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Electric Vehicle Battery Management System with Charge Monitoring and Fire Protection

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ABSTRACT: Battery monitoring system for E-vehicles is an emerging area in the field of automobiles and electricity. In India, there haven't been any existing system for monitoring batteries on a large scale. It hasn't moved from a personal project to a large-scale application. Apart from this there are existing methodologies which rent the batteries to the user as such and rely entirely on the timely payment made by the user in person. A battery supervision scheme is an automatic system that prospers a rechargeable battery, for example by shielding the battery from functioning exterior its benign operational area, monitoring its state, scheming inferior statistics, commentary that data, monitoring its situation, confirming it and / or complementary it. The BMS will also order the reviving of the battery by readdressing the improved energy back into the battery pack. It is used rummage-sale only for dealing the charging and discharging of battery. With our proposed system, the battery management system can be integrated with the monitoring structure which is capable of both managing, monitoring and logging the data to an online database. This system monitors the battery parameters like voltage, current, temperature, power and state of charge. These parameters are then sent and stored in a database via internet which is then shown to the user by means of an android app. When sufficient dataset is available in the database, intelligent machine learning algorithms can be used to predict the life cycle of the battery and give suggestions to the user regarding the time and duration of each charge cycle, the health of the battery and many more. If implemented in battery rental companies, the battery can only be charged when the rent is paid by the user on time.

KEYWORDS— Battery management system, Arduino, android app

I.INTRODUCTION

Battery supervision system [5][6][7] is an application platform for the monitoring the batteries performance and estimated time for charging and discharging battery for at present load conditions. It is used for real time monitoring the performance of batteries. The way to access the data from batteries, which will directly reflect the quality of battery management system.The battery management system is used to see the status of charging and discharging activities of batteries regularly and also having historical information regarding batteries performance. By using historical information easy to analyses the condition of batteries. The more and more advancements in the field of automobile have resulted in autonomous guided vehicles (AGV). In AGV monitoring each and every parameter plays an important role for its movement, path planning and the distance it can travel with the battery's current state. By monitoring the state of the battery, it is possible to predict the life span and the amount of time until which the battery can be drained safely. The battery monitoring system should be reliable and scalable so that the functionalities can be extended whenever needed. Though few systems are available in foreign nations, this type of systems are yet to be implemented in India.

II. LITERATURE SURVEY

The recent research issues in the automotive industry seeming excellent improvement with the atmosphere approachable Electric Vehicles. It considers for the customer expenses and give excellent mileage in one charge. Monitoring and using determined energy from the battery holdup without substantial impact on the battery life. Based on environment conditions and customer request to monitoring battery performance using Wireless communication

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architecture. It is more reliable and environment friendly [1]. Due to technological growth to increase a greater number of vehicles in the globe, but environmental condition and power crises issues needed to develop gradually protruding. Eco friendly situations can create very bad impact on the huge business loss due to power crises. Publics rewarded progressively more attention required on the electric vehicle, but major issues in the development of electric vehicles is battery technology. So, need more concentration on the battery monitoring technology [2], [3]. With the speedy progress of societal and family, the electric vehicles take some important consideration by governments and research institutions. Due to pollution problem, the electric vehicle is best replacement of motor vehicle. The main important reason limited to the EVs is the existing battery technology [4]. The main important problem of battery is shortening life time and also have some serious accident such as fire. Our work gives some suitable solutions to existing problems. PV based high level hybrid multilevel inverter is an advanced converter derived from the buck-boost converter, it is used to enhance the output voltage level. [16]

III. BLOCK DIAGRAM OF PROPOSED SYSTEM

The block diagram consists of several blocks as shown in Figure 1

1. Power Supply Unit
2. Arduino
3. WI - FI Module
4. Micro SD card
5. Real Time Clock
6. Voltage Sensor
7. Current Sensor 8. Relay

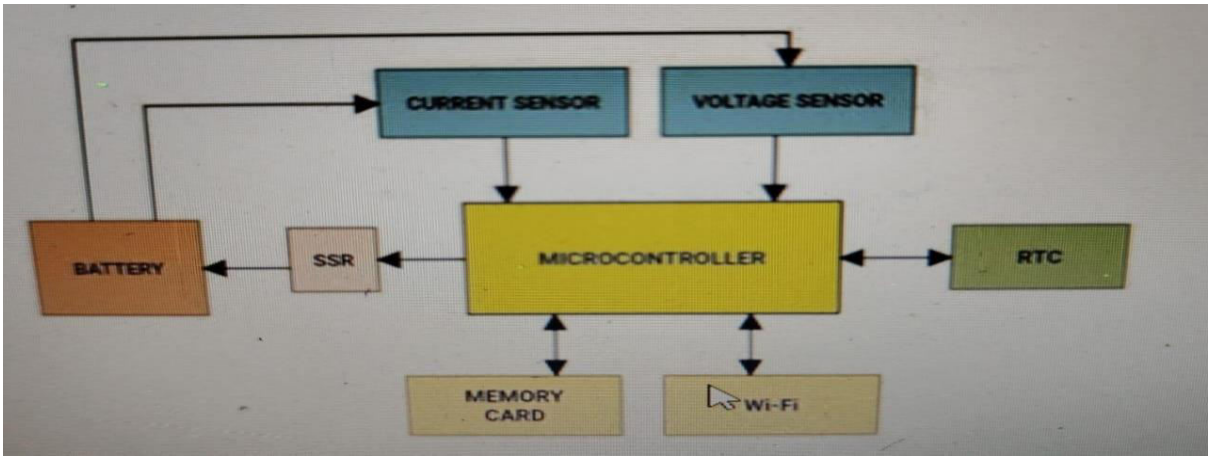

Figure 1. Block Diagram of Battery Monitoring System

The block diagram consists of a power supply (and the unit being monitored), monitoring section logging section and control section. The monitoring section consists of a Voltage sensor and a Current sensor which measures the voltage of the battery and the current flowing from/to the battery when connected to a closed circuit. The output of these sensors is an analog data which is then converted into a digital data using the microcontroller's analog to digital convertor. 250 samples are taken and average is found. The average data is processed in the microcontroller and logged. Wi-Fi module is used to connect to available predefined SSIDs. If no networks are discovered, then the data is logged to the Micro SD card as a temporary storage medium. Whenever Wi-Fi networks are available, the data in the micro-SD card is logged to the server. The RTC module is used to find the time so that Wi-Fi networks can be searched every 'A hours thus saving energy usage. The control section is a relay circuit which is tripped when the user fails to pay the monthly rent.

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IV. HARDWARE SETUP

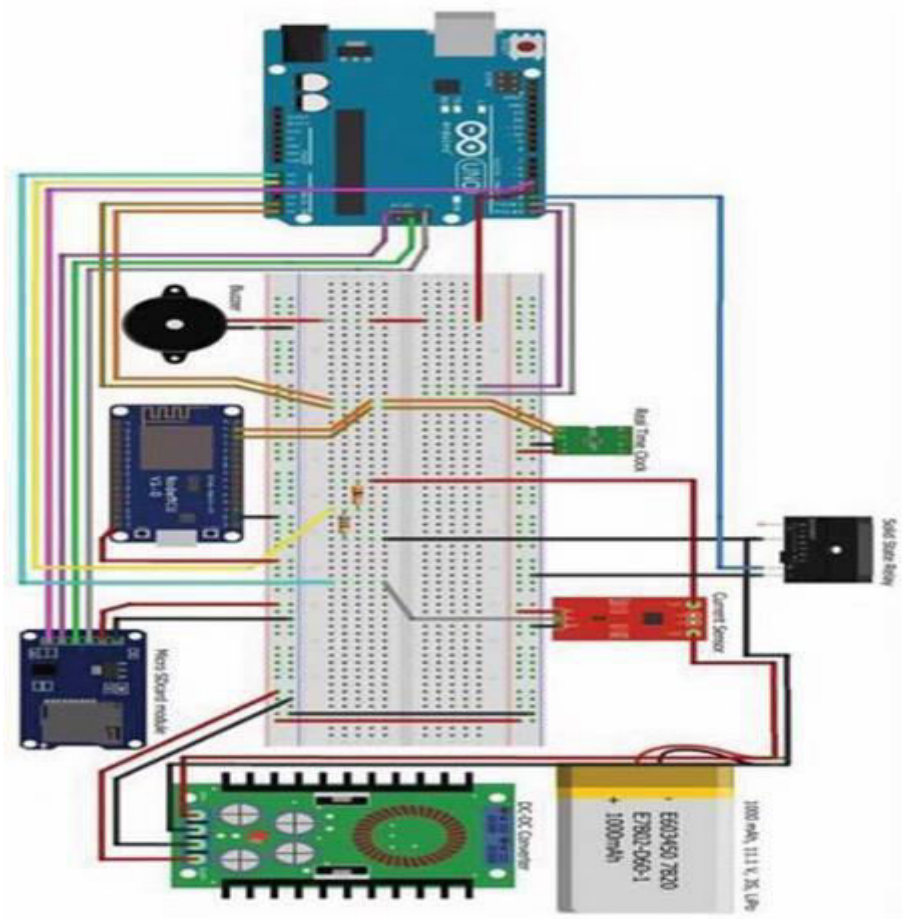

Figure 2. Hardware Setup

The Figure 2 shows the hardware setup of proposed system. Since the monitoring circuit uses very less power, the battery that has to be monitored is used as the power source for the circuit. A DC-DC converter is used to step down the DC voltage to 5V for the peripherals to operate. The battery terminals are connected to the Voltage sensor in parallel and one of the terminals is connected to the Current sensor in series. The other terminal is connected to a relay in series as well for remote ON and OFF of the battery. The output of the two sensors and the input of the relay are connected to the microcontroller (Arduino Uno). It receives the data and sends it to the Node MCU to log it to the GSheet database. If WiFi or server connection is not available, then the data is retrieved and stored in the micro SD card. That data is sent to thedatabase whenever WiFi and Server connection are established. The buzzer is used to give warnings to the user if necessary. A real-time clock is used to check time regularly for data logging operations.

V. SOFTWARE DESCRIPTION

A. Google Apps Script Introduction Google Apps Script is a rapid application development platform that makes it fast and easy to create business applications that integrate with G Suite. Code is written in modern JavaScript and has access to built-in libraries for G Suite applications like Gmail, Calendar, Drive, and more. The Figure 3 shows the snapshot of google apps script. There's nothing to install to start coding—the code editor right in our browser, and our scripts run on Google's servers. Google Apps Script is used to monitor the battery details database. Google sheets API is used to store and retrieve the data coming from the hardware setup.

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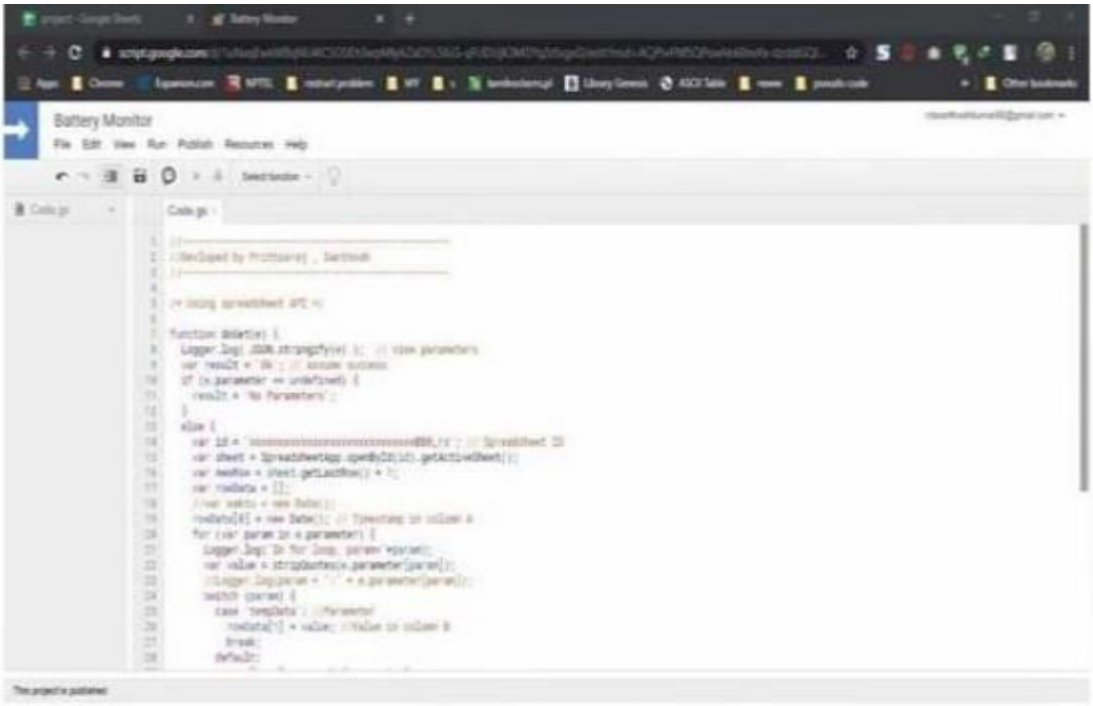


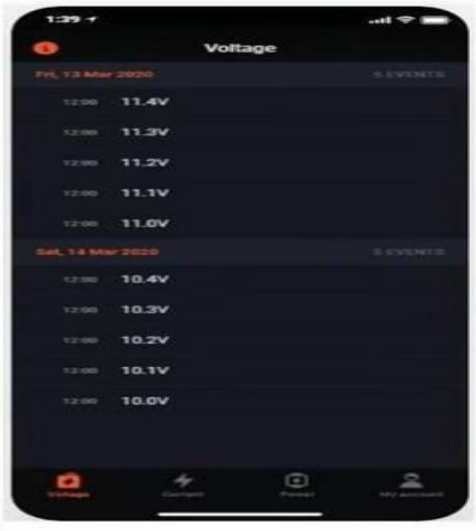
Figure 3. Google Apps Script Snapshot

VI. RESULTS AND DISCUSSION

The following results have been achieved using this project. The battery Current, Voltage and power are monitored and sent to the main database hosted in the server. These details are then sent to the app which can be used to monitor the health and charge state of the battery.

A. Battery Monitoring App

The following are some screenshots of our Battery Monitor App as shown in figure 4,5,6,7,8 &9



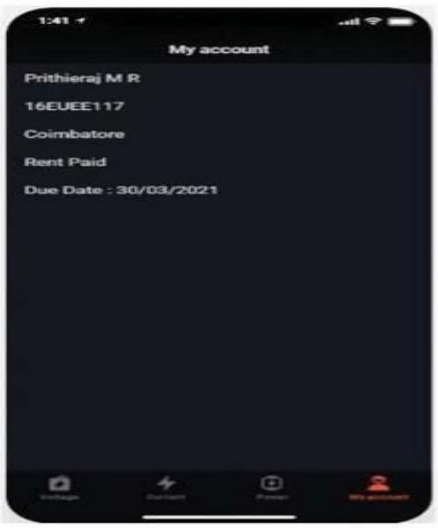


Fig 4.Voltage tab

Fig.5 My Account

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Figure 6 Current Tab

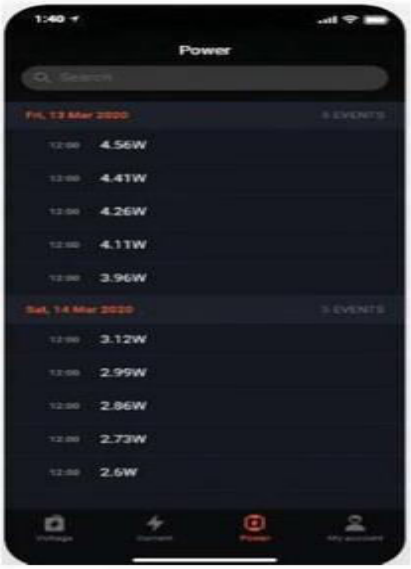

Figure 7. Power Tab

Figure 8 Search Option

Figure 9. Full Details

VII. CONCLUSION

This battery monitoring system for electric vehicles can be used to monitor the real time health of the batteries present in electric cars, bikes or trucks. It paves a way by aggregating data from batteries and other such sources to a common place for analysis and applications. This can be further extended to homes and industries which use large batteries for backup power and other commercial applications to predict the life of batteries and improve it. By knowing the life earlier, it would better be for timely replacement of the components without disrupting the day- to-day work of a person/industry.

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IX. FUTURE ENHANCEMENTS

By monitoring the real time parameters of a battery, one can easily know about the health of the battery anytime and anywhere. Due to the advancements in battery technology batteries with longer life span supporting larger charge cycles are being developed. If sufficient data setis available, machine learning and deep learning algorithms can be implemented to give users about the amount of time the battery has to be charged and the life span of the battery. If more users start to user this system, it would provide sufficient data to improve the life cycle and charging time of the battery in general. Alerts can be given to the user by means of SMS, Application notifications and emails. Since lithium-ion batteries for E vehicles are costlier than conventional batteries, they can be rented out and monitored by the rented firm. If the rent has not been paid, the relays can be tripped preventing the battery from being discharged. If the batteries are rented out, GPS systems can be used to track them. Payment of rents can be made using UPI (Unified Payments Interface), BHIM (Bharat Interface for Money) or any other means of online payment with proper authorization.

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