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ADVANCED SMART BATTERY MANAGEMENT SYSTEM USING IOT WITH AUTO TEMPERATURE AND FIRE PROTECTION

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ABSTRACT

A comprehensive system that tracks vital indicators including temperature, voltage, current level, and fire alarms in real-time is the Internet of Things (IOT) Battery Health Tracker. Through the use of a network of sensors, it continuously monitors these factors to make sure that any abnormalities are found quickly. Important parties are promptly notified by an audible alarm when sensor values surpass predefined parameters. Moreover, the system dynamically controls temperature levels by using a DC motor for cooling to lower the danger of overheating. This self-regulating system contributes to the preservation of the battery's ideal operating parameters, guaranteeing both its longevity and security.

Keywords: Battery Health Monitoring Sensors, Internet of Things, Cooling Fan.

I. INTRODUCTION

1.1 INTRODUCTION

Microcontroller are widely used in Embedded Systems products. An Embedded product uses the microprocessor (or microcontroller) to do one task & one task only. A printer is an example of Embedded system since the processor inside it perform one task only namely getting the data and printing it. Although microcontroller is preferred choice for many Embedded systems, there are times that a microcontroller is inadequate for the task. For this reason, in recent years many manufactures of general-purpose microprocessors such as INTEL, Motorola, AMD & Cyrix have targeted their microprocessors for the high end of Embedded market. One of the most critical needs of the embedded system is to decrease power consumptions and space. This can be achieved by integrating more functions into the CPU chips. All the embedded processors have low power consumptions in additions to some forms of I/O, ROM all on a single chip. In higher performance Embedded system, the trend is to integrate more & more function on the CPU chip & let the designer decide which feature he/she wants to use.

1.2 EMBEDDED SYSTEM

Physically, embedded systems range

from portable devices such as digital watches and MP3 players to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Embedded systems span all aspects of modern life and there are many examples of their use. Telecommunications systems employ numerous embedded systems from telephone switches for the network to mobile phones at the end-user. Computer networking uses dedicated routers and network bridges to route data.

EXAMPLES OF EMBEDDED SYSTEM:

Automated teller. machines (ATMS). Integrated system in aircraft and missile. Cellular telephones and telephonic switches. Computer network equipment, including routers timeservers and firewalls. Computer printers, Copiers. Disk drives (floppy disk drive and hard disk drive). Engine controllers and antilock brake controllers for automobiles. Home automation products like thermostat, air conditioners sprinkles and security monitoring system. House hold appliances including microwave ovens, washing machines, TV sets DVD layers/recorders. Medical equipment. Measurement equipment such as digital storage oscilloscopes, logic analysers and spectrum analysers. Multimedia appliances: internet radio receivers, TV set top boxes.Small hand-held computer with P1M5 and other applications. Programmable logic controllers (PLC's) for industrial automation and monitoring. Stationary video game controllers.

1.3 CHARACTERISTICS:

Embedded systems are designed to do some specific tasks, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs. Embedded systems are not always standalone devices. Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. For example, the Gibson Robot Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile provides a specific function as a subsystem of the car itself.

The software written for embedded systems is often called firmware, and is usually stored in read- only memory or Flash memory chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

1.4 MICROPROCESSOR (MP):

A microprocessor is a general-purpose digital computer central processing unit (CPU). Although popularly known as a "computer on a chip" is in no sense a complete digital computer. The block diagram of a microprocessor CPU is shown, which contains an arithmetic and logical unit (ALU), a program counter (PC), a stack pointer (SP), some working registers, a clock timing circuit, and interrupt circuits.

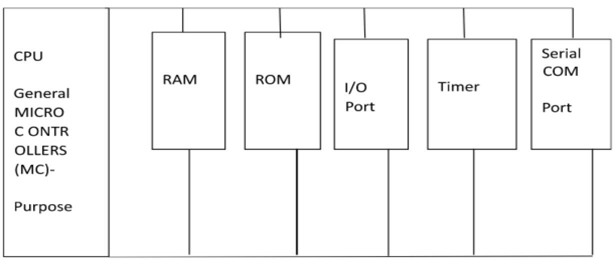


Fig 1.1 Block diagram of microprocessor

1.5 MICROCONTROLLER (MC):

Figure shows the block diagram of a typical microcontroller. The design incorporates all of the features found in micro-processor CPU: ALU, PC, SP, and registers. It also added the other features needed to make a complete computer: ROM, RAM, parallel I/O, serial I/O, counters, and clock circuit.

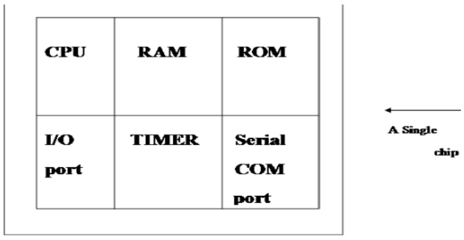


Fig 1.2 Microcontroller

1.6 COMPARISION BETWEEN MICROPROCESSOR AND MICROCONTROLLER

The microprocessor must have many additional parts to be operational as a computer whereas microcontroller requires no additional external digital parts. The prime use of microprocessor is to read data, perform extensive calculations on that data and store them in the mass storage device or display it. The prime functions of microcontroller is to read data, perform limited calculations on it, control its environment based on these data. Thus the microprocessor is said to be general-purpose digital computers whereas the microcontroller are intend to be special purpose digital controller. Microprocessor need many opcodes for moving data from the external memory to the CPU, microcontroller may require just one or two, also microprocessor may have one or two types of bit handling instructions whereas microcontrollers have many.

II. LITERATURE SURVEY

2.1 INTRODUCTION

By utilizing innovative monitoring and control technologies, the Internet of Things (IOT)

Battery Health Tracker project seeks to address significant issues with battery management and environmental concerns. Batteries are used to power a variety of devices in today's networked world, such as electric cars, cell phones, laptop computers, and renewable energy storage systems. On the other hand, poor battery management can result in safety risks like fires or overheating as well as environmental problems like early battery deterioration and increased electrical waste.

The development of an Internet of Things (IoT)-based battery health monitoring system is an attempt to enhance the sustainability, safety, and efficiency of battery consumption in various applications. The real-time monitoring of critical parameters including temperature, voltage, current level, and fire alarms is the main goal of this project.

Such thorough monitoring not only makes it feasible to identify potential issues early on but also enables prompt action to prevent disastrous failures or damage. The study looks at safety issues with batteries, including the possibility of overheating and fire, the image. Serious safety risks can arise from high temperatures and abnormal voltage or current levels, especially in crucial applications like energy storage systems and electric cars. By using automatic warnings and real-time monitoring, the IoT Battery Health Tracker notifies users and stakeholders of any abnormalities, enabling prompt responses to reduce risks and prevent accidents..

2.2 LITERATURE SURVEY

IOT-based Monitoring: Implementing IOT sensors to monitor battery temperature, voltage, current, and state of charge in real-time. Auto Temperature Control: Using temperature sensors and cooling systems, such as fans or heat sinks, to maintain optimal battery temperatures. Fire Protection: Integrating fire detection sensors and suppression systems to prevent battery fires and ensure safe operation Smart Charging and Discharging: Implementing smart charging and discharging strategies to optimize battery life, reduce energy waste, and prevent overcharging or undercharging Electric Vehicles: Optimizing battery performance, range, and safety in electric vehicles. Renewable Energy Systems: Ensuring efficient and reliable energy storage and supply in solar, wind, and other renewable energy systems. Industrial Automation: Implementing smart battery management in industrial automation systems to improve efficiency, reduce downtime, and enhance safety

III. PROBLEM STATEMENT

The current system combines sensors and microprocessor technologies. The device detects essential battery parameters with voltage and current sensors before feeding the data to an Arduino microcontroller for analysis. A cooling device is activated if the battery temperature reaches too high. Furthermore, if battery properties deviate from ideal ranges, the system can notify the car's owner or service facility through integration with a GSM module. This enhances overall battery management and vehicle durability by ensuring proactive maintenance and timely intervention to avoid potential issues.

DISADVANTAGES OF EXISTING SYSTEM

Limited Monitoring: Basic systems do not provide comprehensive real-time monitoring of all critical battery parameters.

Separate Systems: Fire detection and battery management are not integrated, leading to slower response times.

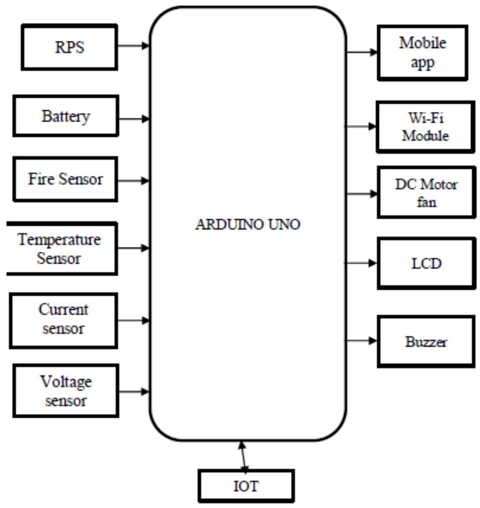
Manual Intervention: Traditional systems often require manual intervention to address issues, which can delay response times.

Lack of Predictive Maintenance: Existing systems do not predict potential failures or optimize battery lifespan effectively

IV. PROPOSED SYSTEM

The proposed Internet of Things (IoT) Battery Health Tracker aims to revolutionize battery monitoring by integrating cutting-edge sensors and control mechanisms. The technology provides detailed information on battery health by continuously monitoring temperature, voltage, current levels, and fire alerts in real time. This new technology enhances battery safety, longevity, and overall efficiency in a variety of applications by implementing proactive monitoring and intervention. This system will ensure efficient, safe, and reliable operation of battery-powered devices or electric vehicles by continuously monitoring critical battery parameters and addressing risks such as overheating and potential fire hazards.The proposed block diagram image.

4.1 BLOCK DIAGRAM OF PROPOSED SYSTEM



V. BLOCK DIAGRAM OF PROPOSED SYSTEM

HARDWARE COMPONENTS

The following hardware tools used in the proposed system

Power Supply, Arduino UNO, Fire Sensor, Temperature Sensor, Current Sensor, Voltage Sensor,DC Motor Fan, LCD, Buzzer, Battery,

SOFTWARE COMPONENTS

The following software tools used in the proposed system : Arduino IDE, Proteus

TECHNOLOGY USED

IOT

VI. RESULT AND DISCUSSION

6.1 PROTOTYPE (THROUGH KIT)

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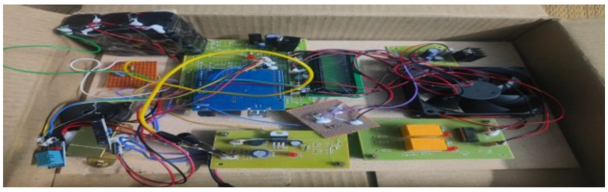
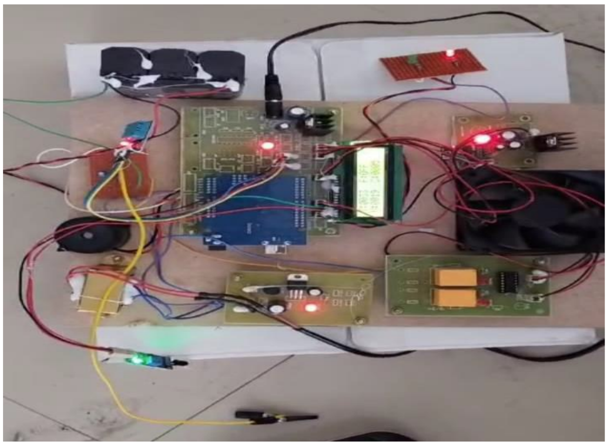


This is our project which involves a microcontroller-based system features an LCD display, relay module, sensors, and power supply. It is designed for automation and monitoring purposes, possibly in an IOT application.



The system monitors current, voltage and temperature levels, displaying real-time data on LCD. It uses a microcontroller, fire sensor, relay to manage the battery

The lcd screen displays smart battery health monitoring. It means monitor the real-time data Parameters.

The system continuously collects data on voltage sensor, temperature sensor, current sensor charge/discharge cycles, and overall battery performance

The LCD Shows, how much temperature in battery. When the temp increases, the buzzer will be activated. If the battery has over heating at that time fire sensor will be on.

The mobile app sends a notification to monitor the battery performance. When the system detects fire or dangerous condition, the fire sensor can be activated. The Battery Management system is responsible for monitoring battery performance, ensuring it operates within safe parameters, and optimizing charge/discharge cycles. The system continuously collects data on voltage sensor, temperature sensor, current sensor charge/discharge cycles, and overall battery performance. The overall data shown in LCD. When the temperature increases the indication comes through buzzer. The mobile app sends a notification to monitor the battery performance. When the system detects fire or dangerous condition, the fire sensor can be activated.

VII. CONCLUSION

The development of the IoT Battery Health Tracker, in conclusion, is a critical step in addressing the challenges associated with environmental sustainability and battery management. This study offers a comprehensive approach to enhancing battery performance, boosting safety, and lessening environmental impact by fusing sophisticated monitoring capabilities with clever management methods. Through real-time surveillance of critical parameters like temperature, voltage, and current levels, as well as automated notifications and proactive measures, the IoT Battery Health Tracker helps users manage their batteries more effectively and efficiently.

VIII. FUTURE SCOPE

By managing battery safety and maintenance proactively, the IoT Battery Health Tracker has produced significant environmental benefits. • Early problem detection has been made possible by the system's constant real-time monitoring of critical parameters like temperature, voltage, and current levels. This has reduced the risk of catastrophic failures and limited the impact on the environment. Proactive monitoring has reduced the frequency of battery replacements, which reduces electrical waste and improves resource conservation. It has also extended battery life by identifying and correcting degradation early on. The utilization of a DC motor for temperature regulation, among other intelligent control techniques incorporated into the IoT Battery Health Tracker

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