Predictive Maintenance And Battery Life Saver for Electric Vehicle

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Abstract: In today's era, due to inflation, environmental pollution and expensive maintenance of diesel vehicles, people will definitely think about the use of electric vehicles as an alternative. Electric vehicles are made up of two main components such as BLDC motor and battery which are used for energy storage device. The prototype of this device is necessary to optimize the use of batteries and is designed to monitor and detect the battery status. By using the parameters of voltage and current, the battery status will be predicted. These parameters are managed by the BMS (Battery Management System). In addition to this, the battery status will be displayed to the Android phone by the use of Wi-Fi communication. It will display the temperature of vehicle, nearby charging station and status of the battery through TFT display. It will also alert you before the battery become drain. In case, there is no other charging station nearby and the primary battery is drained completely the system will automatically switch to the secondary battery and it is being charged by power that is produced when the vehicle runs.

Keywords: Battery, BMS, Microcontroller, BLDC motor, TFT display, Voltage sensor, Current sensor.

1. Introduction

The requirement for green innovations significantly affects the automobile business. The fuel consumption of conventional cars has attracted worldwide attention. As a result, the need for green electric vehicles is increasing. Currently, many designs have been done on electric vehicles. Especially on battery maintenance and battery design. Batteries should be long lasting and also it should be minute. Therefore, to control battery operation, the battery should be compact.

Rechargeable battery materials and chemistry, rechargeable systems are generally too large and inadequate. This means that an energy consumption of more than 40% to 50% is guaranteed. This increases the weight, volume and purchase costs. An effective battery management system is necessary to reduce this conservatism. Load status display, health status is precisely controlled. Pluggable cells must have similar electrical properties.
A multi-level connection battery management system can eliminate these limitations. In addition to this method, there is another system to manage battery communication between the master and the slave cards. This method has advantages in terms of program code efficiency and is easy to develop. The system has excellent performance and is easy to adjust.

1.1 State of charge

The state of charge is the necessary parameter for the batteries and the relationship between the remaining capacity and the total capacity of value is monitoring. The entirely charged state is 100 percentages and the state of discharge is 40%, but the battery capacity may vary depending on the discharging current and voltage stop.

1.2Battery Management System (BMS)

Lithium-ion batteries are used for portable electronics and electric vehicles for their light weight. Despite they can be oversized and they are inherently very unstable. It is very important that these batteries are never recharged or discharged. Hence, it is important to control the voltage and current. This interaction is an extraordinary administration framework called uncommon on the grounds that numerous phones are collected to shape an EV battery and every phone should be observed separately for protected and effective activity. It's a little more complicated because it requires a system. In addition, to get the most out of the battery, all items must be fully charged and discharged at the same voltage at the same time, which again requires BMS. In addition, BMS is responsible for many other functions described below.

1.3 *Battery Loss and Efficiency*

The deficiency of energy during charging or releasing is addressed by a deficiency of voltage. Battery performance can be determined by the relationship between the discharged voltage and the charge. The battery terminal voltage is low during discharge and, when charging, above potential due to chemical reactions. If the charge is low, the battery charging efficiency will be high. Since the point of maximum efficiency is in the range of 50% CHARGE, the battery management system of the electric vehicle system places the CHARGE battery in the medium range to improve operational efficiency and increase the temperature caused by the loss of energy represented. It must be deleted.

1.4 Unbalanced Cell Voltage

The battery contains series and parallel batteries. Since each battery cell has a different internal barrier, the voltage of the battery cells may not match the voltage of the other cells. This condition will worsen if it is not interrupted and the minimum voltage of the battery cells will decrease. A problem with one of the battery cells will result in suboptimal. BMS has been observed using the concept of master and slave plates. BMS has a few sensors introduced, in particular temperature, voltage and current sensors. The parameters received in real time from each sensor are displayed on the mobile Bluetooth interface. So, you can learn and analyze battery performance in real time. The oddity of this investigation was that the BMS was utilized as an application to screen the condition of the battery and recognize the territory of EV electric vehicles with portable interfaces.

2. **Existing System**

In this existing system, concerns about the reduction of fossil fuel reserves and the increase in pollution problems have increased considerably in recent years. Electric vehicles increasingly promise to shift traditional energy demands from raw fossil energy to electricity in the transportation sector. A dispersed charge convention for electric vehicles has been acquainted with utilize the versatility of electric vehicle burdens to fill the channels of the charge profile. Facilitated various leveled control has been acquainted with organize the charging of battery-powered electric vehicles (EPI) in structures.
Disadvantages

- Great loss of renewable energy.
- Safe system maintenance required highly skilled operators.
- Project reduction the cost reduction period is behind expectations.

3. Proposed System

The plan of the venture is done in two phases, the equipment part and programming area. The software part is achieved using Arduino software. The hardware part is done by using ESP32 microcontroller, temperature, voltage, current sensors and BMS system.

This project will overcome the previous drawbacks by the use of BMS system as shown in the figure 3.2. By the use of sensors, the status of the battery will be predicted. The BLDC motor is powered through the ESI driver and the TFT display used in this system will display the following parameters such as amount of charge available in the system, temperature of the battery and average kilometres the battery will remain. It will also display the nearby charging station and the remaining kilometres to reach the charging station this operation is performed through GPS as shown in the figure 3.1. Initially, the primary battery is used to run this system. In case, if there is no other charging stations nearby it will automatically switch to the secondary battery when the primary battery is completely drained off.

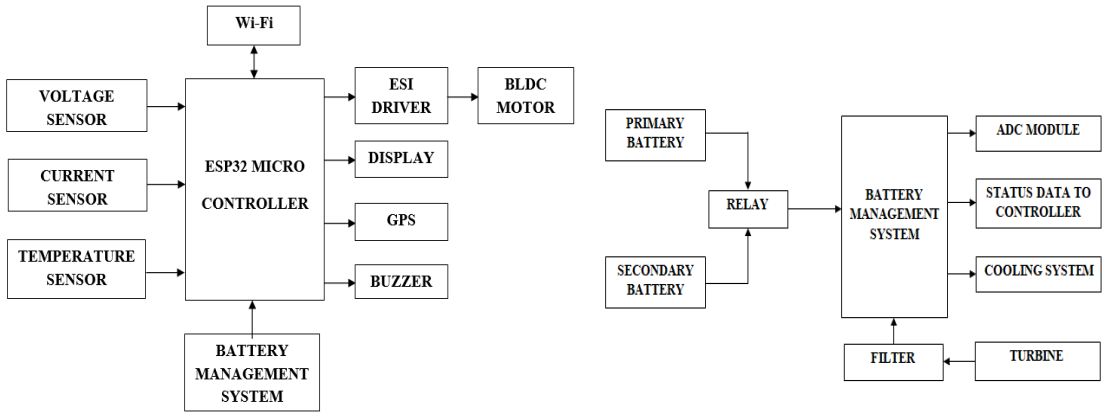

Figure 3.1: Proposed system block diagram **Figure 3.2**: BMS block diagram

3.1 System Receiver

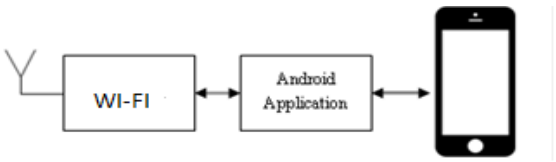

Figure 3.3: Mobile phone Wi-Fi interface

For the working of this system, the voltage sensor will initially measure the voltage level of the lead-acid battery. At the same time, mobile applications based on the Bluetooth interface use the mobile GPS function to read the position of the car. Battery voltage readings and vehicle position are sent to ESP32. The above figure 3.3 shows that the processed data is transported wirelessly to the computer's memory via the mobile APP. If the data is successfully transferred then, the computer's battery monitoring interface will display the updated battery status data. An email notice is shipped off tell the client when the battery is low.

3.2Circuit Diagram

The representation of circuit diagram is shown in figure 3.4

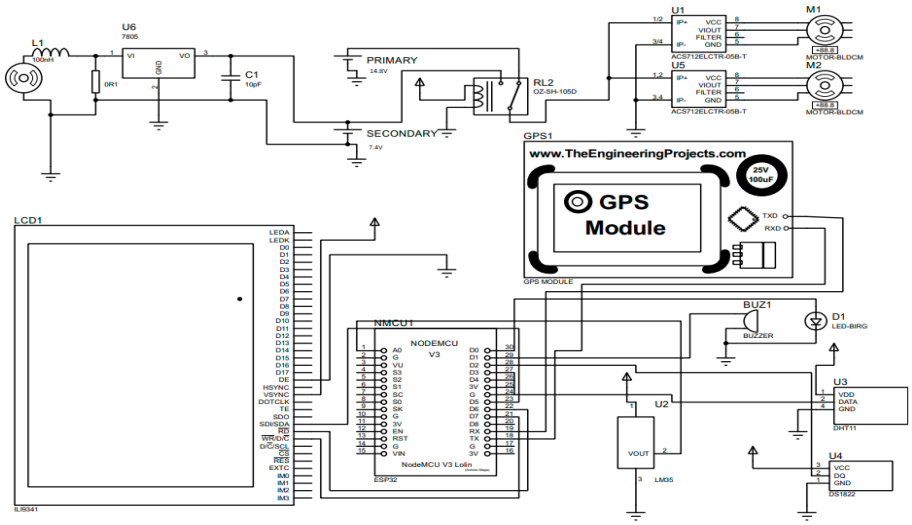

Figure 3.4: Circuit Diagram

3.3Advantages

- It requires initial capital cost and maintenance cost rather than automobiles.
- We will have a backup plan, even though the battery gets discharged.
- Easy prediction of the battery charge, discharge and nearby charging stations.

3.4Applications

- It can be used in the electric vehicle for their maintenance.
- Used in the electric vehicles to find the nearby charging stations.

The main aim of this project is to show the status of the battery to the user through battery management system whether it is full charge or 0%. In addition to this, by optimizing the use of battery, all the information will be displayed to the android phone by the use of Wi-Fi communication. It will notify you the nearby charging station before the battery goes to the dead condition. It will automatically activate the secondary battery when primary battery drains out.

4. Software Description

The ESP32 is a series of Charge's (System on Chip). They contain a MCU, Wi-Fi, and integrated Bluetooth. It was created to have low utilization and ease, and it is an exceptionally fascinating alternative for creators or engineers of items. It tends to be found in certain varieties, from the chip going through modules and improvement sheets. There is likewise the simplicity of utilizing USB-Serial converters on these advancement sheets that make the correspondence interaction with ESP32 a lot simpler.

IFTTT Application:

IFTTT android app will display the battery status of the electric vehicle through the smart phones.

5. Results

Initially electric vehicles run using the main battery. When the battery gets discharged before it reaching the destination or a charging station, the vehicle will stops. At that time an alternate battery/self driven battery is used to charge the discharged battery. The alternate battery is fixed in the vehicle and it gets automatically charged by the EMF generated from the wheels of the moving vehicle. When the main battery gets discharged it will switch over to alternate battery this process is performed by the use of relays. By this way the alternate battery gets charged and the consumer need not depend on charging station. Then live GPS location tracking and live battery status view on website. Fig 6.1 & 6.2 shows the arrangement and output of the system.

Figure 6.1: Snapshot of Hardware setup

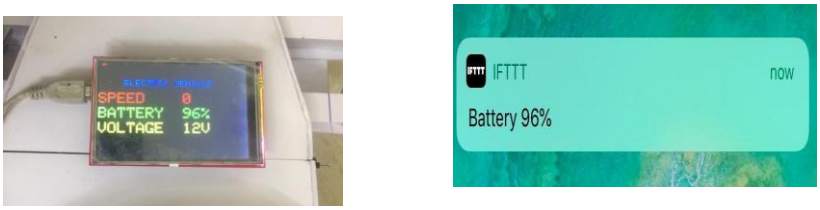

Figure 6.2: Snapshot of Hardware output and battery status through android phone

6. Conclusion

The progress of electric vehicle in recent years is not only welcomed, but also highly necessary in the increasing global greenhouse gas levels. The biggest obstacle to adopt for the electric-vehicle is the battery life is hard to predict and availability of charging station in our locality. This project is to overcome the incognizant knowledge in the prediction of charging, discharging and the nearby charging station in our locality. This system will automatically shift to a backup plan when the primary battery becomes drain.

7. Future Scope

In future, battery charging in electric vehicle will be wireless and the range of battery will increase. Charging station location will be navigated in the map

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