MOBILE BATTERY HEALTH MONITORING SYSTEM USING IOT AND OPTIMIZATION THROUGH SOLAR-POWERED MOBILE BACK COVER TO ENSURE NON-DISCHARGE

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Abstract- This research paper presents a novel mobile battery health monitoring system that leverages the Internet of Things (IoT) technology and incorporates solar power optimization through a mobile back cover. The primary objective is to ensure uninterrupted power supply to mobile devices by continuously monitoring battery health and harnessing solar energy for charging. The proposed system aims to extend the battery life and eliminate the issue of battery discharge, thus enhancing the overall user experience. It briefly mentions the integration of solar power optimization through a mobile back cover to prevent battery discharge and emphasizes the importance of uninterrupted power supply for mobile devices.

Keywords- Mobile battery health monitoring, Internet of Things (IoT), Solar power optimization, Uninterrupted power supply, Battery life extension, Solar energy harvesting.

1. INTRODUCTION
We are currently in a smart technology era, often known as "web 0.3" or "ubiquitous computing". The Internet of Things (IoT) has become a more successful platform for expressing this new technology. Although it is not the first technology in this area, the cloud computing technology has been used to symbolize the world of pervasive computing. The seventh in a series of ITU Internet Reports was initially published in 1997 under the heading "Challenges to the Network" [14], and the term "Internet of Things" was first used by Kevin Ashton in the RFID magazine in 1999 [15]. One of the most significant technologies of modern living, the Internet of Things (IoT), makes it possible for people to live better and more intelligently. IoT devices are what make it possible for machines to connect to the cloud [5]. Data interchange between linked devices on the network is made possible by this technology.

With the increasing demand of mobile devices for various applications and services, ensuring uninterrupted power supply has become a critical concern. The limited battery life of mobile devices often leads to inconvenience and disruption in daily activities. To address this issue, this research paper proposes a mobile battery health monitoring system that utilizes the Internet of Things (IoT) technology and incorporates solar power optimization through a mobile back cover. The primary objective is to ensure non-discharge of mobile devices by continuously monitoring battery health and harnessing solar energy for charging. For the processing of information, it also makes use of software and computational infrastructure. The necessity for IoT technology in this solar power monitoring system arises from the fact that the solar panels that are exposed to the sun must always be monitored because the sun's radiation range is not fixed and may fluctuate depending on the location, time, and climatic circumstances. IoT technology allows for remote monitoring of the solar panels [7], [8].

The pervasive use of mobile devices has transformed various aspects of our lives, including communication, entertainment, productivity, and access to information. However, the limited battery life remains a major hurdle in realizing the full potential of these devices. The need for frequent recharging disrupts user experiences, especially during critical situations or in remote areas where access to power sources may be limited.
In mobile devices mostly lithium battery technology used. Due to its benefits over other battery technologies, energy storage using lithium-ion batteries (LiBs) is gaining market share and significant research and development (R&D) efforts. Long life cycle, high power density, and low self-discharge rate are discovered among these benefits [1], [2]. These batteries have a Battery Management Unit (BMU), also known as a Battery Management System (BMS), which was created by the manufacturer and is used to measure quantities like voltage, current, and temperature, to balance cells, and to regulate charge/discharge cycles under secure circumstances.

The proposed mobile battery health monitoring system aims to address these challenges by leveraging the IoT technology. By integrating sensors and connectivity features, the system enables real-time monitoring of battery health parameters, such as charge level, voltage, temperature, and discharge rate. This monitoring capability allows users to proactively manage their device's power consumption and optimize battery usage.

Furthermore, the system incorporates solar power optimization through a specially designed mobile back cover. The solar cells integrated into the back cover harvest solar energy and convert it into electrical power, supplementing the device's battery charging process. This solar energy harvesting capability provides an additional power source, reducing the dependency on conventional charging methods and mitigating the risk of battery discharge.

The integration of IoT technology enables seamless communication between the mobile device, the battery health monitoring system, and the solar power optimization module. Real-time data collected from the battery health monitoring system facilitates intelligent power management and optimization algorithms. These algorithms dynamically adjust the charging process, considering factors such as solar energy availability, battery health status, and user preferences, to ensure efficient and reliable power supply.

This research paper will discuss the design, implementation, and evaluation of the proposed mobile battery health monitoring system. It will explore the hardware and software components, communication protocols, data collection, and analysis methods. Additionally, case studies and experimental results will be presented to demonstrate the system's effectiveness in ensuring non-discharge of mobile devices, enhancing battery life, and improving user experience.

In conclusion, the integration of IoT technology and solar power optimization through a mobile back cover offers a promising solution to address the battery life limitations of mobile devices. The proposed mobile battery health monitoring system aims to provide users with a reliable and sustainable power supply, ensuring non-discharge and extended battery life. By mitigating the inconvenience caused by battery discharge, this system has the potential to enhance user experiences and enable uninterrupted usage of mobile devices in various scenarios.

2. LITERATURE REVIEW

Author Describe how the DG agents, grid agents, and Mu agents are the main focus. Distributed energy resources (DERs), load, storage, and grid agents are examples of DG agents. The Mu agent serves as a conduit for information flowing from the DG agents to higher level agents like the control agent. An Arduino microcontroller has been used to implement the system. Yasin Kabalci, Ersan Kabalci, and Alper Gorgun are the authors: Introduces an infrastructure for real-time monitoring of a wind turbine and solar panel array-based renewable energy producing system. The monitoring system is based on measurements of each renewable energy source's current and voltage. The relevant values are calculated using the designed sensing circuits and are then processed by a Microchip 18F4450 microcontroller. After processing, the parameters are sent via USB to a personal computer (PC) so they can be kept in a database and used to immediately monitor the system. Monitoring software's programmed visual interface can handle the saved data to analyse the daily, weekly, and monthly values of each measurement independently.[9] Jiju, K., et al. describe the creation of a distributed Renewable Energy Sources (RES) online monitoring and control system built on the Android platform. This method connects the digital hardware of the Power Conditioning Unit (PCU) to the Bluetooth interface of an Android tablet or smartphone to exchange data. This method connects the digital hardware of the Power Conditioning Unit (PCU) to the Bluetooth interface of an Android tablet or smartphone to exchange data.[10] An integrated system that maintains and remotely monitors telecoms power plants has been built and has begun operations, according to Goto, Yoshihiro, et al. The system is utilised to run and maintain more than 200,000 communications power plants, including air conditioning units installed in around 8,000 telecommunication buildings as well as rectifiers, inverters, and UPSs. The system's features include enhanced user interfaces that make use of information and communication technologies, such as web technology, and the integration of management and remote monitoring operations into a single system.[11] Suzdalenko, Alexander, and Ilya Galkin: Identify the issue with the load disaggregation into distinct appliances method.
of non-intrusive load monitoring. When several local generators powered by renewable energy sources are linked to the same grid, they might not be matched with varying time-varying needs.[12] The authors of this article—Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula—discuss recent efforts to create a wireless-based remote monitoring system for renewable energy facilities in Malawi. The primary objective was to create an affordable data collecting system that continuously displays remote energy yields and performance metrics.[13] Through the use of wireless sensor boards and text message (SMS) transmission through cellular network, the project's output provides immediate access to generated electricity at the rural site. The effectiveness of renewable energy systems at isolated rural settings may be measured effectively and affordably, according to preliminary experimental findings. In order to monitor and operate a hybrid "wind PV battery" for a renewable energy system in real time, Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula present a novel monitoring and control system. A programmable logic controller (PLC), digital power metres, and the campus network of National Cheng Kung University are all incorporated into the proposed system, which is a supervisory control and data acquisition (SCADA) system. The suggested system has the ability to measure electrical data in real-time and send it successfully over an intranet to a remote monitoring centre. The findings of the simulation and experimentation can be used to draw the conclusion that the suggested monitoring and control system is capable of real-time supervisory control and data collecting of remote renewable energy systems.[13]

3. RESEARCH METHODOLOGY

3.1 IMPLEMENTATION OF BATTERY MONITORING

The implementation of battery monitoring plays a crucial role in the proposed mobile battery health monitoring system. It involves the integration of hardware components, software systems, and communication protocols to collect and analyze real-time data regarding the battery's health parameters. The following sections outline the key aspects of the battery monitoring implementation.

3.1.1 Hardware Components:

The implementation begins with selecting appropriate hardware components for battery monitoring. This includes sensors or monitoring devices capable of measuring parameters such as battery voltage, current, temperature, and charge level. These sensors should be compatible with the mobile device and have low power consumption to minimize any impact on battery life. Additionally, an embedded microcontroller or a dedicated battery management IC can be used to interface with the sensors and process the collected data.

3.1.2 Software Systems:

The software aspect of battery monitoring involves developing algorithms and software modules to collect, process, and analyze the sensor data. The software should be designed to run efficiently on the mobile device's operating system, minimizing resource consumption. It should also incorporate intelligent algorithms for accurate battery health monitoring, such as predicting battery degradation, estimating remaining battery life, and detecting abnormal behavior. The software should provide a user-friendly interface to present the battery health information to the user.

3.1.3 Communication Protocols:

To enable real-time monitoring and data exchange, appropriate communication protocols need to be implemented. The selected protocols should be efficient, reliable, and capable of transmitting data from the battery monitoring system to the mobile device or a remote server. Wireless protocols such as Bluetooth Low Energy (BLE) or Wi-Fi can be utilized for communication between the battery monitoring system and the mobile device. Additionally, MQTT or HTTP protocols can be employed for transmitting data to a remote server for further analysis and storage.

3.1.4 Data Collection and Analysis:

The battery monitoring system should continuously collect data from the sensors and store it for analysis. The collected data can include parameters such as battery voltage, current, temperature, and charge level, as well as other relevant metrics. Analysis techniques can be applied to this data to identify patterns, trends, and anomalies related to battery health. Machine learning algorithms can also be utilized to predict battery degradation and estimate remaining battery life based on historical data.

3.1.5 Integration and User Interface:

The battery monitoring system should be seamlessly integrated into the mobile device's operating system or as a separate application. It should provide a user-friendly interface that displays relevant battery health information, such as the current charge level, estimated remaining battery life, and any alerts or notifications regarding battery health issues. The user interface should be intuitive and easy to understand, allowing users to make informed decisions regarding their battery usage and optimize power consumption.

3.1.6 Testing and Validation:

Once the battery monitoring system is implemented, it should undergo rigorous testing and validation to ensure its
reliability, accuracy, and performance. Various test scenarios can be conducted, including different charging and discharging patterns, temperature variations, and real-life usage scenarios. The system's response and accuracy should be evaluated against known battery health benchmarks or industry standards.

4.1 EXISTING SYSTEM
The existing system refers to the current state of mobile battery monitoring and management techniques before the implementation of the proposed mobile battery health monitoring system using IoT and solar optimization. Here are some key aspects of the existing system:

4.1.1 Basic Battery Monitoring: The existing system typically relies on basic battery monitoring features provided by mobile device manufacturers. This includes displaying the battery charge level, providing estimates of remaining battery life, and triggering low battery warnings. However, these basic monitoring features often lack comprehensive data on battery health parameters and may not accurately predict battery degradation.

4.1.2 Limited Battery Optimization: Conventional mobile devices offer limited battery optimization features, such as power-saving modes or settings that reduce power consumption by limiting certain functionalities. While these features can improve battery life to some extent, they may not effectively address the issue of battery discharge or extend battery lifespan.

4.1.3 External Battery Packs: To mitigate battery discharge issues, some users resort to external battery packs or power banks. These devices provide additional power supply and can be used to recharge mobile devices on the go. However, they require separate charging and may not provide intelligent battery health monitoring or optimization.

4.1.4 Solar Power Solutions: Solar chargers are available as alternative power sources for mobile devices. These chargers utilize solar energy to recharge the device's battery. However, they are typically separate devices that need to be connected to the mobile device, and they may not integrate advanced battery health monitoring capabilities.

4.1.5 Lack of Continuous Monitoring: The existing system often lacks continuous monitoring of battery health parameters. Users are typically limited to periodic checks of battery levels or rely on alerts triggered by low battery levels. This lack of continuous monitoring hinders proactive battery management and optimization.

4.1.6 Limited Integration of IoT: The integration of IoT technology into battery monitoring and management is not widely implemented in the existing system. IoT capabilities can enable real-time data collection, remote monitoring, and advanced analytics for better battery health management. This integration is essential for optimizing battery performance and ensuring uninterrupted power supply.

Overall, the existing system exhibits limitations in terms of comprehensive battery health monitoring, intelligent optimization, continuous monitoring, and integration with IoT technologies. The proposed mobile battery health monitoring system aims to overcome these limitations by leveraging IoT and solar power optimization, providing users with a more efficient and sustainable solution for managing and extending the lifespan of mobile device batteries.

5. PROPOSED WORK
Our proposed work introduces a mobile battery health monitoring system that utilizes the Internet of Things (IoT) technology and incorporates solar power optimization through a specially designed mobile back cover. The primary objective is to ensure non-discharge of mobile devices by continuously monitoring battery health and harnessing solar energy for charging, thereby extending battery life and improving the overall user experience. The key components and features of our proposed work are outlined below:

5.1 Mobile Battery Health Monitoring:
Our system incorporates advanced battery monitoring capabilities, surpassing the basic monitoring features provided by mobile device manufacturers. It includes sensors that continuously measure critical battery health parameters such as voltage, current, temperature, charge level, and discharge rate. These sensors provide real-time data to accurately assess the battery's condition, allowing users to make informed decisions regarding power consumption.

5.2 IoT Integration:
The proposed system leverages IoT technology to enable seamless communication between the mobile device, battery monitoring system, and solar power optimization module. This integration facilitates real-time data exchange, remote monitoring, and centralized management of battery health information. Users can access battery health data and receive alerts or notifications through a dedicated mobile application or web interface.

5.3 Solar Power Optimization:
To enhance the battery's performance and prevent discharge, our system incorporates solar power optimization through a specially designed mobile back cover. This cover integrates solar cells that harness solar energy and convert it into electrical power. The harvested solar energy serves as an additional power source, supplementing the device's battery charging process. This solar power optimization ensures a sustainable and continuous power supply, even in situations where conventional charging methods are unavailable or limited.

5.4 Intelligent Power Management:
Our system employs intelligent algorithms for efficient power management and optimization. These algorithms consider
factors such as battery health status, solar energy availability, and user preferences to dynamically adjust the charging process. By intelligently managing the power consumption and utilization, the system aims to maximize battery life, minimize energy waste, and ensure non-discharge of mobile devices.

5.5 User-Friendly Interface:
The proposed system provides a user-friendly interface that displays real-time battery health information, including charge level, remaining battery life, and health status. Users can access this information through a dedicated mobile application or a web-based portal. The interface also allows users to set preferences, receive notifications, and customize power-saving modes to further optimize battery usage.

5.6 Experimental Evaluation:
To assess the effectiveness and performance of our proposed system, we will conduct extensive experiments and evaluations. This includes testing the system's accuracy in monitoring battery health parameters, assessing the solar power optimization capabilities, and evaluating the system's impact on battery life extension. Various scenarios, usage patterns, and environmental conditions will be considered to ensure the reliability and robustness of the proposed work.

Figure: 1 BLOCK DIAGRAM

a. WORKING
This is a proposed working model of IoT based solar mobile health monitoring system. In which both batteries attach one is inbuilt mobile lithium based battery and other one is solar panel based back cover battery which optimize the overall user experience so a mobile never discharge as well as mobile battery will charge optimum level always using IoT module kit.

Figure: 2 MONITORING THE WORKING COMPONENTS

b. COMPONENTS
i. VOLTAGE SENSOR:
Voltage gate ion channel generate electrical signals in species from bacteria to man. Their voltage sensing modules are responsible for initiation of action potentials and graded membrane potential changes in response to synaptic response
and other physiological stimuli.

ii. CURRENT SENSOR:
Current sensors are either opened or closed loop. Open loop current sensors measure AC and DC current and give electrical isolation between measured and output of the sensor.

iii. BUZZER:
The Buzzer is an electric signalling device, such as doorbell, that makes a buzzing sound, which may be mechanical, electromechanical, or piezoelectric. Representative uses of buzzer comprise alarm devices, timers, and authentication of user comments such as a mouse click or keystroke. We use buzzer for purpose of battery not over drain (20% or below) or not over charged (80% or above). So we able to maintain overall battery health as well.

4 CONCLUSION:
In conclusion, our proposed work introduces a mobile battery health monitoring system that integrates IoT technology and solar power optimization through a specially designed mobile back cover panel. By continuously monitoring battery health, optimizing power usage, and harnessing solar energy, our system aims to prevent battery discharge, extend battery life, and provide users with a seamless and sustainable power supply for their mobile devices.

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