International Journal of Advance Research in Science and Engineering
Volume No. 12, Issue No. 06, June 2023
www.ijarse.com
IJARSE
ISSN 2319 - 8354

BATTERY MANAGEMENT AND MONITORING SYSTEM FOR E-VEHICLE USING IOT

Dr. P. Govindasamy
dept of Elecctrical and Electronics Engineering
Government College of Engiineering
Affiliated to Anna University
Erode-638316

Submitted by
Sriram. K, Shanmuganathan M, Hariharan K
Dept of Electrical and Electronics engineering
Affiliated to Anna University
Erode-638 316

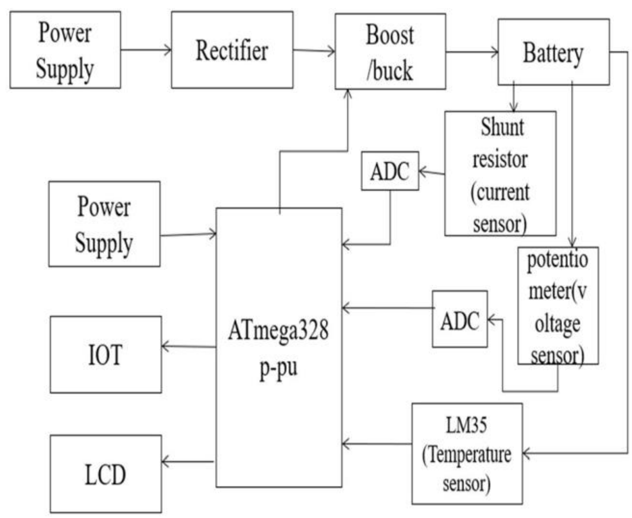
Abstract
The use of the Internet of Things (IoT) in monitoring the operation of an electric vehicle battery is described in this study. It is obvious that an electric car iscompletely reliant on a battery as a source of energy. Theamount of energy given to the vehicle, on the other hand, is gradually reducing, resultingin a performance decline.This is frequently a major source of concern for battery manufacturers. The idea of monitoring the performance of the vehicle using IoT techniques is proposed in this study so that monitoring can be done directly. In this project, continuous observing of batteries based on Internet of thingsis proposed. The system continuously senses voltage, current, and temperature in thebattery. Ifthe battery temperature is high, the system alert intimateto the userthrough LED.

I. INTRODUCTION

Electric vehicles (EVs) are gaining popularity these days as fuel prices become more expensive. Due to this scenario, many vehicle manufacturers looking for alternatives to energy sources other than gas. The use of electrical energysources may improve the environment since there is less pollution. In addition, EV producesgreat advantages in terms of

energy-saving and environmental protection. Most EVsused rechargeable battery which is a lithium-ion battery. It is smaller to be compared with lead-acid. In fact, it has constant power, and energy's life cycle is 6 to 10 times greater compared with alead-acid battery. Lithium-ion battery life cycle can be shortened by some reasons such as overcharging and deep discharge. In this project, continuous observing of batteries based on Internet of things is proposed. The system continuously senses voltage, current, and temperature in the battery. Due to the advancement of the design of the notification system, the internet of things (IoT) technology can be used to notify the manufacturer and users regarding the battery status. This can be considered as one of the maintenance support procedures that can be done by the manufacturer.

III. PROPOSED SYSTEM



BATTERY

II. METHODOLOGY

This method uses temperature sensor, voltage sensor and current sensor . The full charge capacity, the remaining charge capacity, the state of charge,voltage, and average current are assessed through the Atmega328p-pu. For data transmission between the IOT and the Atmag328p-pu, the UARTprotocol is used. The battery data received from the sensor, the calculation and the analysis partis implemented in the microcontroller. Further, the data is transferred to a IOT using a UART protocol.

NOMINAL VOLTAGE	12V	
INTERNAL IMPEDANCE	0.25 Ω	
CHARGING CUT OFF VOLTAGE	13.3 V	
DISCHARGING CUT OFF VOLTAGE	10.5	
OPERATING TEMPERATURE	charging	0 ~45°C
	discharging	0°C~55°C
Chemistry	Lead Acid	
Capacity	7Ah	
Rating whr	84	
Length	5.95 inches	
Width	2.56 inches	
Height	3.7 inches	
Weight	1 Kg	

The two cells are may be connected via a semi permeable membranous structureallowing ions to flow but not the mixing of electrolytes as in the case of most primarycells or in the same solution as in secondary cells.

RELAY

PRINCIPLE OF OPERATION OF THE INVERTING TOPOLOGY:

If the current through the inductor L never falls to zero during a commutationcycle, the converter is said to operate in continuous mode. The current and voltage waveforms in an ideal converter.

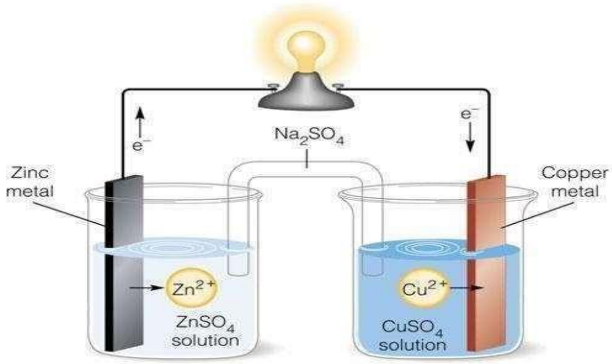
From t=0 to t=DT, the converter is in On-State, so the switch S is closed. The rateof change in the inductor current (I_L) is therefore given by

$$\frac{\mathrm{d} I_{\mathrm{L}}}{\mathrm{d} t} = \frac{V_i}{L}$$

At the end of the On-state, the increase of I_L is therefore:

$$\Delta I_{\mathrm{L_{On}}} = \int_0^{DT} \mathrm{d} I_{\mathrm{L}} = \int_0^{DT} \frac{V_i}{L} \,\mathrm{d} t = \frac{V_i DT}{L}$$

An electric battery is a collection of one or more electrochemical cells in which stored chemical energy isconverted into electrical energy. The principles of operation haven't changed much since the time of Volta. Each cell consists of two half cells connected in series through an electrolytic solution. One half cell houses the Anode to whichthe positive ions migrate from the Electrolyte and the other houses the Cathode to which the negative ones drift. The two



cells are may be connected via a semi permeable membranous structure allowing ions to flow but not the mixing of electrolytes as in the case of most primary cells or in the same solutionas in secondary cells.

Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications.Most of the devices have the application of relays.

- Nominal Voltage (VDC): 12V
- Coil Resistance (Ω) (± 10%): 400Ω
- Power Consumption (W): 0.36 W
- Nominal Current (mA) (± 10%): 30 mA
- Pull in Voltage (VDC): 75% Max.
- Drop Out Voltage (VDC): 10% Min.
- Max. Allowable Voltage (VDC): 130%

BUCK-BOOST CONVERTER

The **buck–boost converter** is a type of DC-to-DC converter that has an output voltage magnitude that is either greater than or less than the input voltage magnitude.It is equivalent to a flyback converter using a single inductor

$$\Delta I_{L_{On}} + \Delta I_{L_{Off}} = 0$$

instead of a transformer.

Two different topologies are called buck–boost converter. Both of them can produce a range of output voltages, from an output voltage much larger (in absolute magnitude) than the input voltage, down to almost zero.

The inverting topology

The output voltage is of the opposite polarity than the input. This is aswitched-mode power supply with a similarcircuit topology to the boost converter and the buck converter. The output voltage is adjustable based on the duty cycle of the switching transistor. One possible drawback of this converter is that the switch does not have a terminal atground; this complicates the driving circuitry.

D is the duty cycle. It represents the fraction of the commutation period T during which the switch is On. Therefore D ranges between 0 (S is never on) and 1(S is always on).

During the Off-state, the switch S is open, so the inductor current flows through the load. If we assume zero voltage drop in the diode, and a capacitor largeenough for its voltage to remain constant, the evolution of I_L.

Therefore, the variation of I_L during the Off-period is:

As we consider that the converter operates in steady-state conditions, the amount of energy stored in each of its components has to be the same at the beginning and at the end of a commutation cycle. As the energy in an inductor is given by:

$$E = \frac{1}{2} L\, I_L^2$$

it is obvious that the value of I_L at the end of the Off state must be the same with thevalue of I_L at the beginning of the On-state, i.e. the sum of the variations of I_L duringthe on and the off states must be zero:

$$\Delta I_{L_{Off}} = \int_0^{(1-D)T} \mathrm{d}I_L = \int_0^{(1-D)T} \frac{V_o\,\mathrm{d}t}{L} = \frac{V_o(1-D)T}{L}$$

$\Delta I_{L_{On}}$ Substituting and $\Delta I_{L_{Off}}$ by their expressions yields:

VOLTAGE SENSOR:

Voltage is sometimes called 'potential difference', and corresponds to the 'potential' or ability for electrons to flow around a circuit. So measuring voltage always requires direct connections to the two terminals we are trying to measure.

Potential divider Method*:*

A potential divider is a simple way of measuring voltages. The input voltageis measured between ground and

$$\Delta I_{L_{On}} + \Delta I_{L_{Off}} = \frac{V_i DT}{L} + \frac{V_o(1-D)T}{L} = 0$$

This can be written as:

$$\frac{V_o}{V_i} = \frac{-D}{1-D}$$

This in return yields that:

$$D = \frac{V_o}{V_o - V_i}$$

From the above expression it can be seen that the polarity of the output voltageis always negative (because the duty cycle goes from 0 to 1), and that its absolute value increases with D, theoretically up to minus infinity when D approaches 1.

CURRENT SENSOR:

Measuring a voltage in any system is a “passive” activity as it can be done easily at any point in the system without affecting the system performance. However, current measurement is “intrusive” as it demands insertion of some type of sensor which introduces a risk of affecting system performance.

Current measurement is of vital importance in many power and instrumentation systems. Traditionally, current sensing was primarily for circuit protection and control. However, with the advancement in technology, current sensing has emerged as a method to monitor and enhance performance.

CURRENT SENSING PRINCIPLES:

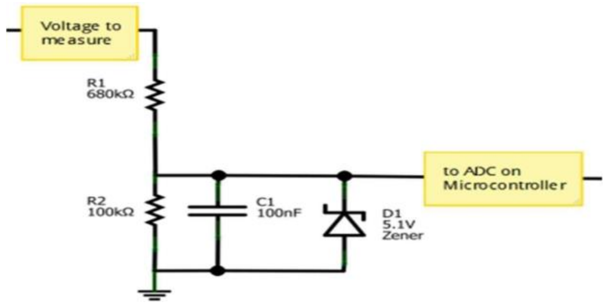
A current sensor is a device that detects and converts current to an easily measured output voltage, which is proportional to the current through the measuredpath.

When a current flows through a wire or in a circuit, voltage drop occurs. Direct sensing is based on Ohm’s law.

CIRCUIT DIAGRAM:

the top point of two resistors in series. The outputvoltage is measured across the bottom resistor. This reduces the voltage of the outputby a factor which relates to R1 and R2, the top and bottom resistors.

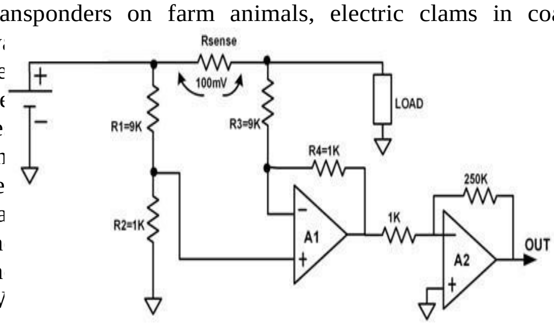
CIRCUIT DIAGARAM:



INTERNET OF THINGS (IOT):

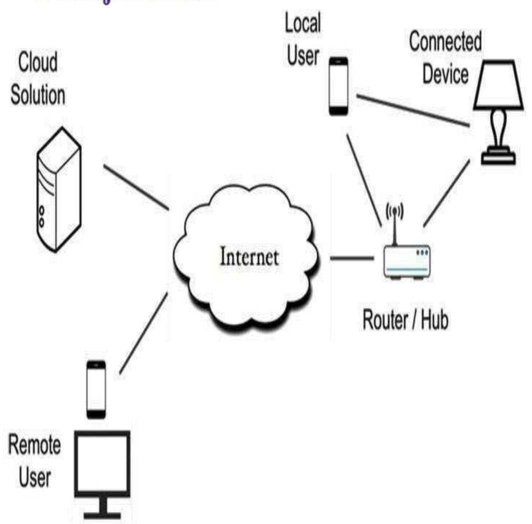
The **internet of things** (**IoT**) is the network of physical devices, vehicles, buildingsand other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoTas "theinfrastructure of the information society." The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologiessuchas smart grids, smart homes, intelligent transportation and smart cities.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal w... ysis de... or fie... and re... s"as an... and se... of va... low th... ples in... use W...



IoT BLOCK DIAGRAM:

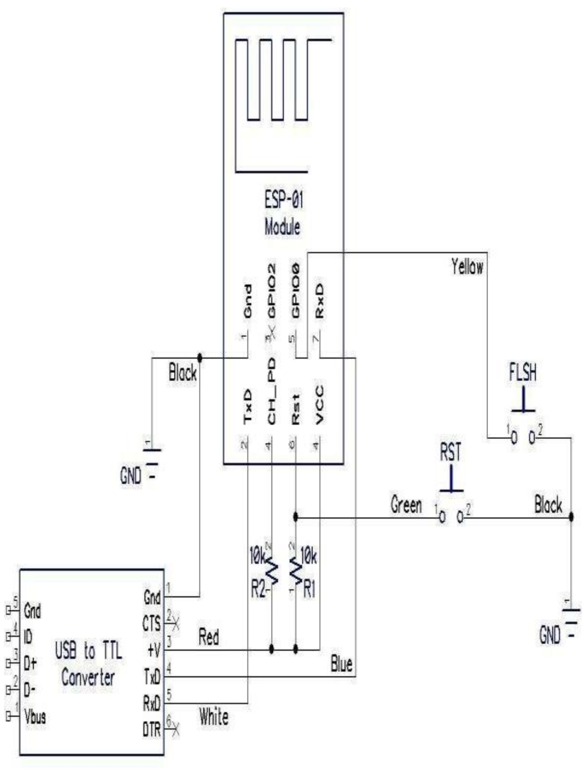
International Journal of Advance Research in Science and Engineering
Volume No. 12, Issue No. 06, June 2023
www.ijarse.com
IJARSE
ISSN 2319 - 8354



IoT MODULE:

As well as the expansion of Internet-connected automation into a plethora of new application areas.

IoT INTERFACING CIRCUIT:

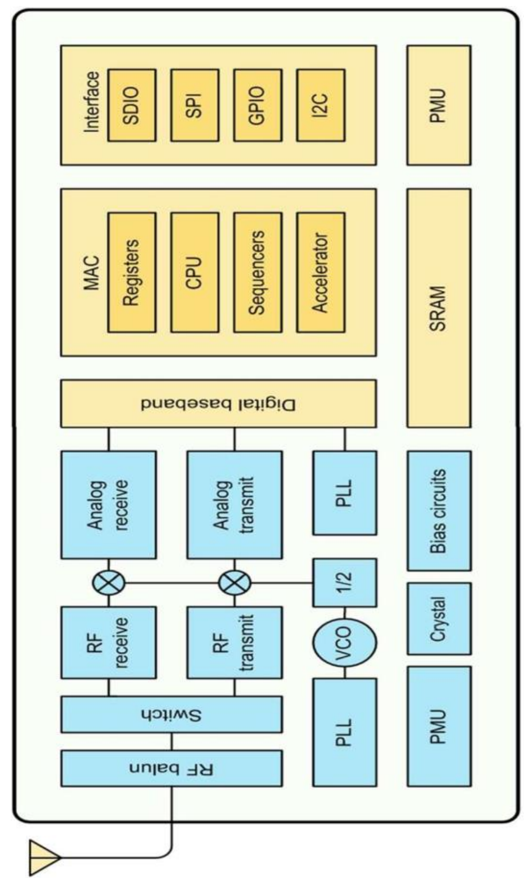


ESP-01 Connection Diagram

ESP8266EX integrates antenna switches, RF balun,power amplifier, low noise receive amplifier, filters

.

version of Tensilica's L106 Diamond series 32-bit processor and on-chip SRAM. It can be interfaced withexternal sensors and other devices through the GPIOs.Software Development Kit (SDK) provides samplecodes for various applications functionalities, ESP8266EX also integrates an enhanced andpower management modules. Besides the Wi-Fi



NODEMCU:

ESP8266EX delivers highly integrated Wi-Fi SoC solution to meet the continuous demands forefficient power usage, compact design and reliable performance in the industry. With the complete and self-contained Wi-Fi networking capabilities, It can perform as either a standalone application or the slave to a host MCU. When ESP8266EX hosts the application, it promptly bootsup from the external flash. The integrated high-speed cache helps to increase the system performance and optimise the system memory. Also, ESP8266EX can be applied to any micro- controller design as a Wi-Fi adaptor through SPI / SDIOorI2C / UART interfaces. is done with an Atmega238p-pu microcontroller which takes the measurement of the voltage, charging current,temperature of the battery. It is capable of sending the acquired data to internet by which the condition of the battery can be monitored .Performance and functionality of this system can be improved by using sensing elements.

FUTURE SCOPE:

Our project has a battery protection and management system, it will increasebattery life time. Less battery maintenance is needed. Due to multi batteries high reliable operation.

Overall efficiency is increased and system cost get decreased

REFERENCE:

[1] K. Guo Dengfeng, Xu Shan, "The Internet of Things hold up Smart Grid networking technology," North China Electric., vol. 2, pp. 59—63, 2010.

[2] B. P. Roberts and C. Sandberg, "The role of energy storage in development ofsmart grids," in Proceedings of the IEEE, 2011, vol. 99, no. 6, pp. 1139—1144.

[3] R. Liu, L. Dow, and E. Liu, "A survey of PEV impacts on electric utilities," in IEEE PES Innovative Smart Grid Technologies Conference Europe, ISGT Europe,2011.

[4] Z. Rao, S. Wang, and G. Zhang, "Simulation and experiment of thermal energy management with phase change material for ageing LiFeP04 power battery," Energy Cowers. Manag., vol. 52, no. 12, pp. 3408-3414, 2011.

[5] N. Watrin, B. Blunier, and A. Miraoui, "Review of adaptive systems for lithium batteries state- of-charge and state-of-health estimation," in 2012 IEEE Transportation Electrification Conference and Expo, ITEC 2012, 2012.

[6] S. Piller, M. Perrin, and A. Jossen, "Methods for state-of-charge determination and their applications," in Journal ofPower Sources, 2001, vol. 96, no. 1, pp. 113—120.

[7] L. Lu, et.al., "A review on the key issues for lithium-ion battery management in electric vehicles," Journal ofPower Sources, vol. 226. pp. 272—288, 2013.

[8] M. Charkhgard and M. Farrokhi, "State-of-charge estimation for lithium-ion batteries using neural networks and EKF," IEEE Trans. Ind. Electron. , vol. 57, no.12, pp. 4178— 4187, 2010. G. Y. Y. Ding-xuan, "SOC estimation of Lithium-ion battery based on Kalman filter algorithm," in 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE), 2013. monitoring and charging system