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Design of IoT Based Battery Monitoring System for E-Vehicle

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ABSTRACT: This paper describes the application of Internet-of-things (IoT) in monitoring the performance of battery in e vehicle. It is clear that an electric vehicle totally depends on the source of energy from a battery. However, the amount of energy supplied to the vehicle is decreasing gradually that leads to the performance degradation which makes great problem to battery manufacture. In this work, the idea of monitoring the performance of the vehicle using IoT techniques is proposed, so that the monitoring can be done directly. Based on experimental results, the system is capable to detect degraded battery performance and sends notification messages to the user for further action.

KEYWORDS: E Vehicle, IoT, Automation, Battery Technology

I. INTRODUCTION

Nowadays, electric vehicle (EV) is becoming popular since the fuel prices becoming more expensive. Due to this scenario, many vehicle manufacturers looking for alternatives of energy sources other than gas. The use of electrical energy sources may improve the environment since there is less pollution. In addition, EV produces great advantages in terms of energy saving and environmental protection. Most EVs used rechargeable battery which is lithium ion battery. It is smaller to be compared with lead acid. In fact, it has a constant power, and energy's life cycle is 6 to 10 times greater compared with lead acid battery. Lithium ion battery life cycle can be shortened by some reasons such as overcharging and deep discharges. On the other hand, EV usually has limited range of travelling due to battery size and body structure. Now, an important reason that limits the application of EV is the safety of existing battery technology.

For example, overcharging battery not only could significantly shorten the life of the battery, but also cause serious safety accidents such as fire. Therefore, a battery monitoring system for EV that can notify the user about battery condition is necessary to prevent the stated problems. Previous battery monitoring system only monitors and detects the condition of the battery and alarmed the user via battery indicator inside the vehicle. Due to the advancement of the design of notification system, internet of things (IoT) technology can be used to notify the manufacturer and users regarding the battery status. This can be considered as one of the maintenance support procedure that can be done by the manufacturer. IoT utilizes internet connectivity beyond traditional application, where diverse range of devices and everyday things can be connected via the internet, making the world is at the user's finger tips.

II. PROPOSED METHOD

Manual battery monitoring system is like normal battery monitoring system which means that it does not save the data into the database. But only show the data collected in real time. Therefore, it is essential to remotely monitor battery systems using wireless technology. There are various battery monitoring system using wireless communication that have been developed for the industry such as uninterruptible power supply (UPS) which is important to ensure continuity of power supply for domestic and commercial during power interruption. The proposed battery monitoring system in this work is consists of a voltage sensor and IOT system. Experiments and analysis to show the characteristics and usefulness of the sensor and module have been presented in the previous subsections.



A. Proposed Block Diagram

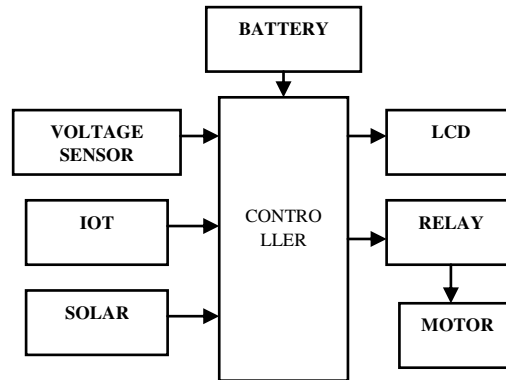


Figure 1. Proposed Block diagram

B. Block Diagram

The Arduino UNO board because it is the most popular board in the Arduino board family. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. An electric motor is an electrical machine that converts electrical energy into mechanical energy. IoT communication protocols are modes of communication that protect and ensure optimum security to the data being exchanged between connected devices. The implementation of a voltage sensor and current sensor techniques has become an excellent choice for the conventional current and voltage measurement methods. Solar power is the conversion of energy from sunlight into electricity, either directly using Photo Voltaic (PV), indirectly using concentrated solar power, or a combination. Typical batteries most often produce electricity by chemical means through the use of one or more electrochemical cells.

C. Photovoltaic Cell

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells must be connected electrically in series, one to another.



Figure 2 : Photovoltaic Cell

D. Lead Acid Battery

The lead–acid battery is the oldest type of 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 means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by automobile starter motors. This project is using dual 6v battery on the roller.

E. DC Geared Motor

It is a classical motor and has been used in motor control for a long time. All the power involved in electromechanical conversion is transferred to the rotor through stationary brushes which are in rubbing contact with the copper segments of the commutators. It requires certain maintenance and has a shorter life time. However, it is suitable for low power application. It has found applications in electric wheel-chair, transporter and micro-car. Today, most of the golf-carts are using DC motors. In this project, by using Geared motor on 12v, 60 RPM rating is shown in the figure

F. Relay Module

The Relay is an electrically operated switch. Relays are used to control a circuit by a low- power signal (with complete electrical isolation between control and controlled circuits), or where several circuits need to be controlled by signal. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the contact of the switch. The rating of relay is 12V/5A..

G. LCD Monitoring

LCD use a liquid crystal to produce a visible image .Liquid crystal display screen works on the principle of blocking light rather than emitting light.16*2 display the input of motor speed is given the motor runs and the output is displayed in the display.

H. Boost Converter

A boost converter is one of the simplest types of switch mode converter. As the name suggests, it takes an input voltage and boosts or increases it. All it consists of is an inductor, a semiconductor switch (these days it's a MOSFET, since you can get really nice ones these days), a diode and a capacitor. Also needed is a source of a periodic square wave. As you can see, there are only a few parts required to make a boost converter. It is less cumbersome than an AC transformer or inductor.They're so simple because they were originally developed in the 1960s to power the electronics systems on aircraft. It was a requirement that these converters be as compact and as efficient as possible.

I. Bluetooth Module

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

III. HARDWARE IMPLEMENTATION

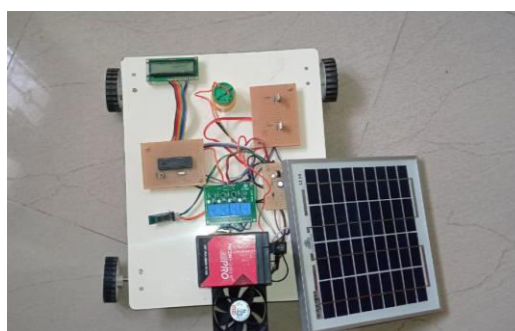


Figure 3. Hardware Implementation

Initially, in order to verify the suitability of the hardware parts, the design of the system was developed using Fritzing software. Figure 3 illustrates the circuit design of the system. The figure show the system is consists of a voltage sensor, an Arduino Uno microcontroller, a SIM808 GSM/GPRS/GPS module and a 9V battery for power supply.

IV. CONCLUSION

The design and development of an IoT-based battery monitoring system for electric vehicle to ensure the battery performance degradation can be monitored online. The objective is to proof that the concept of the idea can be



realized. The development of the system consists of the development of the hardware for the battery monitoring device and a web-based battery monitoring user interface. The system is capable to show information such as location, battery condition and time via internet by incorporating IOT system to detect the coordinate and display it on the Google Maps application further modification can be done to improve the system by adding more functions into the system. The system can be used in smartphones by developing smartphone application that can help user to monitor battery and as a battery degradation reminder. In order to enhance the internet connection, Ethernet can be used to get a better internet connection compared to GPRS.

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