



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com



Soc Determination of Battery using Python

Mr.C. Senthil Kumar, B. Nithin, C. Gobi, D. Anil Kapoor, P. Prasanth

Assistant Professor, Department of Information Technology College of Technology, Coimbatore, India

B. Tech, Information Technology, SNS College of Technology, Coimbatore, India

B. Tech, Information Technology, SNS College of Technology, Coimbatore, India

B. Tech, Information Technology, SNS College of Technology, Coimbatore, India

B. Tech, Information Technology, SNS College of Technology, Coimbatore, India

ABSTRACT: Batteries are fundamental segments of most electrical gadgets. To control battery execution and security it is important to comprehend what should be controlled and why it needs controlling. This requires an inside and out comprehension of the crucial presentation attributes what's more, battery disappointment modes especially. For this reason, many checking strategies are utilized to screen the battery condition of charge, voltage, and current. State of Charge is required in order to predict the performance and battery life such as the charge and discharge process. Estimation of SOC Involves the process of measuring parameters such as battery voltage, current, and temperature. These parameters can be processed to estimate the state of charge and state of health of the battery. This system monitors the battery by calculating its SOC and alert the user about battery condition. It has sensors that measure data of current and voltage of a battery which is manipulated by Arduino microcontroller and data is logged in to an excel sheet using an SD card module. SOC is calculated using python with the obtained data from the CSV file. Then the SOC characteristic curves of the battery are displayed on an HTML page using python.

KEYWORDS: Battery, State of Charge, Time, Voltage, Current, Data visualisation, Pandas, Twilio, Jupyter.

I. INTRODUCTION

Lead Acid batteries are broadly utilized in vehicles and brilliant matrices to store electrical energy. The State of Charge (SOC) of Lead Acid batteries is a vital boundary that shows the measure of charge left in the battery, communicated as a level of the absolute charge limit of the battery. SOC is a pointer of the accessible runtime of the battery before it needs re-energizing, which is of prime significance in versatile applications, Uninterrupted Power Supplies (UPS) and Keen Grids. State of Charge (SOC) assessment is a basic test for battery use. The SOC of a battery, which is utilized to portray its leftover limit, is a vital boundary for a control technique. In any case, a battery is a synthetic fuel stockpiling source, and this substance energy can't be straightforwardly gotten to. This issue makes the assessment of the SOC of a battery troublesome. Precise assessment of the SOC stays exceptionally mind-boggling and is hard to execute on the grounds that battery models are restricted and there are parametric vulnerabilities.

In this project, the values of current and voltage are been taken and are processed by the Arduino microcontroller. Then the data is collected in an excel sheet using the SD card module. The SOC of the battery is calculated from these data by the coulomb counting method and characteristic curves are plotted on an HTML page using Python. This system can predict the available SOC in batteries and alert the users by sending an SMS through python software. Thus, these objectives had been completed successfully in a step-by-step manner. The workflow involves:

- Data obtaining SOC,
- calculation Data,
- cleaning Data,
- Visualizing Sending,
- SMS Alert.

As the SOC is a significant boundary, which mirrors the battery execution, so precise assessment of the SOC cannot just secure battery, forestall over the release, and improve the battery life yet additionally permit the application to make levelheaded control procedures to save energy.



II. HARDWARE DESCRIPTION

The proposed work requires the proper selection of devices and equipment for an optimum design. Hence, this chapter explains the theories and principle behind each component and software used in this project.

II.1 ARDUINO UNO

Arduino is an open-source microcontroller that can be effectively modified, deleted, and reconstructed at any moment of time. In light of basic microcontroller sheets, it is an open-source figuring stage that is utilized for building and programming electronic gadgets. It is additionally fit for going about as a smaller than expected PC actually like other microcontrollers by taking data sources and controlling the yields for an assortment of hardware gadgets.

The Arduino Uno board is a microcontroller reliant upon the ATmega328. It has 14 advanced information/yield pins in which 6 can be utilized as PWM yields, a 16 MHz ceramic resonator, an ICSP header, a USB association, 6 simple data sources, a force jack, and a reset button. This contains all the necessary help required for the microcontroller. To begin, they are basically associated with a PC with a USB link or with an AC-to-DC connector or battery.

II.2 SENSORS

A sensor changes the actual activity over to be estimated into an electrical same and measures it so the electrical signs can be effectively sent and further handled.

1. Current Sensor.
2. Voltage sensor.
3. Temperature sensor.

II.3 12V 1.3AH SEALED LEAD ACID BATTERY

The 'On the web' scope of fixed lead-corrosive batteries are sans upkeep, valve controlled, and watertight undeniably fit every single 'backup application. There will be no misfortune in influence yield over the battery life.

Low self-release of around 2-3% each month contrasted and 20-30% for more normal battery frameworks. Built-in fixed, rectangular high effect plastic case. A battery-powered 12V gel battery is reasonable for high cyclic and reserve applications.

Quality development with no trade-off on materials to guarantee long help life. Low inward obstruction implies a high release rate.

Wide working temperature range working between - 15° C to +50 ° C when completely charged]. They are utilized in Lighting Equipment, Emergency Lighting, Toys, and Consumer Electronics, Fire Alarm, and Security Systems.

Low interior obstruction implies a high release rate with a wide working temperature range working between - 15° C to +50 ° C when completely energized.

III. SOFTWARE TOOLS FOR DATA ANALYSIS

III.1 ARDUINO SOFTWARE

The Arduino Integrated Development Environment (IDE) is a cross-stage application (for Windows, macOS, Linux) that is written in capacities from C and C++. It is utilized to compose and transfer projects to Arduino viable sheets, yet in addition, with the assistance of outsider centers, other merchant improvement sheets. The source code for the IDE is delivered under the GNU, rendition 2.

The Arduino IDE upholds the dialects c and c++ utilizing exceptional guidelines of code organizing. The Arduino IDE supplies programming from the Wiring project, which gives numerous basic info and yield strategies. Client composed code just requires two fundamental capacities, for beginning the sketch and the primary program circle, that is accumulated and connected with a program stub principle () into an executable cyclic leader program with the GNU toolchain additionally included with the IDE dispersion.

As a matter of course, avrduide is utilized as the transferring apparatus to streak the client code onto official Arduino sheets with the rising prominence of Arduino as a product stage, different sellers began to carry out custom open-source compilers and instruments (centers) that can construct and transfer portrayals to other microcontrollers that are not upheld by Arduino's true line of microcontrollers. IN October 2019 the Arduino association started giving early admittance to another Arduino Pro IDE with investigating, what's more, other progressed highlights.

III.2 IMPORTANCE OF DATA VISUALIZATION

Information perception is a visual specialized technique that assists with perusing, examine information and data with higher speed and exactness. Information representation is critical to make significant data and dynamic force in the cerebrum. Information is futile if it's not making any importance. That is the reason information representation assists with introducing significant and profitable information to its clients. These days it is hard to break down the information in a more limited timeframe with less human force. This is on the grounds that the measure of information that is created by sites, internet business store, CRM applications, Website Investigation application, Social Media Analytics application, and so on is large, even deals and buying subtleties are a major measure of information that is difficult to see every day. That is the reason information representation instruments are incorporated into practically all the business applications like sites, advertising devices, Facebook investigation, Twitter examination, Google investigation, CRM Sales and Customer support devices, and some more. One of those instruments, Microsoft Excel is as yet utilized by a great many private venture proprietors, banks, and organizations to imagine the business information with the goal that it assists with understanding option groundbreaking circumstances. Subsequently, Microsoft Excel is utilized. Furthermore, one more extra apparatus Python is additionally utilized due to its plotting library named Pandas.

III.3 PYTHON PANDAS

Pandas comprise a few plots like Line, Bar, Scatter, Histogram, and so on, Scatter plot is mostly utilized. A disperse plot is a kind of plot or numerical graph utilizing Cartesian directions to show esteems for commonly two factors for a bunch of information. On the off chance that the 4 focuses are shading coded, one extra factor can be shown. The information is shown as an assortment of focuses, each having the worth of one variable deciding the situation on the flat hub and the worth of the other variable deciding the situation on the vertical pivot. The principal benefit of the disperse plot is that it shows the connection between two factors, the best strategy to show a non-direct example, the scope of the information stream, for example, most extreme and least worth, can be effortlessly decided.

III.4 JUPYTER

The Jupyter Notebook is an open-source web application that you can use to make and share records that contain live code, conditions, representations, and text. Jupyter Notebook is kept up by individuals at Project Jupyter.

Jupyter Notebooks is a side project of the IPython project, which is used to have an IPython Notebook project also. The name, Jupyter, comes from the center upheld programming dialects that it upholds: Julia, Python, and R. Jupyter ships with the IPython piece, which permits you to compose your projects in Python, yet there are at present more than 100 different portions that you can likewise utilize.

In this, we use Plotly to incognito our python record into an HTML document. Plotly gives internet charting, investigation, and measurement instruments for people and cooperation, just as logical diagramming libraries for Python, R, MATLAB, Perl, Julia, Arduino, and REST. Plotly's Python charting library makes intuitive, distribution quality diagrams. Instances of how to make line plots, disperse plots, region outlines, bar diagrams, mistake bars, box plots, histograms, heatmaps, subplots, numerous tomahawks, polar graphs, and air pocket graphs.

III.5 TWILIO

Twilio is cloud-based assistance that empowers incredible correspondence between cell phones, applications, administrations, and frameworks all through the business to overcome any issues between ordinary correspondence. Twilio looks to free organizations of the muddled telecom equipment by giving a communication framework web administration through an around the world accessible cloud API, permitting web designers to utilize standard web dialects to coordinate calls, instant messages, and IP voice correspondences into their web, 19mobile and conventional telephone applications. Twilio's Programmable SMS API assists you with adding hearty informing capacities to your applications. Utilizing this REST API, it is used to send and get SMS messages, track the conveyance of sent messages, and recover and change message history.

Twilio was such a telephone exchange for working environments, and it improves generally speaking association of managing diverse moving toward calls. Here is the list of Twilio's key parameters:

- secured authorization process;
- call queuing and the API to manage those queues;
- converting text into speech and opposite transformations;
- voice calls recording;
- notifications by means of various channels;
- temporary phone numbers buying.

IV. DESIGN

IV.1 BLOCK DIAGRAM

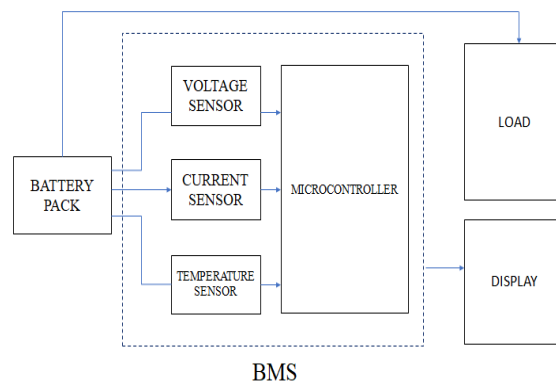


Fig IV.1.1 Block diagram

IV.2 FLOW CHART

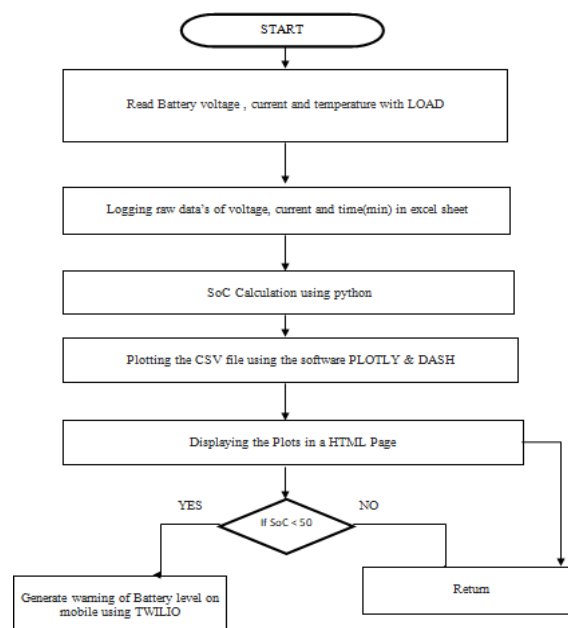


Fig IV.1.2. B

V. IMPLEMENTATION

V.1. DATA LOGGING FROM ARDUINO

Arduino reads the input from the sensors connected to it and the collected data of current, voltage, and time from the sensors is added to Excel through logging it in an SD card module. The data sent from the Arduino is logged in to the excel sheet named “data.csv” in the form of comma-separated values. The excel file should be saved in the form of comma-separated values as only the pandas software can read the file during data cleaning and data processing. The Dataset contains the values of voltage, current, time(hrs.)

V.2. SOCCALCULATION

State of Charge (SoC) is the degree of charge of an electric battery comparative with its ability. The worth of the SOC changes somewhere in the range of 0% and 100%. Assuming the SOC is 100%, the cell is supposed to be completely energized, while a SOC of 0% shows that the cell is totally released.

V.2.1. COULOMB COUNTING METHOD

Coulomb-counting-based calculations are frequently utilized as a center innovation for battery SOC assessment in BMS. They express the SOC as the proportion of accessible ability to the ostensible one. The leftover limit in a battery can be determined by estimating the current stream rate (charging/releasing) and incorporating it throughout the time stretch Δt . The normal condition to compute the SOC is given by Equation is the place where the SOC₀ addresses the underlying SOC, I_{bat} address the current across the battery and, Q_{rated} is the ostensible limit of the battery.

$$SOC = SOC_0 + \frac{\int_{t_0}^{t_0+\tau} I_{bat} \Delta \tau}{Q_{rated}} * 100$$

V.3. DATA CLEANING

Date cleaning involves converting the data into a data frame. Initially, the data type and headers are read from the source file, "data.csv" which is a comma-separated file, and the character data types are converted into date-time objects using python.

V.4. DATA VISUALIZATION

Data manipulated in the form of data frame please is visualized in an HTML page using a python package called Plotly. Plotly is used to obtain the responsible plots on an HTML page. The data frame is plotted with respect to time values on an HTML page. The python file is converted into an HTML page with the help of Plotly. Data visualization of three curves obtained. All three curve5s are explained below.

V.4.1. SOC vs VOLTAGE

The obtained SoC Values in the data frame are plotted against the voltage. The graph clearly shows that the SoC of the battery decreases with a decrease in terminal voltage and they show their proportionality.

V.4.2. SOC vs TIME

The obtained SoC Values in the data frame are plotted against the time. The graph clearly shows that the SoC of the battery decreases with an increase in time and they show their inversive proportionality.

V.4.3. TIME vs VOLTAGE

The obtained Voltage Values in the data frame are plotted against the time. The graph clearly shows that the Voltage of the battery decreases with an increase in time and they show their inversive proportionality.

V.5. SENDING ALERTS FROM TWILIO

Twilio is python REST API which is utilized to send ready message to cell phone on low battery level Indication. Twilio's Programmable SMS API assists you with adding vigorous informing capacities to your applications. Utilizing this REST API, you can send and get SMS messages, track the conveyance of sent messages, and recover and change message history.



VI. CONCLUSION

In this project, the SOC of Lead Acid Battery is successfully calculated and characteristic curves are plotted using python. This system successfully sends SMS alerts on low battery level indications. But other parameters such as State of Health (SOH), Depth of Discharge (DOD) is also prominent in determining the lifetime of battery such as charging and discharging. This system also requires a battery backup which automatically charges the battery when the battery gets drained.

Future work of this project involves providing solutions such as:

1. Predicting the time within which the battery will drain.
2. Predicting the State of Health (SOH) of Battery.
3. Auto Recharging of battery from solar backup.

REFERENCES

- [1]. Reddy, T. Linden's, Handbook of Batteries, fourth ed.; McGraw-Hill Education: New York, USA 2010.
- [2]. Y. Nishi, "Lithium particle optional batteries; recent years and the future," Journal of Power Sources, vol. 100, no. 1, pp. 101–106, 2001.
- [3]. V. Pop, H. J. Bergveld, P. Notten, and P. P. Regtien, "Cutting edge of battery condition of-charge assurance" Measurement Science and Technology, vol. 16, no. 12, p. R93, 2005.
- [4]. B. Xiao, Y. Shi, and L. He, "An all-inclusive condition of-charge calculation for batteries," in Proceedings of the 47th Design Automation Conference, pp. 687–692, ACM, 2010.
- [5]. W.- Y. Chang, "The state of charge evaluating systems for the battery: an investigation," ISRN Applied Mathematics, vol. 2013, 2013
- [6]. <http://www.online.sysconmetering.com>
- [7]. <http://sites.ieee.org/pes-iss/data-sets/#elec>
- [8]. <https://codequs.com/p/BkaLEq8r4/a-complete-machine-learning-project-walk->
- [9]. <https://www.powermag.com/using-data-analytics-to-improve-operations-and->
- [10]. www.geeksforgeeks.org/python-introduction-matplotlib/



**Impact Factor:
7.512**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details