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Battery Management System in Electric Vehicle

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ABSTRACT: Monitoring of Electrical Vehicle EV charging ecosystems is essential to identify the parameters that determine their condition. The data derived from the sensors used to monitor them are a fundamental source for the development of models. To predict the behavior of conditions of the battery and charging station, the voltage level and the other inhabiting it. A design and implementation for a new multisensory monitoring system for battery management system (BMS). The system design is based on a number of fundamental requirements that set it apart from other recent proposals. For the state of health (SOH), a variance-based detection scheme is proposed to provide degradation prediction and fault detection battery in EV.

KEYWORDS: Electric Vehicle, Battery Management System, State of Health

I. INTRODUCTION

The electric vehicle drivetrain offers new freedom in terms of electric vehicle architectures while leading to new challenges in terms of meeting all requirements. Since electric vehicles have an electric motor and a battery instead of a combustion engine and a fuel tank, the architecture becomes simple and controllable at the component level. Modifications to locate the battery pack safe zone in an EV require extensive adoptions to integrate the battery safely. State-of-Health (SOH) estimation is of utmost importance for the performance and cost-effectiveness of electric vehicles. Incremental capacity analysis (ICA) has been ubiquitously used for battery SOH estimation. However, challenges remain with regard to the characteristic parameter selection, estimation viability and feasibility for practical implementation. In this paper, a novel ICA-based method for battery SOH estimation is proposed, with the goals to identify the most effective characteristic parameters of IC curves, optimize the SOH model parameters for better prediction accuracy and enhance its applicability in realistic battery management systems. To this end, the IC curve is first derived and filtered using the wavelet filtering, with the peak value and position extracted as health factors (HFs). Then, the correlations between SOH and HFs are explored through the grey correlation analysis. The SOH model is further established based on the Gaussian process regression (GPR), in which the optimal hyper parameters are calculated through the conjugate gradient method and the multi-island genetic algorithm (MIGA). The effects of different HFs and kernel functions are also analysed. The effectiveness of the proposed MIGA-GPR SOH model is validated by experimentation.

Ocean wave is one of the promising renewable energy sources all around the world. In this paper, an electromagnetic ocean wave energy harvester (OWEH) based on efficient swing body mechanism is presented. A swing body senses the ultra-low frequency wave motion and drive the rotor of an electromagnetic power module (EPM) rotating at high speed through transmission gears. A series of electromagnetic and dynamic simulations were carried out to optimize the power generation capability of the OWEH. Additionally, the power management circuit is specially designed such that the generated power is able to charge a lithium battery and discharge an external load automatically. The OWEH is installed inside an ocean buoy and tested in the Yellow China Sea. When the peak wave height is greater than 0.6 m, the maximum peak-to-peak output voltage is 15.9 V. The corresponding output power is as high as 0.13 W and the maximum power density is 0.21 mW/cm^3, where the internal resistance of the OWEH is 122 Ω. Due to the high performance and adaptability, the OWEH can potentially power many low power components, which opens a promising way for improving the life of ocean buoys. Considering the small dimension of $10 \times 10 \times 6.3\ cm^3$, this OWEH can be mounted inside most buoys easily and realize the self-powered ocean buoys in the near future.

II.EXISTING SYSTEM

Battery models can be categorized into electrochemical and equivalent circuit models (ECMs). An electrochemical model represents the internal reactions and physics of a battery cell. However, due to their high computational complexity, it is quite challenging to use them with estimation algorithms and in real-time. On the other hand, ECMs can be easily parameterized by experimental data using system identification techniques. Although the identified parameters of ECM models do not reflect the physical reaction within a battery cell, the accuracy of SoC estimation is sufficient for a BMS within bounded operating region. However, the battery model considered onboard of a BMS, cannot represent the inevitable degradation happening inside the battery over time. The BMS should therefore be able to indicate the battery SoH and determine its capacity to store energy. An indicator for SoH is the internal resistance or the capacity of the battery. The aging affects the battery's characteristics and in turn its model. Therefore, the BMS must be able to update the parameters of the model as the battery ages.

Now-a-days, mobile phone is used almost by all people. With internet usage are also at all. So these mobile phone also provide communication platform as they are equipped with 2G & 3G network. There are lots of cause of accident of car and they are drunkenness of driver, drowsiness of driver, unconsciousness of driver and many time what happen driver is not responsible for accident but their neighboring car behavior also have made role to enforce accident. There are also some system have been implemented to avoid the accident but that do not give proper solution to implemented in car to avoid various accidents that they are normally being happen. For example, when driver at speed suppose 80km/h suddenly stop ignition system may leads to changes of dangerous accident. There are several efforts, application: approaches are projected to produce security and safety just in case accident. A completely unique approach to extend the protection of road travel victimization the ideas of wireless detector network and therefore the Bluetooth protocol has been protected.

It mentioned however, vehicles will type mobile ad-hoc network and exchange information perceived by the onboard sensor. Platform of the robot in operation system and software system development atmosphere well-tried optimum resolution for public safety just in case of accident. An honest survey of victimization personal itinerant, Microcontroller, Bluetooth and JAVA Technology has been well tried. It developed integrated system to manage, management associated monitor accessories within the vehicle so as to attain the concept of an intelligence automobile with ability to uses personal mobile hand phone as a far of interface. Sensible phone-based accident detection will scale back overall traffic jam and awareness of emergency responders. This approach conjointly has been projected.

III.PROPOSED SYSTEM

Reliable battery management is necessary for safety purposes. There are several reasons that cause battery breakdown such as deterioration of battery and design defects. 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 which is important to ensure continuity of power supply for domestic and commercial during power interruption. The system consists of several devices such as bluetooth that sends signals to the interface, where the function of the interface itself is to display measured data so that the user can read it. The test object of an electric vehicle is a battery pack. Each battery pack consists of 12V/48V battery, with the arrangement of 2 or 3 parallel batteries. In the battery pack there are multi cells arranged in series. In the battery several sensors are installed such as temperature sensors, current sensors, voltage sensors. In the BMS module, there are several sensors installed. In BMS there is a master board, slave board and auxiliary board for the CAN bus slot to USB.

BLOCK DIAGRAM OF PROPOSED SYSTEM

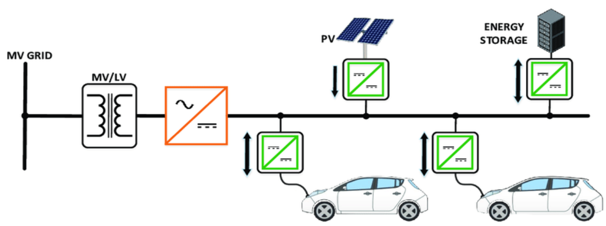

Figure.1.Overview of EV Charging Station

Figure depicts the overview of the proposed system. In order for the system to work, initially, the voltage sensor measures the lead acid battery's voltage level. At the same time, a bluetooth interface based mobile application reads the location of the vehicle by using the mobile GPS function. The battery's voltage level readings and location of the vehicle are conveyed to an Arduino NANO microcontroller for processing. As shown in the figure, the processed data are sent to a battery monitoring user interface in a computer wirelessly using the mobile apk. Once data transfer is successful, the battery monitoring interface on the computer will show the updated data of battery status. When the battery produced low voltage level, a notification email is sent to notify the user. The online battery system not only can measure the voltage of the batteries but also communicate with the battery monitoring system to get the parameter of batteries. The detail design of the system is described in the next sections.

The purpose of the project is to design a bidirectional DC/DC converter to implement the function of controlling the energy transfer between the batteries.

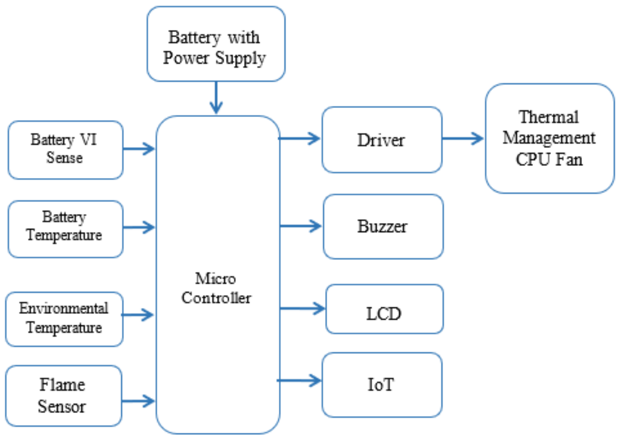

Figure.2. Proposed Block Diagram

In order to succeed with the energy transfer, an understanding of how the system shall be interconnected with the BLDC motor and the PV panels is required. For this interconnection, a design using a shared PCB for the bidirectional DC/DC converter and the BLDC-inverter is proposed to increase the energy density. Software shall also be implemented on an Arduino Due which controls the power transfer and supervises the batteries. This design will provide broader insight on the techniques that can be used to increase the days at sea without land charging with a dual battery setup and hopefully inspire others to convert their boat into a greener solution.

MICROCONTROLLER BOARD

The master board is the main controller of the BMS which functions to process data, acquire data and display the results of process to users. Besides that it also serves to monitor and safety protection. This master board uses the ATMega328 based Arduino NANO microcontroller. This microcontroller is equipped with a real-time operation system that can be done with multi-tasking with a handing timer reaching 16 MHz In the master board, it consists of several module series includes controller Module, Current Sensor Module, Temperature Sensor Module, Voltage Regulator Module, Communication Module, Voltage Sensing Module, Main Contactor Control and Motor Control Module.

VOLTAGE DETECTION

The cut-off voltage of the battery is 2.8V, while the battery's maximum voltage is 4.2V. The Arduino NANO Analogue Pin will successfully support any voltage below 3.3V. We must first descend from the higher voltage level. Two 100K resistors are present, and the supply voltage is 4.2V. A result of 2.1V will occur from this. The base value is 2.8V in essence, and the cut-off voltage drops down to 1.4V using the same voltage divider organisation. As a result, the NANO Analogue Pin maintains both the higher and lower voltage. If the voltage rises beyond 4.2V, the automated supply of power will be cut off.

TEMPERATURE DETECTION

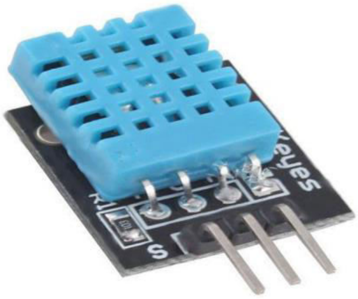

Figure.3. Temperature Sensor

The framework to screen DHT11 temperature and dampness, battery voltage, alongside charging and releasing status. For the microcontroller, we use Arduino NANO, which has an AtMega328 empowered chip. The Out pin of the DHT11 sensor is associated with the D4 pin of the NANO. SCL and SDA pins are associated with D1 and D2 pins. Though VCC and GND of DHT11.The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in˚Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

CURRENT SENSOR MODULE

The 5A – 30A range Current Sensor Module ACS712 consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field in which the Hall IC converts into a proportional voltage. Sensing and controlling current flow is a fundamental requirement in a wide variety of applications including, over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc.

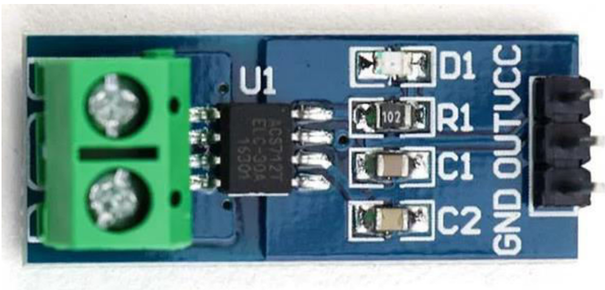

Figure.4. Current Sensor Module

FLAME SENSOR

The flame sensor is used to detect the presence of fire or other infrared source (Flame or a light source of a wavelength). It can be used in fire detection robot or heat seeking robot.

- Input operating voltage: 5V
- Logic high level: supply voltage (5V)
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Figure.5. Flame Sensor

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IV.RESULT AND DISCUSSION

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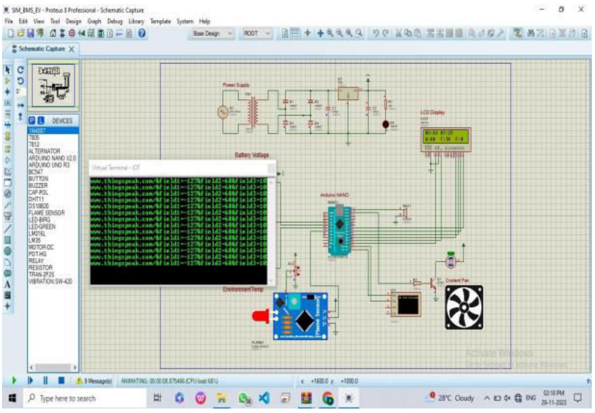

Figure.6. Simulation Results

V.CONCLUSION

The master board is the main controller of the BMS which functions to process data, acquire data and display the results of process to users. Besides that it also serves to monitor and safety protection. This master board uses the ATMega328 based Arduino NANO microcontroller. This microcontroller is equipped with a real-time operation system that can be done with multi-tasking with a handing timer reaching 16 MHz In the master board, it consists of several module series includes controller Module, Current Sensor Module, Temperature Sensor Module, Voltage Regulator Module, Communication Module, Voltage Sensing Module, Main Contactor Control and Motor Control Module.

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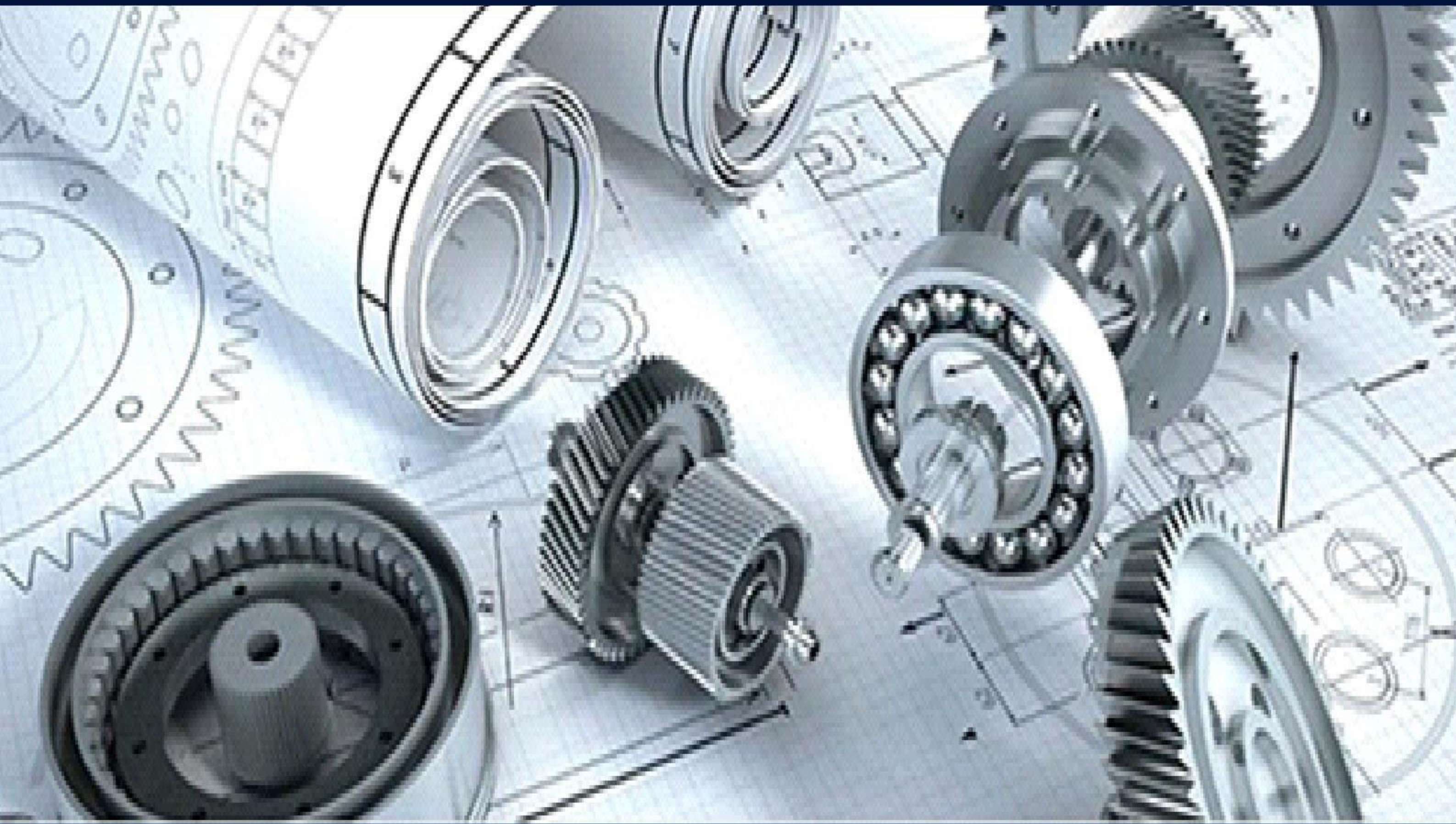

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