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A REVIEW ON BATTERY MANAGEMENT SYSTEM IN ELECTRIC VEHICLE

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ABSTRACT- To improve the quality of battery and safe operation, battery management system is employed and it plays a vital role in application of Electric Mobility. This paper reviews the attributes of battery management system and its technology with benefits and drawbacks for electric vehicle application. This audit incorporates the battery cell checking, state assessment, charging and discharging control, temperature control, fault analysis, data acquisition and protection schemes to improve the performance of battery for EV applications.

Index Terms - Electric Vehicle Battery, Li-on Battery, Internet of Things (IOT), Battery Management, Battery Monitoring, Battery Protection.

I. INTRODUCTION

Electric vehicles are becoming more commonplace as the technology matures and gas prices remain higher than in earlier many years. While the inward ignition motor actually rules a significant part of the world's streets, electric vehicles and cross breeds (vehicles with both an inner burning motor and some type of electric engine) are more common in metropolitan regions than earlier many years. Crossovers work similar as ordinary vehicles, requiring occasional refueling to supply the inside ignition motor, however regularly with preferable efficiency over their unadulterated gas controlled partners. Then again, electric vehicles don't have any installed power age and depend exclusively on put away energy in batteries to control the electric engines during activity. Deciding the excess energy put away in a battery is more difficult as there is no “fuel level” that can be observed. The energy in a battery is stored as chemical energy, much like the energy stored in gasoline, but when a battery provides energy, there is no combustion or exhaust of gases. In other words, while your gas tank empties as you drive, your battery does not lose any mass. This paper outlines a scalable method of determining the voltage across each battery in an electric vehicle and an eventual path for the development of a real-time battery “fuel gauge” for use in the Department Electric Vehicle.

II. RESERCH ELABORATION

For several years now, the TCU Department of Engineering has been converting a 1973 Porsche 914 from its original gasoline-powered state to a completely electric vehicle. The project is student-led, but under the supervision of Dr. Stephen Weis, a professor in the TCU Department of Engineering. The motivation behind the conversion centered on the desire to create an experimental environment where students could get hands-on experience during their undergraduate education and explore the opportunities for electric vehicles. The author has been working on the project for almost three years at the time of publication. The Porsche proves to be a suitable target for conversion efforts as Ferdinand Porsche’s first automobile design in 1898 happened to be an electric vehicle with a top speed of 21 miles per hour and an estimated range of 49 miles.

The project started with a Jeep Cherokee (donated by Jon Eidson, of the TCU IT Department) that had already been converted to an electric vehicle and the Porsche 914. The Jeep was scavenged for parts and understanding while the Porsche was stripped to bare metal. The first few years were concerned with repairing the body of the Porsche; including patching rusted areas and giving the whole body a new primer coat to protect from future rust. Much of the body work was done in-house at the TCU Physical Plant by James Griffin and in the Machine Shop by David Yale and Mike Murdock. Several students were involved as well. Once the Porsche was rust-free, the DC series motor from the Jeep was installed where the 4-cylinder engine used to sit, just behind the passenger compartment.

The twelve batteries were split between the forward (under the hood) and rear compartment (in the trunk) of the Porsche to distribute the approximately 520 pounds of batteries evenly in the vehicle. With the motor and battery pack chosen, a motor controller was needed to control the speed of the motor. Without a controller, the motor would spin at a single speed, making it unusable for vehicle operation. A Zilla Controller Package, manufactured by Café Electric, was chosen to interface between the “gas” pedal and the electric motor. The package includes a Zilla motor controller which controls the flow of current into the DC series motor and a Hairball motor control interface which acts as the “brains” of the motor control, translating pedal movements to changes in motor current. To charge the motive battery pack between uses, an “octopus” style battery charger was mounted in the vehicle. This charger connects to a standard 120 VAC wall outlet and charges each of the twelve motive batteries individually rather than charging the pack as a whole. With the motive circuit essentially complete, the accessory circuitry was connected as originally designed from the factory with the exception of the HVAC system and radio.

Air conditioning would use too much energy, thereby reducing the range, and a ceramic heater would have to be installed to heat the vehicle. All of the accessories, including the vehicle lighting and windshield wipers, are powered by a 12 V standard automotive battery located in the forward compartment of the vehicle. In a conventional vehicle, the accessory battery is charged during operation by an alternator that is connected to the internal combustion engine. Since the Porsche does not have an internal combustion engine anymore, the accessory battery is charged from the motive battery pack using a DC-DC converter. This reduces the overall range of the vehicle by diverting energy normally earmarked for propulsion to the operation of vehicle accessories. A second 12 V battery was positioned in the rear of the vehicle, next to the Hairball motor controller interface, to provide power to the motor controller.

This E-Meter monitored both the voltage of the entire battery pack and the current flowing through the motor at any given time. To determine how much energy is left in the batteries, the E- Meter essentially “counts” all of the charge that has left the battery by integrating the motor current over time. The “used” charge is then subtracted from the nominal total charge present in the battery pack based on battery specifications. The ratio of “used” charge to nominal total charge is presented to the operator in the form of a percentage of charge remaining, analogous to the fuel remaining in a gas tank. While this might seem like a good solution to the problem of determining remaining range by monitoring the SoC of the motive batteries, there are several drawbacks to this approach. Firstly, battery capacity (how much energy it can store) degrades over time and charge/discharge cycles. Therefore calculating the energy remaining can be difficult since only the nominal total capacity is used and not the actual total capacity. Secondly, the Link-10 only monitors total pack voltage and not the voltages of each individual battery.

As with many engineering problems, there are multiple ways to determine the state- of-charge of batteries. In this case, a system was designed to take periodic voltage measurements from each of the twelve batteries in the main power pack on the Department Electric Vehicle (EV). These voltage measurements are then saved on an SD card via an Arduino Uno.

III. BLOCK DIAGRAM

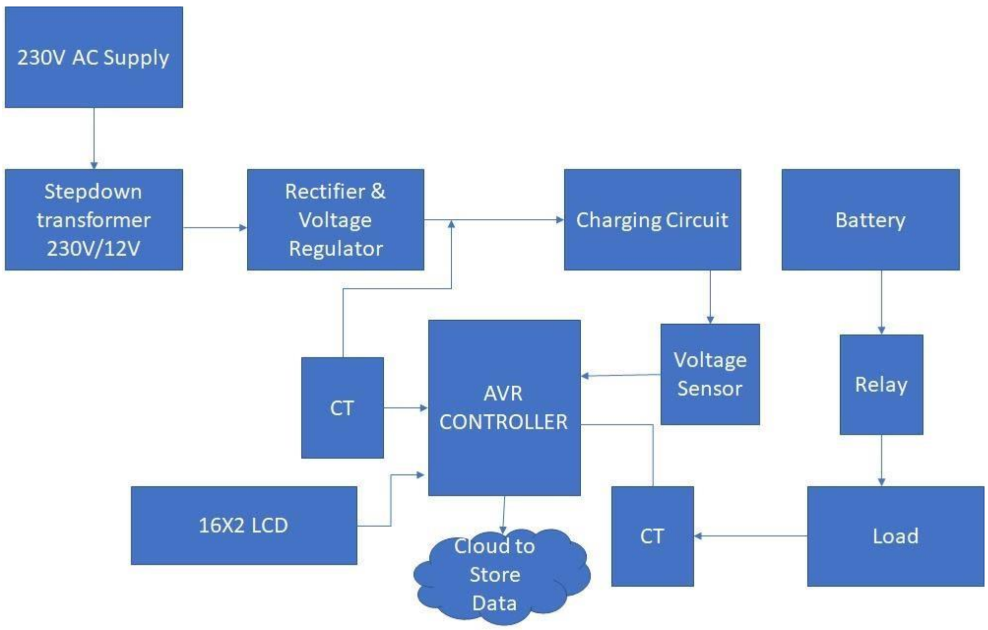


Fig.1-Block Diagram

IV. RESULTS AND FINDING

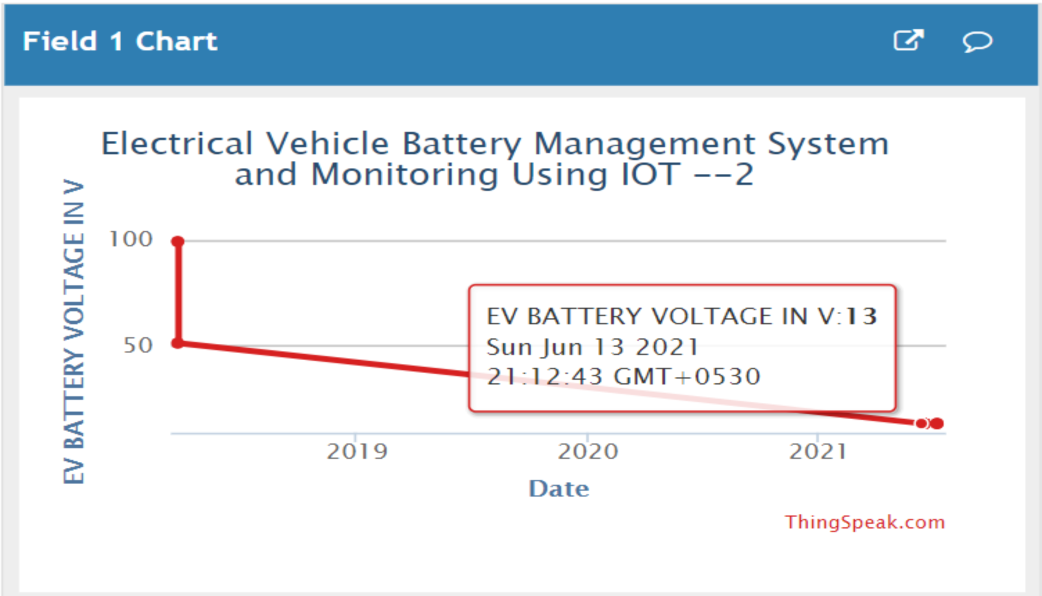


Fig.2- Battery Voltage

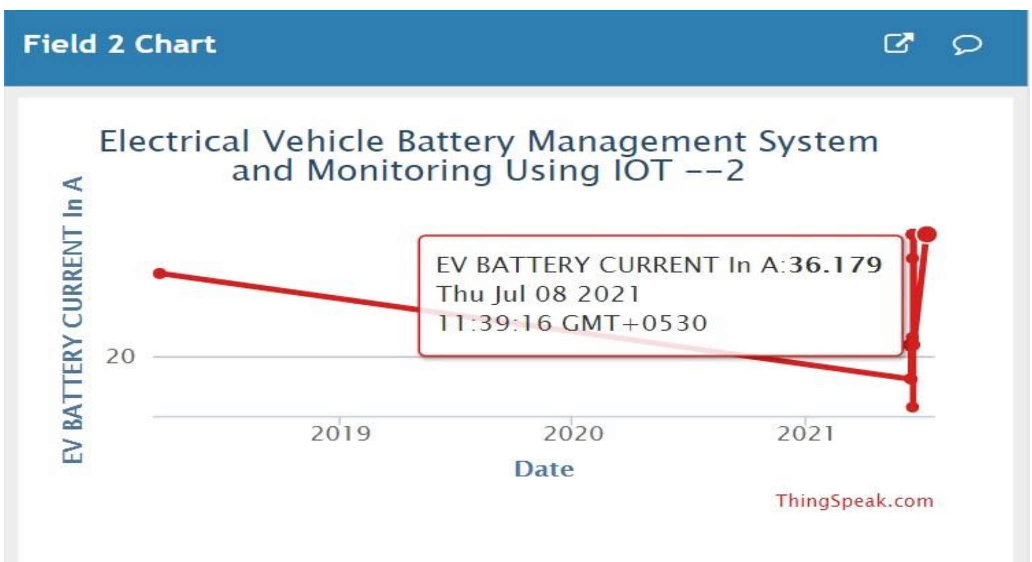


Fig.3 - Battery Current

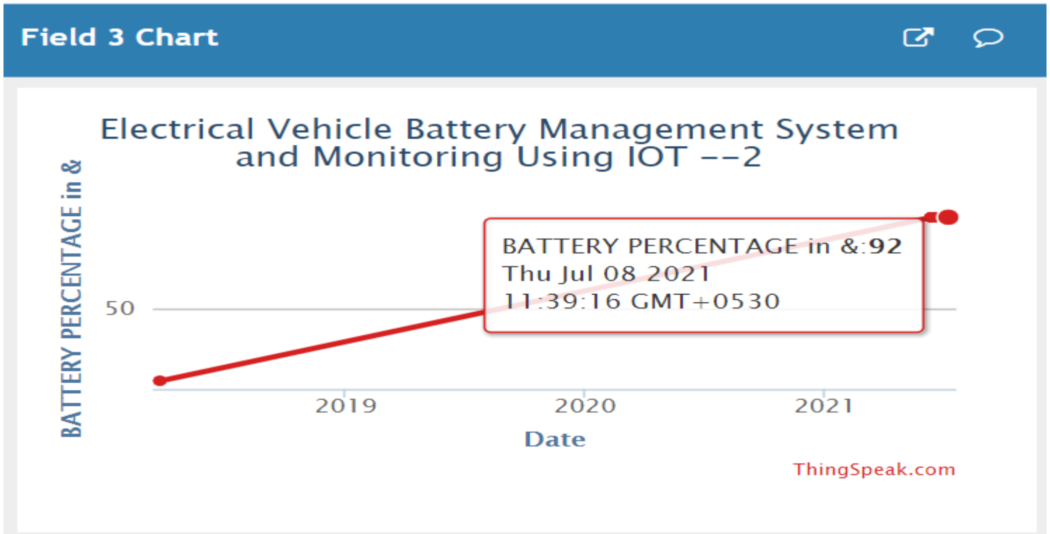
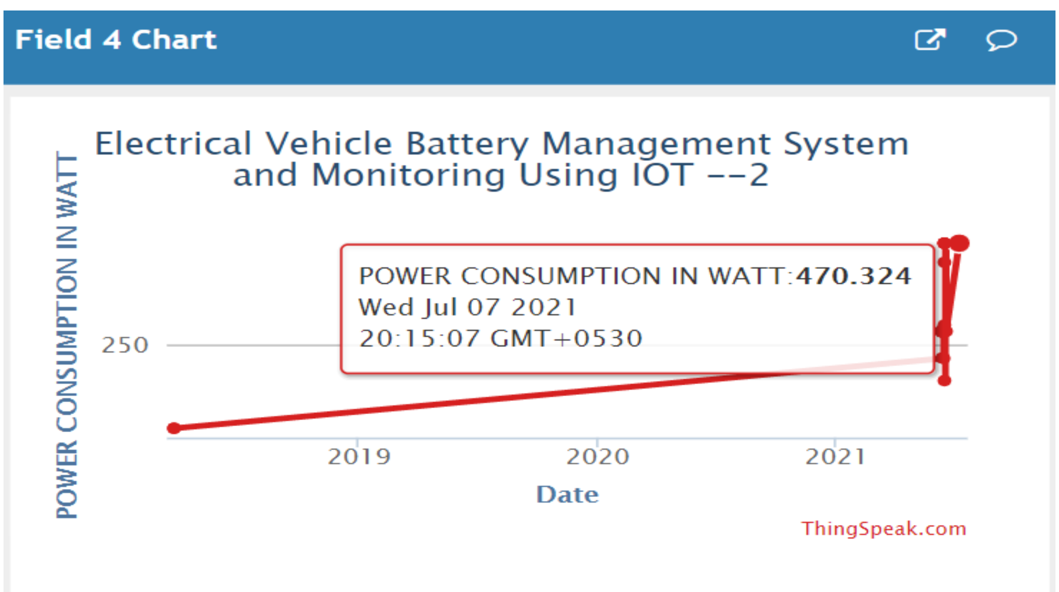


Fig.4 - Battery Percentage



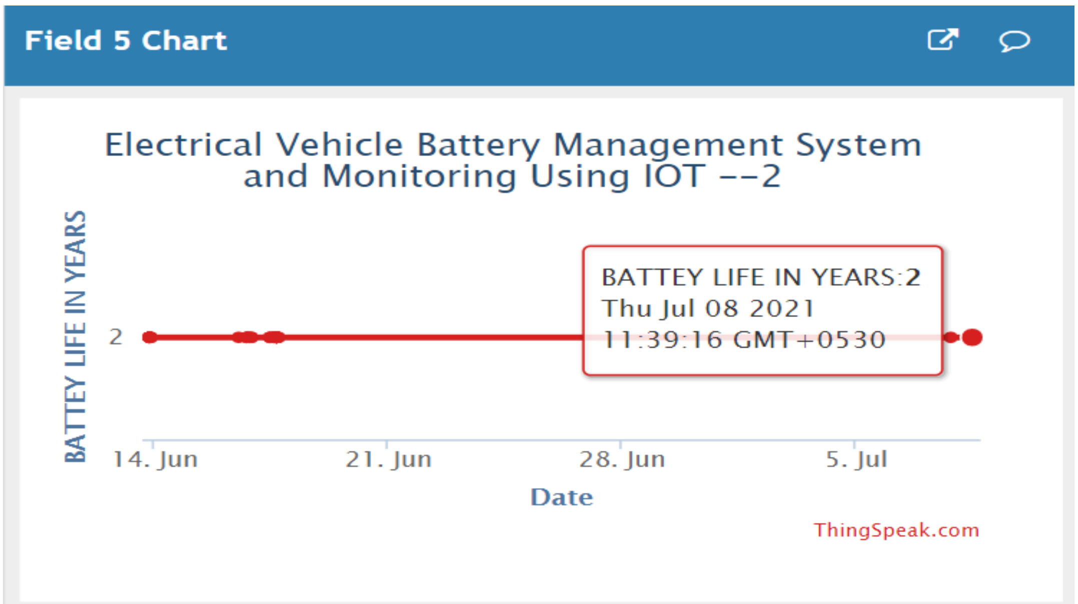


Fig.5- Battery life in year

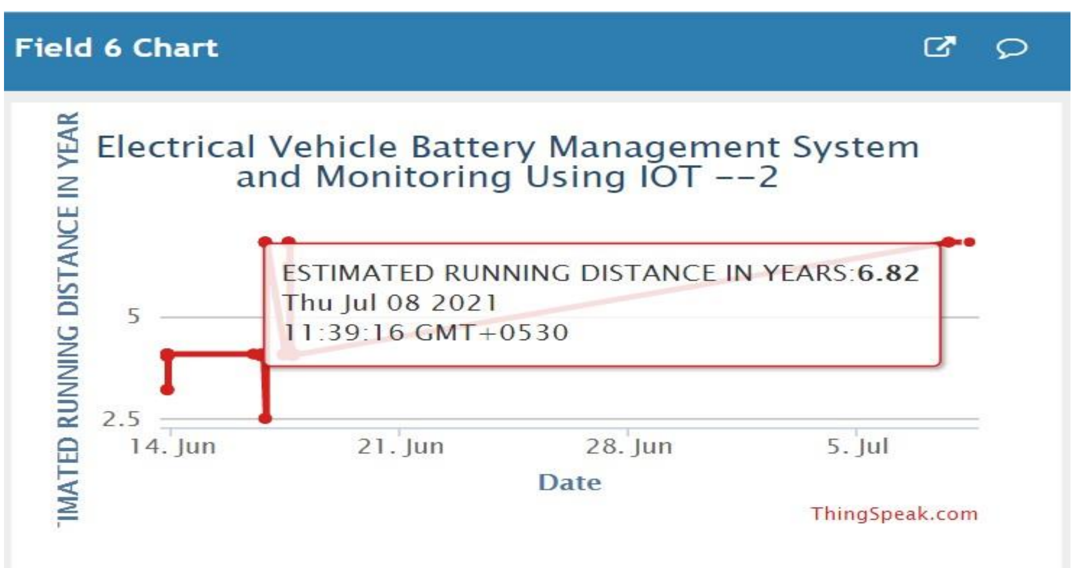


Fig. 6 -Estimated in Running Distance

V. CONCLUSION

The Manufacture of Li ion batteries has seen a drastic increase due to its prominent necessity in electric vehicles. This review gives a total sketch of outline of Li-particle battery. In future Lithium innovation battery would characterize the total transportation. The significant commitment of batteries is to control the compact gadgets and electrical utilities. The cost of li-particle batteries is expecting. This survey gives a definite clarification on methods of observing a battery, controlling strategies of info voltage and current, procedures for charging and releasing, protective measures for a battery, techniques of cell balancing and equalizing the battery process, management of power, temperature and heat. It also gives a thorough interpretation and fault diagnosis and its assessment methods. The attributes of battery management system are getting upgraded to modern technological development.

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