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# IOT Enabled Smart Charging For Electric Vehicle

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**ABSTRACT:** Electric vehicle plays a Vital role in Limitation of Greenhouse gas and Carbon dioxide pollution. These E-Vehicles are running because of the Rechargeable Batteries. This project is enabled with IOT Technology which focuses on the Status of Charge (SOC) of the Lithium-Ion Battery of an Electric Vehicle, The SOC is calculated by using the Coulomb integral method and sends the data to the cloud and can view the data in ThingSpeak software. We can also view our data in LCD screen which will be placed in the E-Vehicle so that user can view the data while riding the Electric vehicle. Blynk App is also used to track the vehicle location when it is in a stationary state which is done for security purpose

**KEYWORD:** Electric Vehicle(E-Vehicle),Status of Charge(SOC),Lithium-ion battery,Internet of Things(IOT), ThingSpeak,, ESP8266-Node MCU

## I. INTRODUCTION

As the Electric vehicles are getting popular the batteries are mainly required for the electrical energy storage in EVs. The evolution in city transportation has boosted over the last few decades which in turn increased the growth of societies and industry for the use of vehicle so the batteries must maintain and monitored .Though battery is a commonly used device for the storage of energy, calculation of Status of Charge of the battery plays a vital role in the future. This days, vehicles are essential in the day to day life and for industrial use as well. Sufficient effort is being done to withdraw the combustion engines by electric motors . Due to the increase in Carbondioxide(CO2) caused by the industries and transportation, the Kyoto treaty was signed. This treaty was aimed to reduce the level of CO2 and has boosted the findings for new clean energy solutions. As a finding, Electrical Vehicles (EVs) appeared as a solution to reduce CO2 emissions. Electric Vehicles are increasing day by day across the globe when the number of Electric vehicles is increasing, the demand for the batteries is also increase so these batteries must maintain and monitor

So this project focused on checking the Status of charge (SOC) i.e (it shows the remaining battery capacity which is in percentage) to increase the life of battery by checking and maintaining the various parameter of the Battery like Voltage, Current, Temperature, Vibration Level and Speed of the Lithium-Ion Battery.

## II. RELATED WORK

Earlier works on the Battery monitoring system is focused on battery cell monitoring, state estimation , fault analysis , data acquisition for improvement for the performance of the battery also it focuses on calculating the SOC of the battery to know the charge percentage of the battery

## III. METHODOLOGY

### 1. EXISTING SYSTEM -

This project focuses on the IOT part of determining the SOC value of the Battery and Speed of the vehicle

The state of the charge is calculated by using Columbs Counting method , SOC of the battery shows the remaining Battery Capacity and this value is expressed in percentage values (Ranging from 0 to 100)



**Calculation of SOC Formula :**

$$SOC = \text{Initial SOC} - (\text{current flowing through battery} / \text{Nominal capacity of battery})$$

The magnitude of current is constantly positive for the process. discharging process and it will be negative for charging

Case (i): If SOC = 100 Battery is fully charge

Case (ii): If SOC = 0 Battery is Empty

The code is written to calculate the SOC of the Battery then the calculated data is send to Node -Mcu via Arduino and the data can be viewed in LCD display and in ThingSpeak Software also

Speed of the Vehicle is calculated using the IR Sensor. For further accuracy it can be replaced by Proximity Sensor

**2. PROPOSED SYSTEM -**

The Proposed method will add the additional features in the Battery monitoring system along with the existing features

The BMS is updated in order to increase the life of the battery

In Proposed methods the features added are :

- Determining the Temperate value and it is cooled down when overheated
- Determining the vibration level of the Battery
- Charging time determined
- The Battery Percentage is displayed
- Blynk App is used to determine the location of E-Vehicle

The Temperature value is determine by using LM35 Temperature sensor and then the data is sent to cloud and it can be viewed in LCD display & in Graph via ThingSpeak software

The Battery is cooled down when Temperate is over heated i.e. Increased above 30°C by using the DC fan

The battery percentage is displayed on the LCD Screen so that the E- vehicle user can know the time takes to charge the battery

Blynk App is used to determine the location of the Electric vehicle when it is in stationary state which is used for Security purpose and this Location data i.e Longitude and Latitude can be viewed in the Blynk Application.

**3. SYSTEM OVERVIEW**

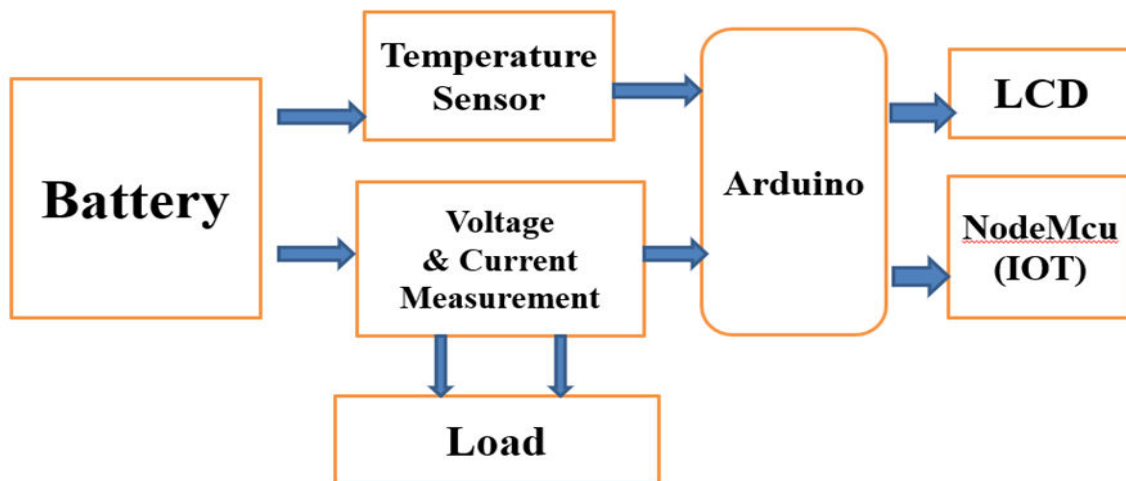


FIGURE (1)

Fig (1) shows the entire system Block Diagram of the Proposed system where the cells are connected in series and the parameters of the lithium ion battery is measure then for discharging of the battery load is said to be used, this parameters such as Temperature , voltage , current , speed , Charge Time , Status of charge and Vibration level of the battery is measured to avoid the short circuit of the battery and then it is send to the Arduino Uno and the data is viewed in ThingSpeak software via NodeMcu(IoT) and it is also displayed in LCD Display



#### 4. HARDWARE DESCRIPTION

**Lithium Ion Battery**—Among all of the batteries Lithium Ion Batteries have high efficiency for electric mobility, wide operating range and it can store large amounts of energy ,it can be recharged many times, they offer good charging capacity and long lifespan. Because of this above reasons Lithium Ion Battery is mostly preferred for Electric vehicle.

**Temperature Sensor** – LM35 Temperature sensor is used to sense the temperature of the battery -55°C to 150°C and when it is over heated it is cooled down by using Dc fan

**Arduino Uno** - Arduino is an open-source electronics platform based on easy-to-use hardware and the software can tell the board what to do by sending a set of instructions to the microcontroller on the board. It has 32kb of flash memory of storing our code and also has button in chip to reset the program and the Arduino is connected to Node MCU to share data to it.

**Node Mcu**-It is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi, SoC from Espressif systems and hardware, which is based on the ESP-12 module.

**Vibration Sensor** –The vibration sensor will measure the amount and frequency of vibration occurred in a battery to avoid the short circuit

#### 5. SOFTWARE DESCRIPTION

**ThingSpeak** - It is a popular IOT analytics platform .all the parameter is monitored over internet using Thingspeak and We have programmed our ESP to send the monitored values to ThingSpeak .It is accomplished by the data communications between Arduino, Sensor Module, ESP8266 Wifi module and LCD. All parameter value is send to ThingSpeak server for live monitoring over world

**Blynk App** – It is Android Mobile App named “Blynk”. Blynk is a very compatible app with Arduino, to make IoT based project. This App can be downloaded from the Google Play Store, and canbe easily configured.

#### IV. EXPERIMENTAL RESULT



FIGURE (2)

Fig(2) shows the Voltage(v), Status of charge (SOC), Temperature (T) & Current (I) in the LCD Display

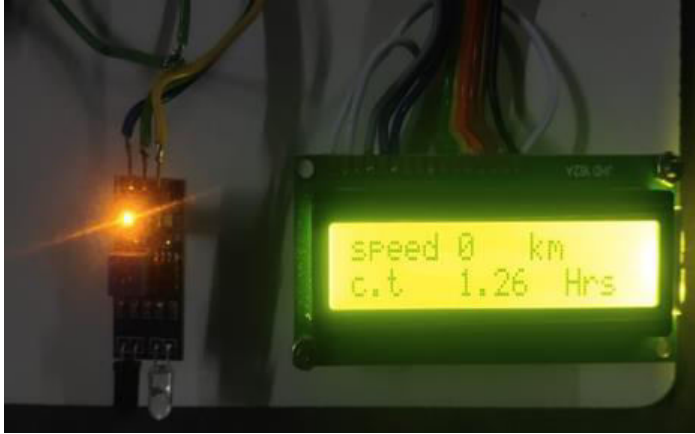


FIGURE 3

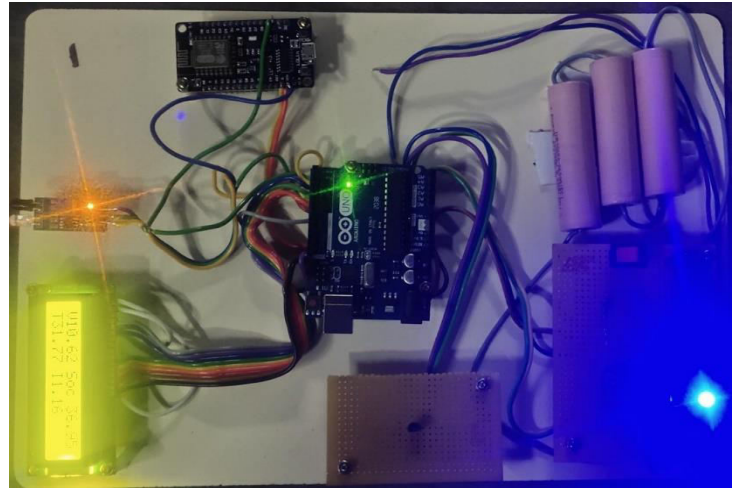


FIGURE 4

The fig(3) shows the Speed of the vehicle which is determined by using the IR Sensor and the Charge Time (CT) i.e. Times takes to charge the Battery and Fig(4) Shows the entire Project Real time kit.



FIGURE(5)

Fig (5) shows the Voltage , SOC, Current, Speed and Temperature which is represent as graphical manner by using the ThingSpeak Software

V. CONCLUSION

The Project described the design and development of an IOT-based battery monitoring system for an electric vehicle to ensure the battery performance degradation can be monitored online. Internet of Things (IOT) based smart charging for electric vehicle has been developed to monitor status of batteries. The IOT which is developed here uses a cloud platform and software for communication purposes. The vehicle user can easily check the health of his vehicle battery and also we can locate the location of the vehicle when it is in stationary state, The system can be used in smart phones by developing smart phone application that can help user to monitor battery and as a battery degradation reminder For future work, handling of multiple users could be implemented so as to compare the status of different users.



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