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Solution for Predictive Maintenance and Battery Life Saverfor Electric Vehicles

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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, it will display the voltage and current, battery parentage of vehicle, status of the battery through LCD 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 with the help of relay.*

Keywords: Battery, BMS, Micro-controller, Motor, LCD Display, Voltage Sensor, Current Sensor, Relay, etc.

I. INTRODUCTION

A battery is an electrical energy storage system that can store a considerable amount of energy for a long duration. A battery management system (BMS) is a system control unit that is modeled to confirm the operationalsafety of the system battery pack. The primary operation of a BMS is to safeguard the battery. Due to safety reasons, cell balancing, and aging issues, supervision of each cell is indispensable. Moreover, BMS ensures the preset corrective measures against any abnormal condition at the system infrastructure. Besides, since the system temperature affects the power consumption profile, BMS also confirms the proper procedure to control the system temperature. In, authors discussed the battery management systems in electric and hybrid vehicles.

This project will overcome the previous drawbacks by the use of BMS system as shown in the figure. By theuse of voltage and current sensors, the status of the battery will be predicted. The LCD display used in this system will display the following parameters such as amount of charge available in the system, voltage and current of the battery. the primary battery is used to run this system. In case, if there are no other charging stations nearby it will automatically switch to the secondary battery when the primary battery is completely drained off with the help of relay.

II. OBJECTIVES

- To provide battery backup during unwanted conditions.
- To display battery charging, battery voltage, battery current.
- Able to control through IOT.

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III. LITERATURE SURVEY

[2] The vehicles emitting organic compounds, Pd, nitrogen oxide and carbon monoxide have done significant pollution of air. World population is growing by an extremely high rate so that the vehicle usage is also rising with the rise of the population. Fossil fuel is the main energy resource of these vehicles. In 21th century oil production reached a peak. Estimates indicate that petroleum and natural gas will be run out by the year 2042 (Shafiee and Topal, 2009). After inventing the lead acid batteries and the electric motors in late 1800s, the first electric vehicles were invented. In the early 1900s, electric vehicles were very popular and that time is called the golden period of electric vehicles. After the arriving of gasoline powered vehicles almost every electric vehicle was disappeared due to limitation of range, long charging time, heavy weight and poor durability of batteries (Young, Wang, and Wang, 2013) (Kulkarni, Kapoor, and Arora, 2015).
Because of gas emission laws and air pollution automobile manufactures were forced to manufacture lowcarbon emission vehicles so the electric vehicle manufacturing is increasing today (Sagar, 1995) (Kulkarni, Kapoor, and Arora, 2015). Electric vehicles present an excellent alternative to the current fossil fuel powered vehicles due to several reasons. Low noise and zero emission are some main reasons why people buy electric car now days. Electric vehicles are perfectly suitable for urban environment thus they are very compact, not as wasteful as internal combustion engines in traffic and the limited range is not a matter in the urban environment (Sagar, 1995). Internal operation of electric vehicles is similar to the internal combustion vehicles. Like in combustion vehicles, electric vehicles have an electric motor, an ECM, a battery, battery management system with regenerative braking system a charger and a cooling and heating system.

[3] There are two types of motors used in electric vehicles AC motors, and DC motors. DC motors are easily control when comparing with AC motors and also less expensive than AC motors. However, DC motors are larger and heavier than the AC motors. Hence the electric motors have high torque acceleration of an electric vehicle is quicker than the internal combustion engine. That property can use to build fast electric racing cars because in races instant torque is much help full. Electric vehicle also has a feature called regenerative breaking and by using that feature the vehicle can generate electricity by own kinetic energy that can be stored in super capacitors. Electric vehicles sales are increasing rapidly when we compare the sales data for previous years. That shows that the demand for electric vehicles is higher now days.
With the rise of the demand, much more research must be done to develop the EV technology. A cell of a battery is consisting of an anode and a cathode and all the chemical process happen between those two. Other than the electrodes a battery has separators, terminals, electrolyte and a case (Dhameja and Dhameja, 2000). A battery has one negative terminal and a one positive terminal. The electrolyte can be a gel, solid or liquid according to the battery type and it can be acidic or alkaline (Dhameja and Dhameja, 2000).

[4] For an example electrolyte of a lead-acid battery is sulphuric acid and the negative terminal is made by pure lead and the positive terminal is made by lead-dioxide. In late 80's there were electric vehicles but failed, in early 90's due to lack of battery technology (Kulkarni, Kapoor, and Arora, 2015). Nevertheless, in 1990s due to climate change governments looked forward to develop electric vehicle. For example, the U.S. Advanced battery consortium (USABC) was formed to develop electric vehicle batteries (Dhameja and Dhameja, 2000). Therefore, the electric vehicle battery technology was developed up to now passing so many stages.
Electric vehicle batteries should have some special properties rather than the normal batteries like laptop and cell phone batteries. The battery should have high energy density to travel long range. The battery should give a stable output with different acceleration and it should have a higher C rate. Long life cycle is more important for electric vehicle battery and the maintenance cost also should be low. Also, the battery must be environmentally friendly and recycling must be possible (Dhameja and Dhameja, 2000). Battery characteristic of some batteries displayed in below table. Referring the table, we can see that Li-polymer has the highest energy density with respect to the Li-ion but considering the battery safety Li-polymer is dangerous to use in electric vehicle because in a collision the battery can be exploded.

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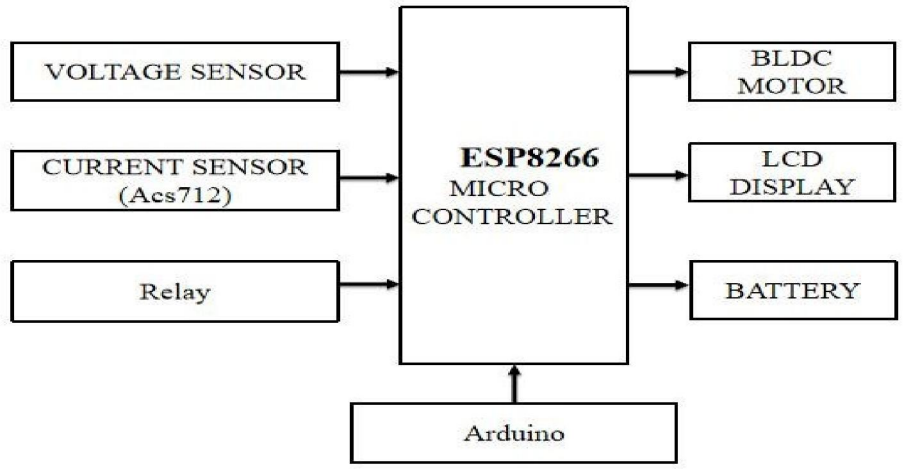
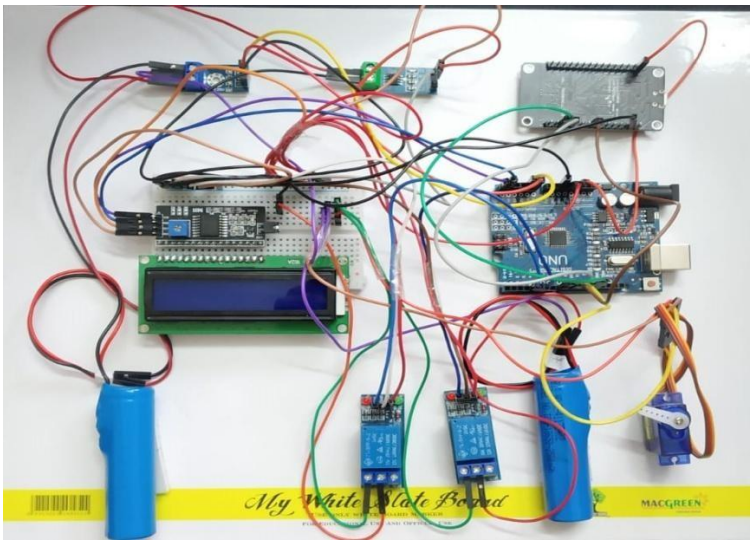


Figure: System Block Diagram

IV. PROPOSED METHODOLOGY

This project will overcome the previous drawbacks by the use of BMS system as shown in the figure. [5] By the use of sensors, the status of the battery will be predicted. the display used in this system will display the following parameters such as amount of charge available in the system, The primary battery is used to run this system. In case, if there are no other charging stations nearby it will automatically switch to the secondary battery with the help of relay, when the primary battery is completely drained off.



V. CONCLUSION

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 stop. 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.

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It is indeed a great pleasure and moment of immense satisfaction for we to present a project report on "**Solution for Predictive Maintenance and Battery Life Saver for Electric Vehicles**" amongst a wide panorama that provided us inspiring guidance and encouragement, we take the opportunity to thanks to thanks those who gave us their indebted assistance.

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