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Design of Battery Management System for E- Bikes

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Abstract: *Battery management systems (BMS) is used in electric vehicle to monitor and control the charging and discharging of rechargeable batteries which makes the operation more economical. Battery management system keeps the battery safe, reliable and increases the senility without entering into damaging state. In order to maintain the state of the battery, voltage, current, ambient temperature different monitoring techniques are used. For monitoring purpose different analog/digital sensors with microcontrollers are used. This Project addresses state of charge, state of health, and state of life and also maximum capacity of a battery. By reviewing all these methodologies future challenges and possible solutions can be obtained.*

Keywords: ArduinoUNO, Lithium ion Cells-12 (4Volts/3Ah), MCP2515_CAN (TX/RX), K Type Thermocouple/LM35 IC, Current Shunt – 20A, Relay – 5, PCB

I. INTRODUCTION

Electric vehicles (EV) are playing a key role because of its zero-emission of harmful gases and use of efficient energy.Electric vehicles are equipped by a large number of battery cells which require a effective battery management system (BMS) while they are providing necessary power. The battery installed in a electric PPIshould not only provide long lasting energy but also provide high power. Lead-acid, Lithium-ion, -metal hydride are the most commonly used traction batteries, of all these traction batteries lithium-ion is most commonly used because of its advantages and its performance. The battery capacity range for a electric vehicle is about 30 to 100 KWH or more Battery management system (BMS) makes design based on the battery charging and discharging rates , state of charge estimation, state of health estimation, cell voltage, temperature, current , etc.

II. PROPOSEDSYSTEM

As per the aims and objective of the project, different component have their own roles and make the successful project. So BMS is break down in four parts 1) Battery modeling 2) SOC & SOH estimation 3) Thermal management 4) Safety management, which refers to the modelling of the battery which defines the characteristics of the battery. After modeling the battery SOC&SOH are estimated using different methods for the estimation. Then to have longevity and less error prone due to higher longevity of the battery latest best operation. After the basic operation of the system whitch the vehical to control and remote acces data predicated including SOC status are display on the thing speak API based cloud. This all process is formulated in the simulation that was done on MATLAB

Lithium ion cells

Li-ion batteries, as one of the most advanced rechargeable batteries, are attracting much attention the past few decades. They are currently the dominant mobile power sources for portable electronic devices, exclusively use in the cell phones and laptop computers. Li-ion batteries are considered the decades ago, roughly at the same time when li-batteries were commercialized, as one may has already noticed from his/her daily life, the increasing functionality of mobile electronics away demand for better li-ion batteries.

Specifications-

- Battery voltage-4V
- Current -3Amps

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Controller (Arduino-Uno)

The arduino Uno is an open source microcontroller board baced on the microchip ATmega328P microcontroller and develop by Arduino.cc. the board is equipped with sets of digital and analog input/output (I/O) pines that may be interface to various expansion boards (shields) and other circuits.

Specifications

- Microcontroller – microchip ATmega328P
- Input voltage- 7 to 20 volts
- Digital I/O pins- 14 (of which 6 can provide PWM output
- PWN pins- 6 (pin 3, 5, 6, 9,10and 11)
- UART- 1
- I2C-1
- SPI-1
- Analog input pins- 6
- DC current per I/O pin-20mA
- Dc current for 3.3V pin – 50 mA
- Flash memory 32KB of which 0.5 KB used for boot leader
- SRAM- 2KB
- EEPROM- 1KB
- Clock speed- 16MHz
- Length- 68.6mm
- Width- 53.4
- Weight- 25g
- ICSP Header– yes
- Power sources- DC Power Jack & USB Port

MCP2515 Trans Receiver Module

This particular module is based on MCP2515 CAN Controller IC and TJA1050 CAN Transceiver IC, the MCP2515 IC is a standalone CAN Controller and has integrated SPI interface for communication with microcontroller, MCP2515 IC is the main controller that internally consist of three main subcomponents: the

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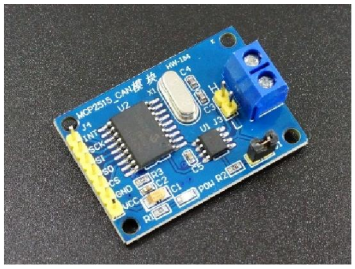
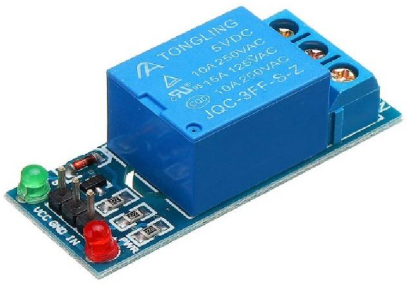
CAN module, the control logic and SPI block. CAN module is responsible for transmitting and receiving messages on the CAN bus. Control logic handles the setup and operation of the MCP2515 by interfacing all blocks, the SPI block is responsible for SPI. Communication interface. Coming to the TJA1050 IC, since it acts as an interface between MCP2515 CAN controller and the physical CAN bus, this IC is responsible for taking the data from the controller and relaying it on the bus



Relay Module

A power relay module is and electrical switch that is operated by an electromagnet. The electromagnet is activated by separate low power signal from a microcontroller. When activated, the electromagnetic pulls to either open and close an electrical circuit. A simple relay consist of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and on or more seat of contacts. The movable armature is hinged to the yoke and linked to one or more seat of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While this position, one of two sets of contracts is closed while the other set remains open



Current Shunt

Shunts provide an accurate DC millivolt signal to drive ammeter indicators, overload protection and control devices, especially for higher amperage. They supply a voltage drop proportional to the dc current which is measured and indicated by a moving coil meter with the dial calibrated in amps

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Electronic components

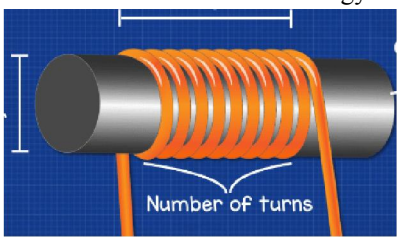
Resistor – A resistor is two terminal passive electronic component, used to oppose or limit the current

Capacitor

A capacitor made from two conductive plates with an insulator between them and it stores electrical energy in the form of an electric field

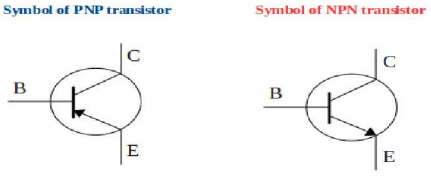
Inductor

A inductor is also referred to as an AC resistor which store electrical energy on the form of magnetic energy



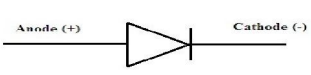
Transistor

A transistor is three terminal semiconductor device. Mostly it is use as switching device and also as an amplifier. This switching device can be voltage and current controlled.



Diode

A diode is a device that allow current to flow in one direction and usually made with the semiconductor material



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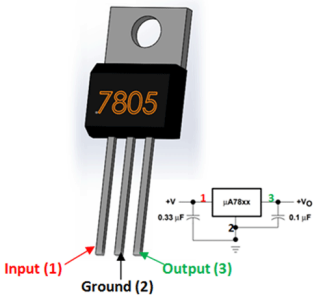
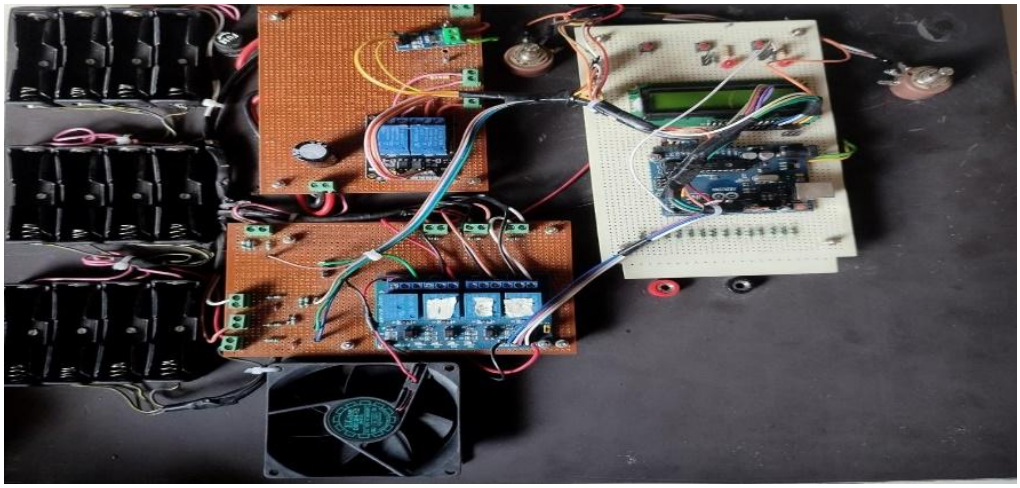
IC (LM7805 & LM7812)

The LM7805 is a voltage regulator that outputs +5/+12 volts. Like most other regulation in the market, it is a three pin IC; input pin for accepting incoming DC voltage, ground pin for establishing ground for the regulator, and output pin that supplies the positive5/12 volts.



Hardware



III. SIMULATION RESUL

Signal Watch - CAN

Message	Signal	Physical Value	Raw Value
BM1_Overview	ESS_BM1_Voltage_Act_V	55.32 V	159C
BM1_Overview	ESS_BM1_Temperature_Act_degC	22.5 degC	D2
BM1_Overview	ESS_BM1_iMod_Act_A	0.109985 A	FFE7
BM1_MinMaxState	ESS_BM1_MinCell_Act_V	3.951 V	F6F
BM1_MinMaxState	ESS_BM1_MaxCell_Act_V	3.952 V	F70
BM1_MinMaxState	ESS_BM1_MaxTempCell_Act_ID	3 ID	3
BM1_MinMaxState	ESS_BM1_MinTempCell_Act_ID	5 ID	5
BM1_Sox	ESS_BM1_Soc_Est_perc	86 perc	AC
BM1_Sox	ESS_BM1_Sohc_Est_perc	99.5 perc	C7

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IV. APPLICATIONS

1) Used in E-bikes
2) Used in home inverters
3) Industrial Battery Applications

V. FUTURE SCOPE

The market for lithium-ion batteries in India is expected to register a CAGR of 17.21% during the forecast period. The market value of 2020 is USD 1.66 billion, and the estimated market value for the year 2026 is USD 4.14
All Lead Acid Batteries Can be Replaceable in Future With Lithium ion batteries.
In Project We have using Relays CAN be replaced with MOSFET to compact BMS Size

VI. CONCLUSION

In this way we are developing the system model for battery management in electric vehicle by controlling the crucial parameters such as voltage, current, State of charge, state of health, state of life, temperature. It is every important that the BMS should be well maintained with battery reliability and safety. This present project focusses on the study of BMS and optimizes the power performances of electric vehicles. Moreover, the target of reducing the greenhouse gases can greatly be achieved by using battery management system.

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