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Battery Monitoring System Using Lab view

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ABSTRACT: -
A battery must be checked and constantly maintained in order to have the rated service life and the longest run times. Over the past ten years, the quantity of energy stored and utilised in batteries has quadrupled. This necessitates the use of an efficient battery monitoring system that can forecast a battery's life based on the load it is connected to and takes battery ageing into account. We therefore plan to develop a real-time battery monitoring system that will be able to inform the user of the battery's constant state of charge, the amount of time the battery will last under the current load before running out, and the rate at which the battery will degrade over time in relation to temperature and the load it is connected to. The instantaneous values can be recorded without human involvement. A LabVIEW Graphical User Interface (GUI) is created to automate the battery monitoring system, which simplifies the task at hand.
The GUI for this project includes a feature that allows users to read the battery's voltage, current, and temperature while the battery is being charged or discharged. There is a provision for all voltage, current, and charging and discharging times to be recorded in the database. By identifying the battery's genuine issue up front, damage to the battery can be avoided.
Key Words: — LabVIEW, Battery monitoring system.

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I. INTRODUCTION

In this study, several rechargeable battery pilot experiments were conducted for a variety of problems. The data collecting system has been tested and utilised to read numerous battery properties in order to build straightforward and practical experiments for batteries. The LabVIEW data gathering programmes are created and effectively run in accordance with the needs of the research project. Circuits for signal conditioning are necessary for measurements of temperature and heavy loads. This hardware is connected to LabVIEW, and tests are run on both components with results shown. The rechargeable battery's self-discharge rate has been investigated so that an accurate evaluation of its remaining power can be made.

Electric and hybrid vehicles' battery monitoring systems (BMS) are crucial and significant parts of these vehicles. The BMS's job is to guarantee the battery's safe and dependable operation. State monitoring and evaluation have been integrated into the BMS in order to preserve the battery's reliability and safety. A battery behaves differently depending on the operating and environmental circumstances because it is an electrochemical product. The implementation of these functions is complicated by a battery's unpredictable performance. This chapter discusses issues with the BMS as it stands. A crucial role for a BMS is to evaluate a battery's state, including its charge, health, and life.

A. Objective
To identify the parameters of the battery which leads to the degradation using Arduino UNO interfaced with LabVIEW.

II. EXISTING SYSTEM

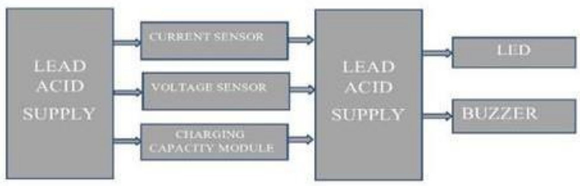


Fig.1. Block Diagram of Existing System

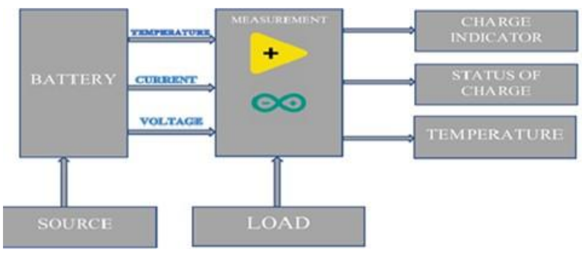
shown in the Fig.1. the current and voltage levels of the battery are obtained through sensors and these sensors gives these values as inputs to the ARDUINO. By depending on the output voltage of the battery, the approximate charge of the battery can be estimated. When the battery level is getting low, the led will blink, as well as it will be also displayed in LCD and also send message to the particular person using internet of things.

A. Disadvantages in Existing System
The main problem in this system is that it shows only the voltage and current levels and nothing about the other parameters.

III. PROPOSED SYSTEM

In an electric car, the battery management system keeps track of whether or not the battery is being charged or depleted. The devices have dedicated electronic systems designed for user protection, efficiency, comfort, and enjoyment. These features have significantly increased the load placed on batteries powering today's electronics. In order to ensure the security, portability, and comfort of battery-operated devices, a LabVIEW-based battery monitoring system has been developed and is now available for widespread usage. The created LabVIEW-based battery management keeps an eye on the battery's various settings. If you want to get the most out of your rechargeable battery, you need the system that was established. Both the device's maker and user will benefit from this approach, as it will make it simpler to determine if it is best to replenish the battery or get a new one.

The term "real-time system" refers to any computerised system that is intended to, or required to, continuously monitor, respond to, or control any aspect of its external environment. This BMS study makes an effort, using LabVIEW, to create a battery monitoring system (BMS) for electrical gadgets. The data acquired is read, processed, monitored, and stored in real time on this system's platform. When it comes to battery capacity, the solution that was designed is applicable to all battery-powered systems and electrical vehicles.



This diagram illustrates the BMS's operation in terms of temperature and connected load. Using custom-built signal conditioning circuitry, the data acquisition system measures and records the battery's voltage, temperature, and discharge current. In the preceding sections of this chapter, we experimented with signal conditioning circuits for sensing battery properties. Battery monitoring system inputs and outputs are clearly labelled in the block diagram. The BMS takes the battery's ampere-hour value as input and outputs the battery's temperature, charge level, and terminal voltage. The user is responsible for providing the necessary data to the system, and the setup procedure will then present the user with the required data.

IV. LITERATURE SURVEY

By maintaining tabs on voltages, currents, and the battery's internal and external temperature, a battery management system (BMS) ensures that rechargeable batteries are charged and discharged safely and efficiently. When factors such as overcharge, undercharge, or high temperature are detected by the monitoring circuits, they will typically serve as inputs to protective mechanisms that will cut power to the battery from the load or charger. An integral part of EVs and HEVs is the battery management system (BMS). The BMS is there to make sure the batteries always work properly and safely. State monitoring and evaluation, charge control, and cell balancing are just a few of the BMS's features that have been included to ensure the battery's continued security and dependability.

This work focuses on the investigation of Lithium-ion batteries and their management using the PNGV model, and on a distributed BMS utilised for hybrid electrical vehicles (HEVs). The given BMS is made up of both distributed and integrated modules, with the former responsible for monitoring critical parameters like voltage and temperature and exchanging data with the latter through CAN bus. The IM is responsible for determining the SOC of Lithium-ion batteries using information from the DM and the PNGV model. Because of the challenging electromagnetic environment, the BMS employs anti-jamming techniques amongst all of its components. Due to the non-linear nature of Lithium-ion batteries, the PNGV model provides a highly accurate representation of the open circuit voltage (OCV) and state of charge (SOC). The PNGV model proves to be well-suited for Lithium-ion batteries, and the results reveal that the BMS has the qualities of being easily expandable, precise, and reliable in operation. The Bluetooth subsystem. The optimal route is determined by a hybrid genetic algorithm. Here, long-distance communication proved impossible.

[3]

Lithium-ion batteries used in electric vehicles (EVs) must be constantly monitored online to ensure safe and reliable functioning. In this paper, we present a real-time Android-based monitoring system for lithium-ion batteries on Electric Vehicles; this system integrates monitoring of batteries, phones, and computers for owners and repairs, making it more convenient for car owners to keep tabs on their vehicles' battery health whenever they like. The system includes a tracking unit, an android client, and a web-based interface. Web-based software compiles and presents the battery load parameters via remote server connection. We give Prototype as proof that our real-time monitoring system is feasible. The findings indicate that the battery data is sent to the owner's phone and displayed on it via web based Application, which could allow users to effortlessly monitor the batteries' status.

A. Batteries

General Description

In 1859, French physicist Gaston Planté developed the lead-acid battery, the first rechargeable battery. The cells have a reasonably high power-to-weight ratio due to their capacity to supply strong surge currents, but they have a very low energy-to-weight ratio and a poor energy-to-volume ratio. Due to these qualities and their low price, they are a viable option for supplying the high current needed by car starter motors.

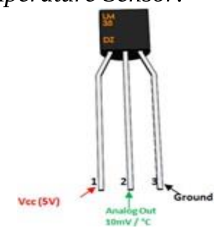
B. DC Motors:

To gain greater torque and speed from your gearmotor, you can swap in this high-power, 130-size brushed DC motor in favour of less powerful 130-size motors. However, it will require more current and will likely wear out sooner. The motor is designed to run on a voltage between 1.5 V and 3 V, but can be run on higher voltages to produce more power at the expense of durability. It can work with the larger Pololu plastic gear motors.

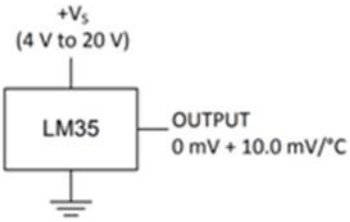
Specifications:

- Voltage – 3V
- RPM - 20,000
- free-run current -350 mA
- stall current - 4 A
- stall torque - 55 gf-cm

C. LM35 Temperature Sensor:



The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly- proportional to the Centigrade temperature. TheLM35 device is rated to operate over a −55°C to 150°C temperature range,while the LM35C device is rated for a −40°C to 110°C range.



If the temperature is 0°C, then the output voltage will also be0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature.

Pin Configuration:

Pin Number	Pin Name	Description
1	Vcc	Input voltage is +5V forapplications
2	AnalogOut	increase in 10mV raise of every1°C.
3	Ground	Connected to ground of circuit

D. Arduino Uno

The ATmega328 forms the basis of the Arduino Uno microcontroller board (datasheet). It comes with a USB port, power jack, ICSP header, reset button, and analogue and digital input pins (16 in total, 6 of which can be used as PWM outputs). It has everything you need to get started with the microcontroller; all you need to do is plug it into a computer through USB or supply power using an AC-to-DC adapter or battery. In contrast to its predecessors, the Uno does not employ an FTDI USB-to-serial driver chip. Rather, it has a USB-to-serial converter programmed into an Atmega16U2 (Atmega8U2 up to version R2).
Arduino Board: How to Use It
The pinMode (), digital Read (), and digital Write () routines in Arduino code allow the 14 digital I/O pins to be switched between input and output modes. There is a 20-50 KOhm pull-up resistor built into each pin, however it is not connected by default. Each pin runs at 5V and can send or receive a maximum of 40mA current. The following is a breakdown of the 14 pins and their respective purposes.
Pins 0 (Rx) and 1 (Tx) on a serial port are used to receive and send TTL serial data, respectively. The ATmega328P USB to TTL serial chip is used to link the two devices.
Pins 2 and 3 of the external interrupt header can be set to generate an interrupt when they reach a low value, on a rising or falling edge, or when their values change.
The analogue Write () function on PWM Pins 3, 5, 6, 9, and 11 generates an 8-bit PWM output.
To communicate using SPI, you'll need to use pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK).
LED linked to pin 13; while HIGH, the LED lights up, and when LOW, it goes dark.
●
There are 14 Digital pins and 6 Analog input pins, with each Analog input pin offering 10 bits of resolution, or 1024 possible values. They have a range of 0 V to 5 V, although this can be expanded with the help of an AREF pin's analogue Reference () feature.
TWI connection using the Wire library makes use of analogue pins 4 (SDA) and 5 (SCA).
Additional pins on the Arduino Uno are described below.
An analogue Reference () function makes use of an AREF to supply a voltage reference for analogue inputs.
The microcontroller can be reset by setting the Reset Pin to LOW.

V. INTRODUCTION TO LAB VIEW

As a graphical programming language, LabVIEW has similarities to both conventional non-graphical languages (such as C, Pascal, and others) and hardware definition languages (VHDL, Verilog). In particular, it incorporates the multitasking capabilities of hardware description languages with the flexibility of conventional programming data structures like loops, if-then branching, and arithmetic operators.

Using a graphical environment for programming entails laying out blocks of code that conduct individual operations on a worksheet and connecting them with wires to pass information between them. From adding the information on two input wires and outputting the result to doing sophisticated calculations, these blocks can do it all (take two arrays of data as input and display the contents on a log-log graph as x, y pairs).
These building blocks of functionality can also convert graphical programme data into a format that can be read by other devices.

Image 3.1 depicts the NI logo.

For those unfamiliar with the potential of computers in modern engineering, LabVIEW is a great way to get started. Despite the fact that you did not choose electrical engineering as your major in college. Any instrument conforming to the IEEE 488.2 standard can be controlled by LabVIEW via the GPIB-General Purpose Interface Bus. A new approach to programming is offered by graphical programming languages. Graphical languages are written by picking objects, wiring them together, and adding functionality rather than writing high-level statements like in procedural languages like C or Object-Oriented languages like C++ or Java.

By allowing programmers to concentrate on the problems at hand, high-level languages facilitate the construction of efficient and effective software. The programmers are written in assembly language using the specified statements and then compiled and linked into an executable file. The instructions in the code are followed as the processor is executed step by step. Typically, a graphical interface is used to create a graphical language, with the user selecting items and the underlying portions being revealed. Specifics will vary per language. National Instruments creates the software known as LabVIEW (NI). Licensed versions are needed, but there are free and trial versions available. The LabVIEW Maker Hub is a great resource for those interested in discovering more about LabVIEW. This article was written using a student version. The resulting files are saved with a Vi extension. Once installed, LabVIEW provides a unified setting for creating, testing, and running code. LabVIEW is a platform for developing programmers to manage and monitor laboratory instruments. LabVIEW programmers can track and manipulate electronic devices thanks to NI's extensive collection of hardware interfaces and meters. The software can receive signals from the hardware interfaces and process them without any intermediate steps. As well as the ability to read and write files and manipulate circuits, there is a simulation mode. It's just as necessary to be familiar with the engineering that supports the process being controlled and measured as it is to be fluent in LabVIEW.

VI. OUTPUT AND RESULTS

Customers expect electronic systems built into the dashboards of electric devices to ensure their safety, convenience, comfort, and pleasure. For this reason, electrical devices in particular have taken use of the LabVIEW-based battery monitoring system because of the benefits it provides in terms of user ease. Terminal voltage, temperature, state of charge, depth of discharge, and load are just few of the metrics tracked by the LabVIEW-based battery management. The temperature, load voltage, terminal voltage, and status of charge will all be displayed graphically and digitally on the front panel of this intended system, as illustrated in the image. To test and refine the prototype LabVIEW-based Battery management system, we use a wide range of flooded and unflooded batteries, from 2.5AH to 65AH, for our research and development. A 4V rechargeable lead-acid battery is used.

The hardware consists of the reference battery being measured, an Arduino processor, a load, and the power supply for charging the battery. After installing LabVIEW and connecting it to the system, the latter is started.

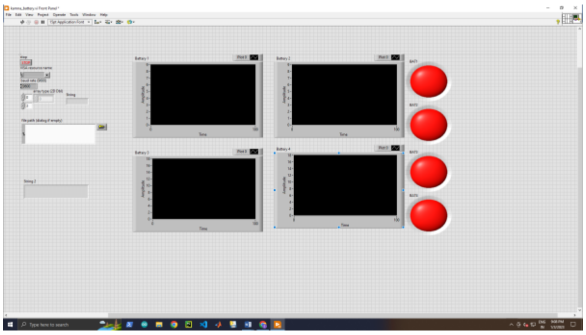


Fig.2.Front panel View of BMS

On the front panel, you can see information about the connected device (in this case, Arduino), the baud rate (9600), whether or not the battery is full, and the battery level as a percentage. When the user makes their selection, the desired outcomes are displayed in a graphic user interface on the front panel.

VII. SHOWING THE BATTERY STATUS WITH LOAD

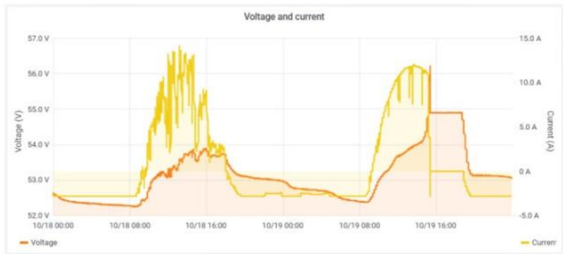


Fig.3. Summarize Battery status

In Fig.3, we see how the battery's health can be detected by adjusting the connected load. If the battery's temperature sensor detects a rise in temperature due to an increase in load, the battery's charge will be gradually discharged. With less work being done, the battery temperature rises and the battery capacity rises.

VIII. CONCLUSION AND FUTURE ENHANCEMENT

a. *Conclusion*

With the help of the monitoring system we developed, users can see the battery's charging and discharging status as well as its temperature in relation to the connected load and the battery's usage to prevent the battery from being wasted.

b. Improvements to Come

Automatically regulating the undesirable characteristics is a great way to improve the Battery Monitoring System. Future improvements to this project could include the ability to automatically adjust some parameters in response to changes in temperature or load, both of which would improve the battery's performance..

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