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Cloud based BMS Data Analytics & Alert System in EV using IOT

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Abstract : *The demand for electric vehicles in India seems to be growing. As energy is scarce and there is pressure on the world to reduce carbon footprint, the manufacturing industry is transitioning to the production of electric vehicles. It is necessary to improve the technology and functionality of electric vehicles. For the protection of customers against accidents caused by battery failure, continuous battery monitoring is essential. In order to improve EV performance, battery analysis and monitoring must be improved. An ongoing monitoring method for analysing battery performance is the pall- grounded BMS system for EV data analysis using IOT. Additionally, each EV battery's performance is analysed by the system using data provided by the battery manufacturer. Compared to reactionary energy vehicles, the EV production process is still in its infancy.*

Reactionary energy technology has advanced significantly thanks to experimentation, experience, ground-breaking ideas, and the stringent moral standards of governing bodies like Euro/Bharat Stage 6 etc. The successful implementation of EVs will be made possible by the harmonious advancement in battery technology. The maker of batteries should be able to directly estimate the battery model, state of charge, state of health, etc. with the aid of ongoing monitoring of battery performance parameters. Additionally, it will prove the reliability of EVs and correctly predict the risk of accidents brought on by careless battery charging and draining. IOT-Cloud technology is a key component of this architecture. Every lithium-ion cell's performance parameter is delivered to an IOT webpage and further depicted in graphical form are graphical representations that enable easy analysis of EV performance.

INTRODUCTION

Using tools like the Arduino UNO, IOT (Internet of effects), and Wi-Fi module, the Pall Grounded BMS Data Analytics System for EV using IOT is used to continuously monitor the performance parameter of Electric Vehicles. This design's goal is to continuously examine each lithium-ion cell's performance parameter and evaluate the performance of electric vehicles using that parameter. Voltage, temperature, and current are the parameters that are being considered. Additionally, publish this data using a Wi-Fi module to the IOT website so that the manufacturer of electric vehicles can easily cover the parameter and, if necessary, take any necessary precautionary action. The parameters are simultaneously shown on the TV screen. From an examination of the literature, it was found that the process of creating a bed system to continuously cover the electric vehicle parameter and estimate the battery system based on the parameter. Voltage, current, and temperature detectors, among other colourful detectors, are utilised to determine accurate parameters. The author then utilised the Arduino UNO software IDE as a platform to aid in the construction of the required task.

Literatrure Survey

1. Hossam a. Gabbar, ahmed m. Othman, et al. (1) gave an overview of bms and its safety in operation. Bms is configured differently depending on how it is used, but its core components and safety features never change. Additionally, the author discussed the inadequacies in current blackened standards.

2. Using labview, r.m. Vethekar, a.b. Chandgude, et al. (2) described how to cover and operate an electric vehicle and monitor battery parameters on a personal computer. Utilises wireless iot technology to prolong battery life by preventing deep drain and overcharging.

3. Anjali Vekhande, Ashish Maske, et al. (8) described a real-time monitoring system for lithium-ion batteries that was grounded on an on-board monitoring device with colourful detectors attached. An android smartphone with web-grounded operation shows battery parameter values with and without cargo. By using a phone, the voltage, current, and temperature parameters of batteries may be collected and displayed.

4. A system using a current and voltage detector was described by M. Ramesh Kumar, S.A. Arshiya, et al. (9). The LED will flicker and the communication will be shown on the TV screen when the battery is low. Through IOT, the owner is immediately informed of the battery's status.

BLOCK DIAGRAM :

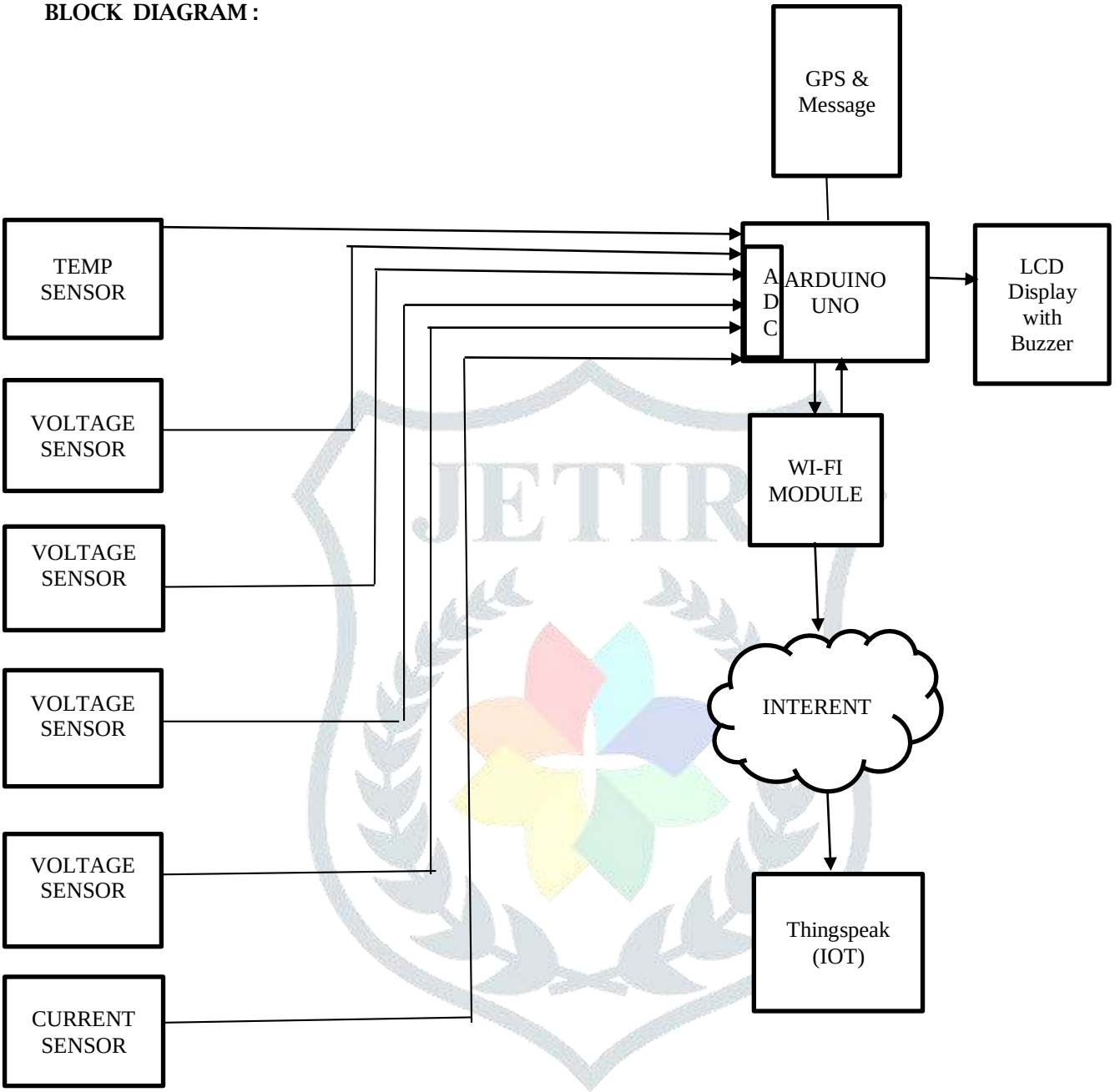


Fig 1 . Block Diagram

one module of current sensors. Since the four voltage sensors and the current sensor are analogue devices, they cannot be connected directly to the Arduino UNO's digital input legs. Therefore, the voltage sensor module and a total of four temperature sensors, one current sensor module, and a total of four voltage sensor modules are connected to five ADC legs.

The DS18B20 is a single-line digital temperature sensor, therefore the Arduino UNO digital input line is directly linked to it. A single line with four temperature sensors connected to it is then connected to an Arduino UNO microcontroller. The Arduino UNO is connected to a television display in order to show the performance parameter of the lithium-ion battery cell. 20x4. As a result, the parameters are instantly displayed on television. The parameter is sent by the WI-FI module to the IOT webpage. In order to gather the parameter, this WI-FI module is connected to an Arduino. The ESP8266 is linked to the internet so that performance parameters can be uploaded. The IOT provider we utilised, thingspeak, has eight channels.

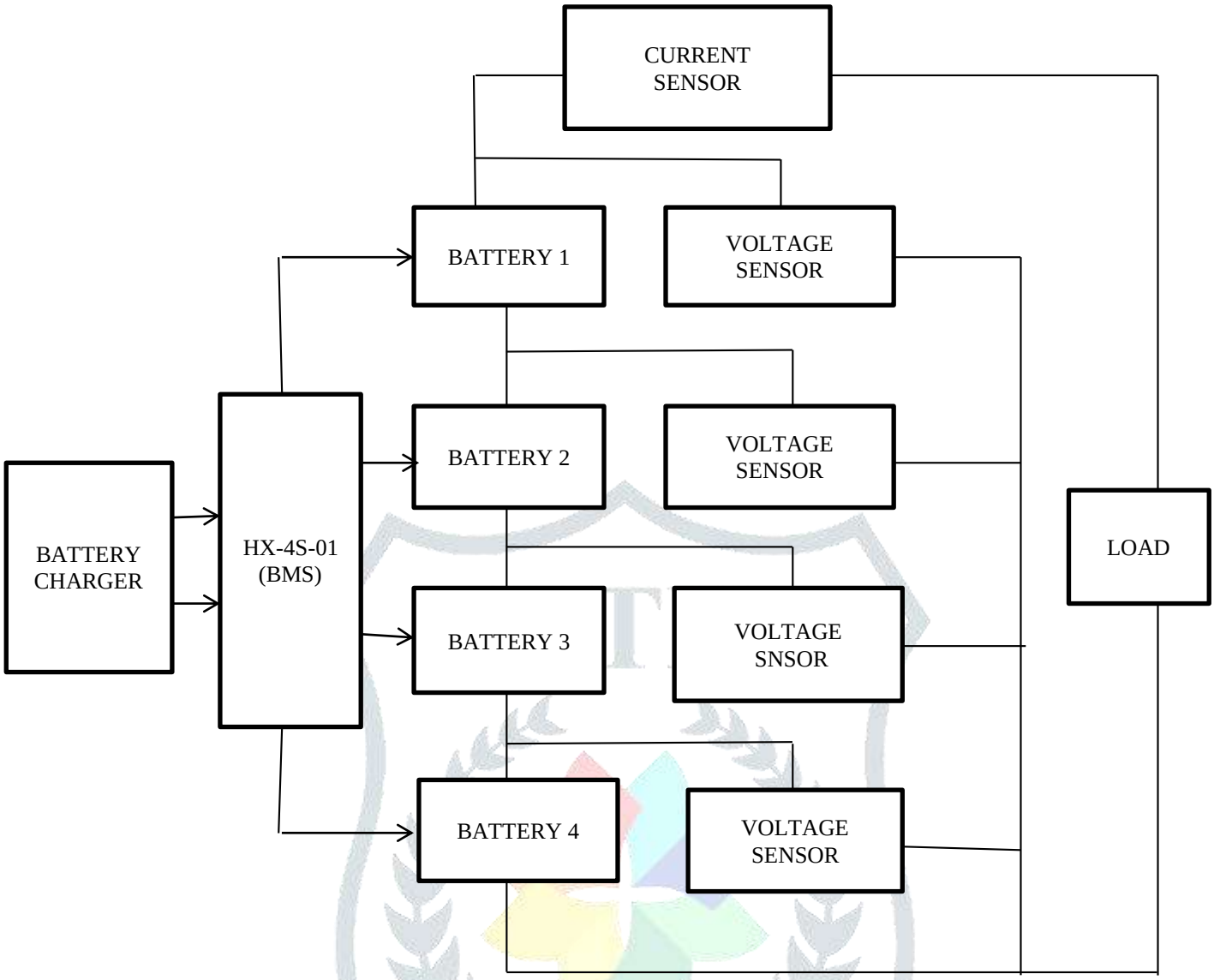


Figure 2. The connection between a BMS chip and lithium-ion batteries is depicted in a block diagram.

The connection between a BMS chip and lithium-ion batteries is depicted in a block diagram. As a BMS, the HX- 4S01 chip is employed. To protect the lithium-ion cell from deep discharge and fleecing, a BMS is used. As a BMS, the chip HX- 4S-01 is employed. The battery's operating system protects the lithium-ion cell from deep draining and overcharging.

The BMS chip connects the lithium-ion battery bowl to the batteries. There are a total of four lithium-ion cells that are seriously connected to one another and have a 3.7 V voltage. For the purpose of measuring battery voltage and transmitting it to Arduino UNO, each voltage detector is linked across each battery cell. All lithium-ion batteries are connected to the current detection module, and one end is attached to the bulb-shaped load.

Operation

1. The power force should be turned on first. The TV will display the design information once being powered on. also establish an internet connection for the ESP8266 Wi-Fi module so that it can communicate the parameter to the IOT webpage.

2. The lithium-ion cell and the four temperature detectors are physically connected. in order to directly calculate the battery cell's temperature. A single leg of the Arduino UNO digital input is used to connect all the temperature detectors.

3. By connecting each voltage detector across a lithium-ion battery, the voltage of each cell will be calculated. Programmatically, the voltage is computed by deducting the previous cell voltage from the total battery voltage.

4. The current detector module is attached to four lithium-ion batteries in a manner that resembles a cargo (bulb). The bulb can be switched on and off with a switch. The current value will change depending on whether the bulb is on or off.

5. Because the voltage and current detector module's readings are all in analogue form, they are sent to the Arduino UNO's ADC, which converts them all to digital values. Since the temperature detector is digitally deficient, it connects directly to the Arduino UNO's digital input leg.

6. The TV and ESR8266 Wi-Fi module are connived with by the Arduino UNO. Since the TV and Wi-Fi module are asymmetrical, the Arduino UNO will transmit the performance parameter to both of them.
7. After displaying the design details, the TV will next show the voltage, temperature, and current of each lithium-ion cell.
8. Data is transferred to the IOT Thingspeak website every 20 seconds, where it is graphically depicted.

3. CIRCUIT DIAGRAM

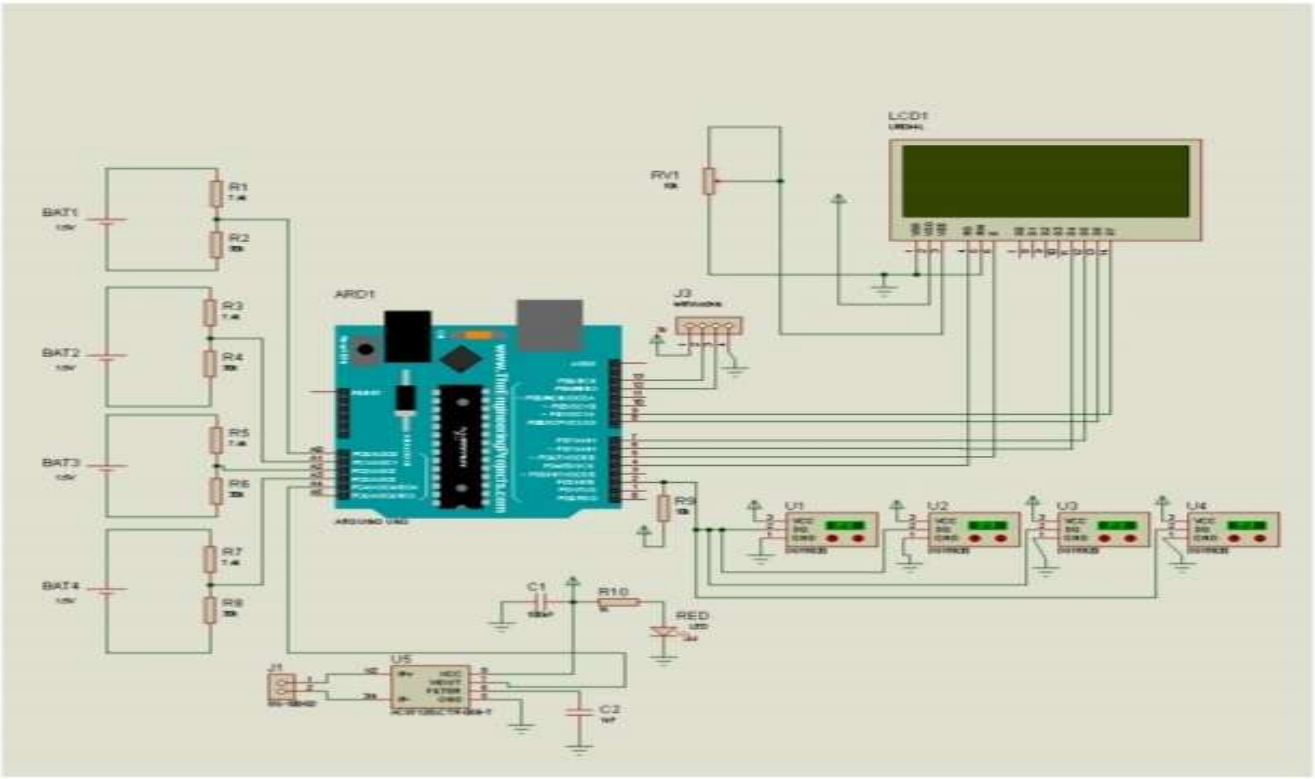


Figure.3 Circuit diagram

Figure 3 illustrates the cloud-based BMS data analytics system for electric vehicles employing IOT. Four battery cells are linked in series, as seen in figure 2, with each cell having a 3.7 V voltage and a 2000mAh current. The BMS chip HX- 4S-A10, which is a battery overcharging and deep draining protection circuit, is directly coupled to these lithium-ion cells. This guarantees the longevity of lithium-ion batteries and guards against their overheating and explosion. The BMS is attached to a 14.8 V battery cell bowl.

The BMS is mostly attached to the bowl and lithium-ion battery cell. To accurately measure voltage, the voltage detector module is linked across each cell. The Digital one line detector DS18B20 measures temperature. Since it is a digital detector, the Arduino UNO's digital input legs are directly linked to it. Temperature sensors is linked to Arduino UNO pin number 2. Due to the analogue nature of voltage, the voltage detector is linked to the Arduino UO's ADC legs ADC0-ADC3. Additionally, because the current detector operation is analogue, it is applied to the Arduino UNO's ADC4 leg.

The 20X4 TV shows each lithium-ion cell's current, total voltage, and total temperature. Legs 4 and 9 are attached to this TV. The UART periodic communication protocol is supported by Wi-Fi modules. Pins 12- and 13 on the Arduino Uno are the legs where Wi- Fi module was designed. Since this Wi-Fi module uses the internet to communicate performance parameters to the IOT Thingspeak webpage.

4. SOFTWARE REQUIREMENTS:

4.1 Arduino UNO Connection

Figure 4.1-1 Arduino UNO

• Step 1: The first step involved downloading the Arduino Software IDE from the internet. Install the Arduino Software IDE on the PC after downloading it. This program provides a variety of platforms for using the Arduino UNO for various functions.

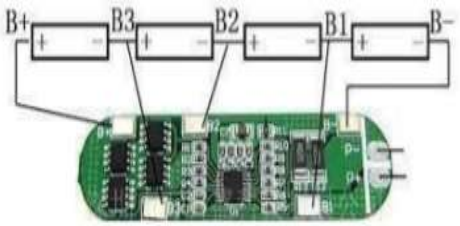
• Step 2: Use a USB cable to connect a laptop to a jeer pi 3 module and turn it on. The Arduino UNO must be connected to a USB port on a computer in order to be set up and enabled. The board automatically draws power from the USB cable when we connect it to a computer or personal computer. The green power LED turns on instantly after connecting.

• Step 3: a. I also set up the driver and downloaded the aforementioned libraries.Temperature control for Arduino

b. Periodical Communication Library One Wire Library

•Step 4: Include the downloaded software IDE for Arduino library. Programming requires the use of these libraries.

4.2 HX-4S-01 Connection

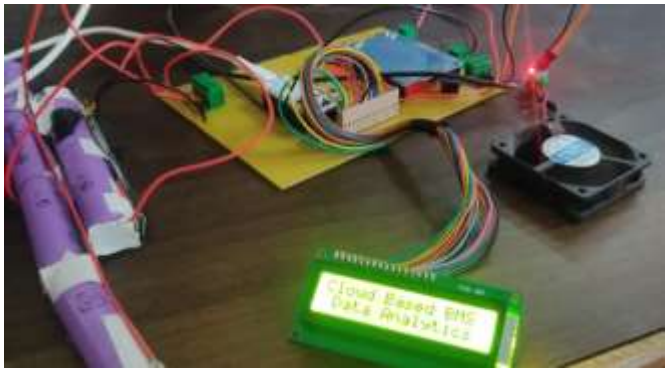


Step 1: The lithium-ion charge protection circuit/BMS is connected in series with four 3.7V lithium-ion cells (see Figure 4.2-1). Steps 2 and 3 are used to attach the other two HX- 4S- 01 chip outstations to the lithium-ion battery bowl and the HX- 4S- 01 chip to the lithium-ion cell.

4.3 Thingspeak : It is IOT service provided by MATLAb which uses MQTT protocol

5. RESULT

Project Details And Name Display On LCD



5.1 EV Performance Parameter On LCD Display

5.2 Lithium-Ion Cell Parameter On LCD Display

Graphical Representation Of EV Parameters Uploaded On Thingspeak

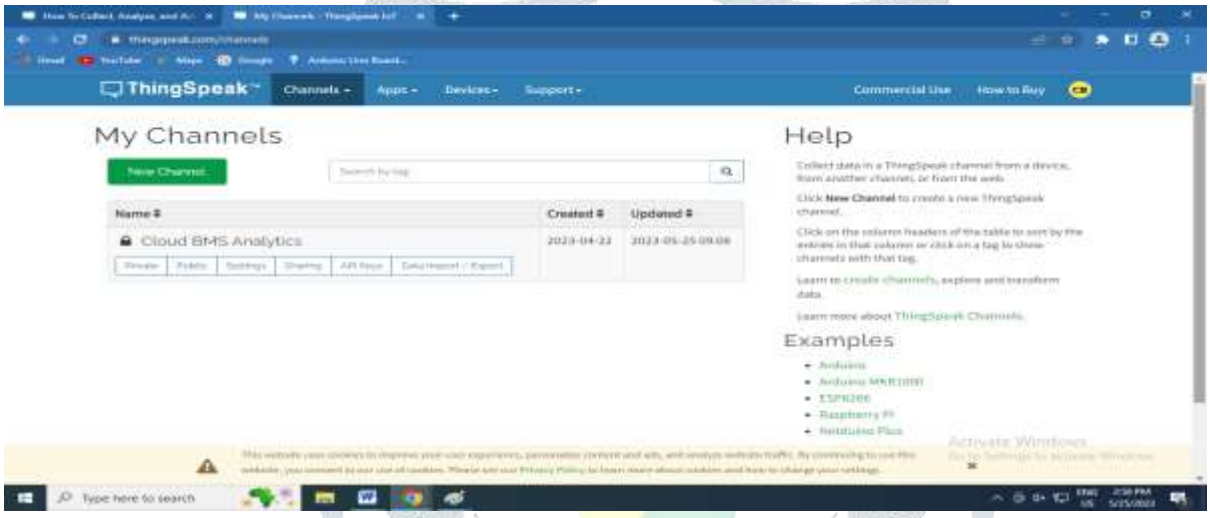


Figure 5.3 Channel Of Cloud Based BMS Data Analytics System Created

Graphical Representation Of Lithium-Ion Cell Voltage

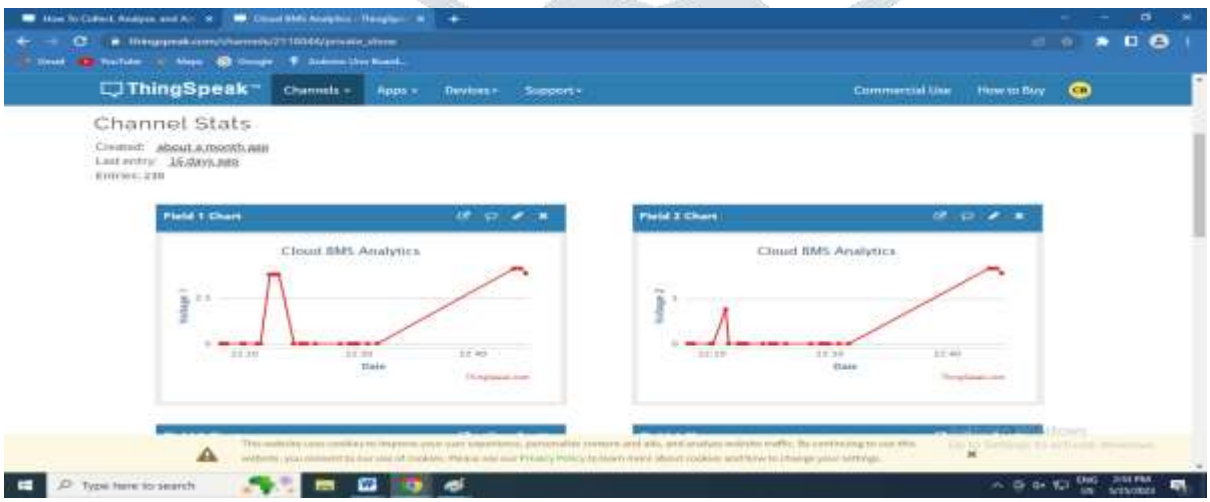


Figure 5.4 Graphical Representation Of Voltage Of Lithium-Ion Cell 1&2

Graphical Representation Of Lithium-Ion Cell voltage & Temperature

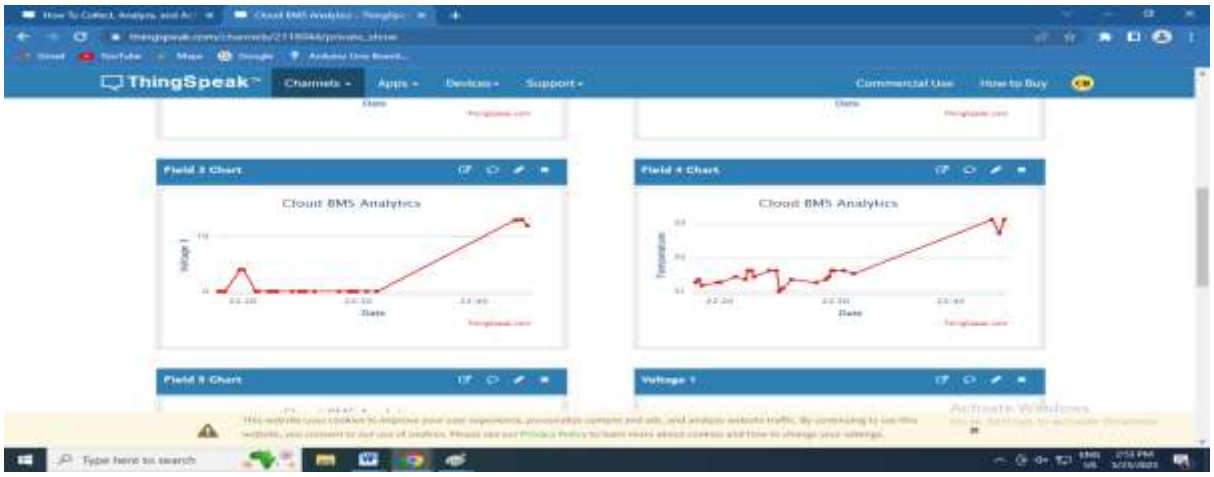
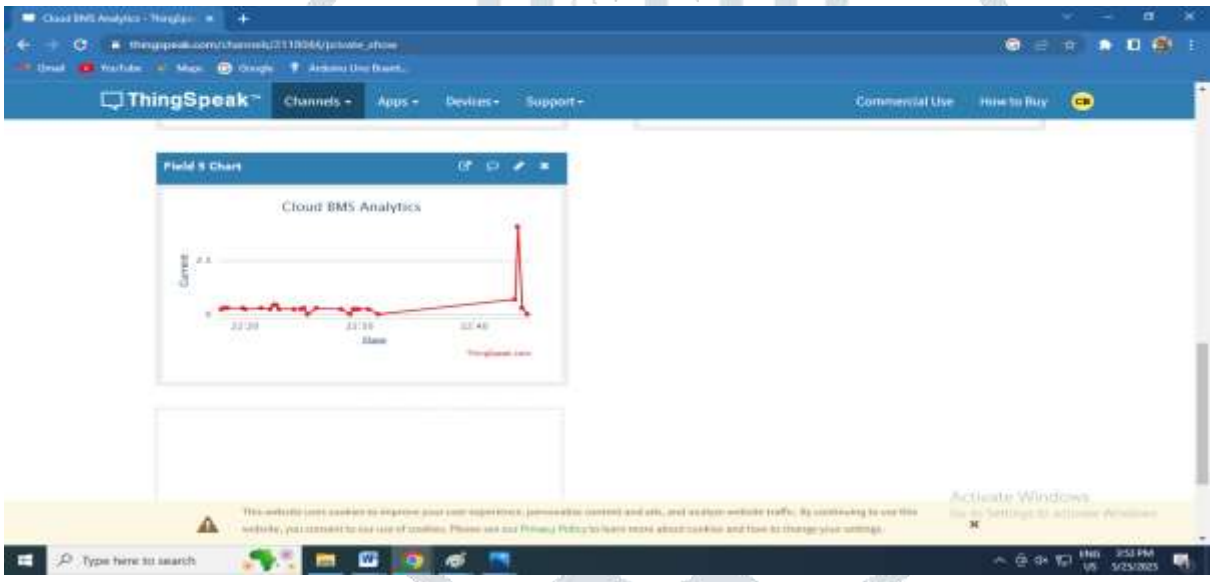


Figure 5.5 Graphical Representation Of Lithium-Ion Cell Voltage & Temperature

Graphical Representation Of Lithium-Ion Cell Current



5.6 Graphical Representation Of Lithium-Ion Cell Current

6. FUTURE SCOPE:

Create a straight forward database for the analysis of all performance parameters for each lithium-ion cell in an EV battery in order to make the system more dependable and accessible to the owner of the electric vehicle. Create a mobile application that shows the study of each EV cell's performance parameter and provides announcements and cautions for additional preventive action. Analysis of each electric vehicle battery supplied by battery manufacturers to identify the most fashionable battery supplier and identify areas for improvement for the remaining battery suppliers to improve their goods.

7. CONCLUSION:

We can easily connect the various detectors attached to lithium-ion batteries using an Arduino UNO. The detectors are analogue, but because Arduino UNO has an integrated ADC, it translates each lithium-ion cell's analogue parameters, which are crucial for evaluating the operation of electric vehicles. This is why it's important to regularly cover the parameters.

With the aid of the internet of things (IOT) and a Wi-Fi module, this continuous parameter monitoring is made possible. We can interface with vibrant lithium-ion cell detectors, such as voltage, current, and temperature detectors, using the Arduino

UNO. It offers a list of important vehicle battery metrics to consider so that we can analyse the performance of the EV battery. The basic goal of this system is to continuously cover the EV performance parameter using IOT without causing battery damage.

• In order to extend the life of the battery by protecting the chip from deep discharge and overcharge, the lithium-ion battery is first linked to a BMS/charge discharge protection circuit.

• Subsequently, several detectors are connected to each lithium-ion cell in order to collect cell performance data. Additionally, this parameter will be posted to an IOT website with the aid of an Arduino UNO.

• Each lithium-ion cell's performance parameter is represented graphically on the IOT website.

8. REFERENCES:

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