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Battery Monitoring for E-Scooter Using Internet of Things

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ABSTRACT: This method describes the application of Internet-of-things (IoT) in monitoring the performance of electric scooter. 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. This is a major concern for 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. The proposed IoT-based battery monitoring system is consists of two major parts i) monitoring device and ii) user interface. 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 are 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 monitor and detect 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.

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II. SCOPE AND OBJECTIVES

Wireless communication is a type of data communication that is performed and delivered wirelessly. This is a broad term that incorporates all procedures and forms of connecting and communicating between two or more devices using a wireless signal through wireless communication technologies and devices. From the previous work there are several types of technology that have been used for wireless battery monitoring system such as GSM, ZigBee, GPRS, Android, WIFI and Bluetooth communication. Global Positioning System (GPS) utilizes GPS satellite to transmit data that provides location and the current time to a GPS receiver globally. It synchronizes the operation so that these repeating signals are transmitted at the same instant. The signals, moving at the speed of light, arrive at a GPS receiver at slightly different times because some satellites are further away than others. The distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver. When the receiver estimates the distance to at least four GPS satellites, it can calculate its position in three dimensions.

III. 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

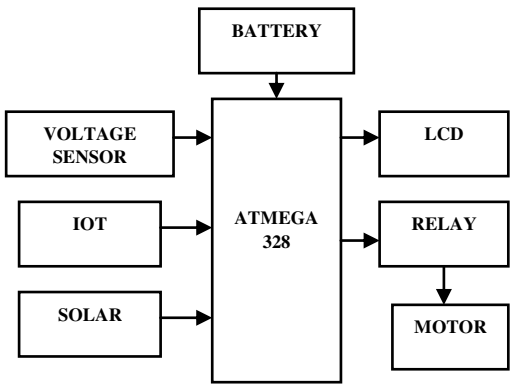

Figure 1. Proposed Block diagram

B. Block Diagram Explanation

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.

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C. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

D. Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this is the conversion of mechanical energy into electrical energy and is done by an electric generator, which has much in common with a motor. Most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force. In certain applications, such as in regenerative braking with traction motors in the transportation industry, electric motors can also be used in reverse as generators to convert mechanical energy into electric power. Found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives, electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as from the power grid, inverters or generators.

E. Solar

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. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect. Photovoltaic were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system.

F. Voltage Sensor

Sensors are devices that can sense or identify and react to certain types of electrical or optical signals. The implementation of a voltage sensor and current sensor techniques have become an excellent choice for the conventional current and voltage measurement methods. A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.

G. Battery

A battery is a device that stores energy and then discharges it by converting chemical energy into electricity. Typical batteries most often produce electricity by chemical means through the use of one or more electrochemical cells. Many different materials can and have been used in batteries, but the common battery types are alkaline, lithium-ion, lithium-polymer, and nickel-metal hydride. Batteries can be connected to each other in a series circuit or a circuit. There is a wide variety of batteries that are available for purchase, and these different types of batteries are used in different devices. Large batteries are used to start cars, while much smaller batteries can power hearing aids.

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IV. SIMULATION RESULT

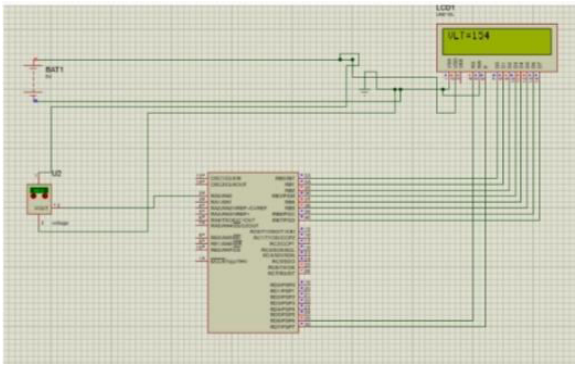

Figure 2. Simulation Result

Proteus isn't a name that rings a bell. If you work in the medical field you've probably heard of it because it's a bacteria genre that includes different species such as mirabilis or vulgaris that reside in our digestive tract. But beyond microbiology, in the software sector, it turns out to be one of the most acclaimed electronic design programs by engineering students and electronics professionals, capable of offering us an advanced simulation of electronic circuits and microprocessors.

V. HARDWARE IMPLEMENTATION

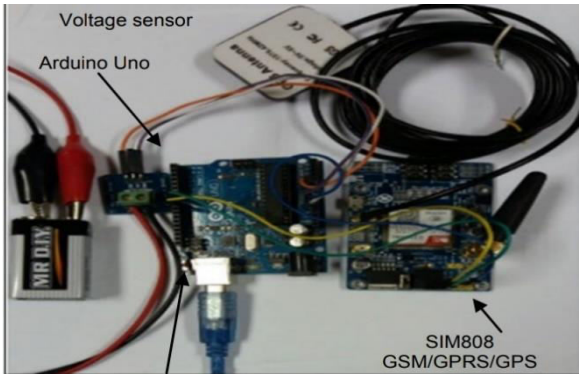

Figure 3. Hardware Implementation

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.

VI. 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

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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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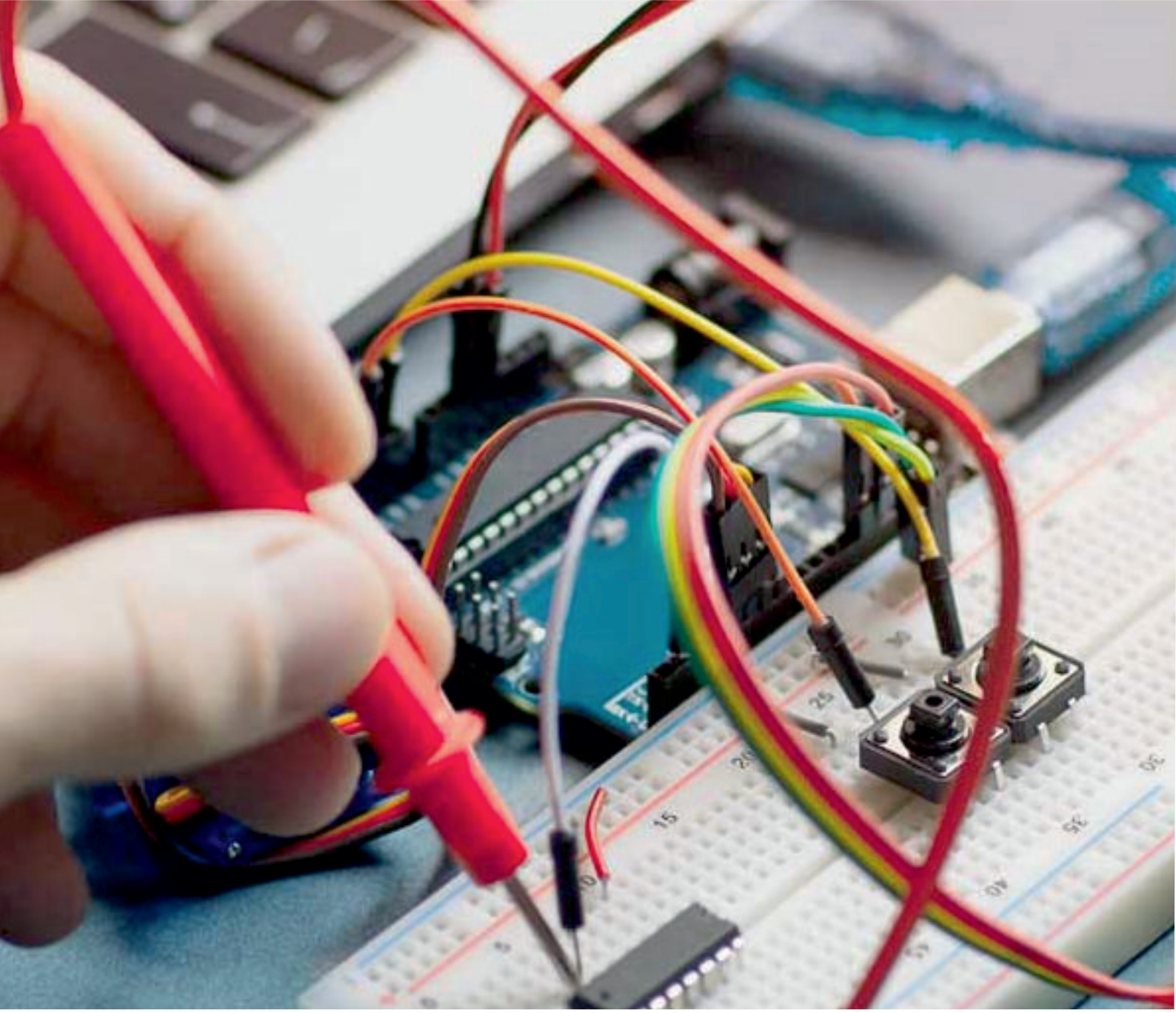

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