has to be avoided, robots are used, which are programmed to do specific jobs. The robots are now becoming very powerful and carry out many interesting and complicated tasks such as hardware assembly.

Medical Electronics:

Almost every medical equipment in the hospital is an embedded system. These equipments include diagnostic aids such as ECG, EEG, blood pressure measuring devices, X-ray scanners; equipment used in blood analysis, radiation, colonoscopy, endoscopy etc. Developments in medical electronics have paved way for more accurate diagnosis of diseases.

Computer Networking:

Computer networking products such as bridges, routers, Integrated Services Digital Networks (ISDN), Asynchronous Transfer Mode (ATM), X.25 and frame relay switches are embedded systems which implement the necessary data communication protocols. For example, a router interconnects two networks. The two networks may be running different protocol stacks. The router's function is to obtain the data packets from incoming pores, analyze the packets and send them towards the destination after doing necessary protocol conversion. Most networking equipments, other than the end systems (desktop computers) we use to access the networks, are embedded systems.

Telecommunications:

In the field of telecommunications, the embedded systems can be categorized as subscriber terminals and network equipment. The subscriber terminals such as key telephones, ISDN phones, terminal adapters, web cameras are embedded systems. The network equipment includes multiplexers, multiple

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access systems, Packet Assemblers Dissemblers (PADs), sate11ite modems etc. IP phone, IP gateway, IP gatekeeper etc. are the latest embedded systems that provide very low-cost voice communication over the Internet.

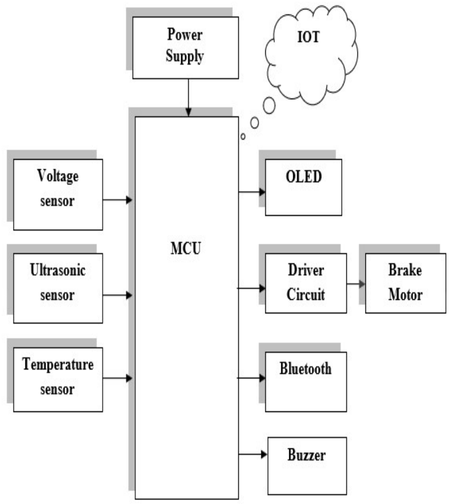
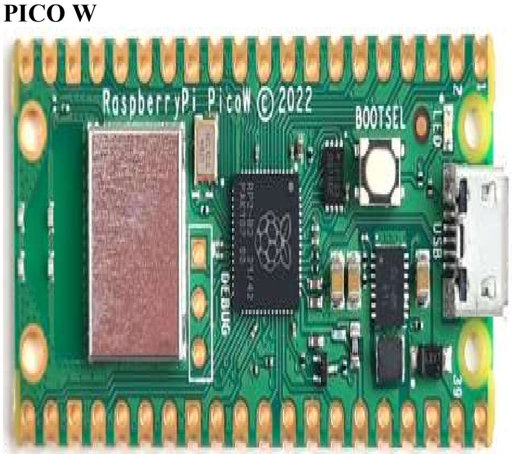


Fig: Block Diagram of Power Supply

MICROCONTROLLER: RASPBERRY PI PICO W



Raspberry Pi Pico W is **Raspberry Pi**'s first wireless microcontroller board, designed especially for physical computing. It is the successor of the popular **Raspberry Pi Pico** board. Similar to the Pico board, which we discussed earlier, the **Pico W** board is also built around the **Raspberry Foundation** in-house ARM chip RP2040. The main improvement is the addition .of Wi-Fi and Bluetooth functionality. **Raspberry Pi Pico W** incorporates an Infineon **CYW43439** wireless chip that supports IEEE 802.11 b/g/n wireless LAN, and Bluetooth 5.2.

Raspberry Pi Pico Vs Raspberry Pi Pico W

The main difference between the **Pico** and **Pico W** is the inclusion of Infineon's CYW43439 2.4-GHz Wi-Fi chip, which is responsible for WiFi and Bluetooth. Another major change is with the power section. The new Pico W uses the **RT6154A** from **Richtek** as the power regulator instead of the **RT6150B** in the original Pico design. The debug port also moved near the SoC to make space for the Wi-Fi antenna.

MODULES

a) **POWER SUPPLY**

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.

The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

Transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in India) to a safer low voltage.

Rectifier

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying Dc

Bridge Rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

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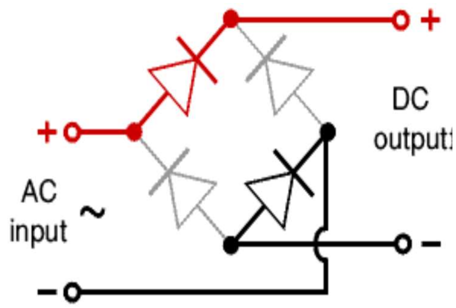

Implementation

The proposed system consists of an IoT-based automated braking and battery monitoring system designed for electric vehicles (EVs). The implementation integrates sensors, a microcontroller, a Wi-Fi communication module, and a cloud-based monitoring application to improve vehicle safety and battery management.

Hardware Implementation

The hardware setup includes an ultrasonic sensor, temperature sensor, voltage sensor, microcontroller, braking control unit, battery, and Wi-Fi module. The ultrasonic sensor is mounted at the front side of the EV to continuously detect obstacles present in the vehicle path. The sensor measures the distance between the vehicle and the obstacle using ultrasonic waves.

A low-cost microcontroller is used as the central processing unit of the system. It receives distance data from the ultrasonic sensor and battery parameters from the monitoring sensors. Based on the received information, the controller processes the data and performs the required control actions.

The temperature sensor monitors the battery temperature continuously to prevent overheating conditions, while the voltage sensor measures the battery voltage level to determine battery health and charging status. The collected parameters are transmitted to the microcontroller for analysis.

The braking mechanism is connected to the controller through a motor driver or relay circuit. When the detected obstacle distance becomes lower than the predefined threshold value, the controller automatically activates the braking system to reduce vehicle speed or stop the vehicle, thereby preventing collisions.

The Wi-Fi module enables wireless communication between the EV system and the cloud platform. The processed battery parameters such as voltage, temperature, and battery status are uploaded to the Blynk application for real-time monitoring.

Software Implementation

The software part of the system is developed using embedded C/C++/Python programming in the Arduino IDE environment. The control algorithm continuously reads sensor values and executes decision-making operations.

The implementation process includes the following steps:

1. Initialization of sensors, Wi-Fi module, and controller peripherals.
2. Continuous acquisition of obstacle distance using the ultrasonic sensor.
3. Monitoring of battery voltage and temperature values.
4. Comparison of obstacle distance with predefined safety limits.
5. Automatic activation of the braking system when an obstacle is detected within the unsafe range.
6. Transmission of battery and system parameters to the Blynk IoT platform using Wi-Fi communication.
7. Real-time display of EV parameters on the Blynk mobile application.

The Blynk application provides a user-friendly graphical interface for monitoring battery conditions remotely. Users can observe live voltage levels, battery temperature, and warning notifications directly through the smartphone.

Working Principle

During vehicle operation, the ultrasonic sensor continuously scans the road ahead for obstacles. If the measured distance is safe, the vehicle operates normally. When an obstacle is detected within the critical range, the microcontroller generates a control signal to activate the braking mechanism automatically.

Simultaneously, the battery monitoring system measures voltage and temperature values in real time. These parameters are transmitted through the Wi-Fi module to the Blynk cloud server, enabling remote monitoring and analysis of EV battery performance.

Thus, the proposed implementation enhances vehicle safety through automatic braking and improves battery management through IoT-based real-time monitoring.

Results and Discussion

The proposed IoT-based automated braking and battery monitoring system for electric vehicles was successfully designed and tested under different operating conditions. The system demonstrated effective obstacle detection, automatic brake activation, and real-time monitoring of battery parameters through the IoT platform.

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

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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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