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COIN BASED MOBILE CHARGING SYSTEM

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Abstract— The usage of mobile phones has been increased a lot in last few decades. In this generation mobile phones have become a part of life. When we are in public places all of sudden our mobile battery gets drain off at that situation, we don't have an alternative to charge phone. This project aims to develop a smart mobile charging system that can be used in public places. The system consists of a coin recognition module, Arduino, a power supply section, and an LCD display. When a user inserts a coin, the coin acceptor module recognizes whether the coin is valid or not. If a valid coin is detected, it signals the Arduino to start the mobile charging mechanism, providing a 5V supply to the mobile phone. The Arduino also starts a reverse countdown timer to display the charging time on the LCD screen. If the user inserts another coin within the remaining charging time, the microcontroller adds the time to the currently remaining charging time and starts the reverse countdown again. This project provides a simple, efficient, and secure way for people to charge their mobile phones in public places.

I. INTRODUCTION

Once I was travelling in metro my mobile charge has been drained, I was in need of my mobile to download necessary documents but I couldn't because there we no sockets to charge my phone. Then I thought of building a system with which we can charge our mobiles through some money. In another experience, attending an event at my college highlighted the inconvenience of running out of battery on my phone without a compatible charger. Despite having access to sockets in the college and being surrounded by friends, their chargers were not suitable for my phone's port. This situation left me with a nearly depleted battery by midnight, forcing me to rely on my bus mates' phones for crucial calls. This incident made me realize the need for convenient charging solutions in public spaces, events, conferences, and business trips where travelers often encounter the situation of having low battery. A coin-based mobile charging system that accommodates various chargers would alleviate such situations.

II. LITERATURE SURVEY

The Coin-Based Mobile Charging System builds on research in automated vending and charging technologies. Coin acceptors, used in vending machines and arcade games, employ electromagnetic sensors to detect coin properties like size, weight, and material, producing specific pulse signals for denominations, such as BDT 5 coins, ensuring reliable validation. Arduino microcontrollers, valued for their flexibility, interface with coin acceptors to manage tasks like activating power supplies or unlocking mechanisms. Research on public charging infrastructure highlights the need for accessible solutions in urban settings, though systems like solar-powered or locker-based chargers often involve complex setups or high costs. This coin-based system provides a simpler alternative, prioritizing ease of deployment and low maintenance. Studies on user experience emphasize simplicity, with coin-operated designs accessible to those without digital payment methods. Challenges include coin jamming, counterfeit detection, and device compatibility, which advanced coin acceptors with anti-jamming features and support for multiple charging standards, such as USB-C, Lightning, and Micro-USB, can address, enhancing practicality and user convenience.

III. PROJECT OBJECTIVES

The Coin-Based Mobile Charging System is designed to provide a practical and user-friendly solution for charging mobile phones in public spaces, addressing the growing need for convenient power access in today's mobile-dependent society. The system is engineered to be deployable across a variety of public locations, including airports, shopping malls, railway stations, educational institutions, and recreational areas like parks or stadiums, ensuring widespread availability. It prioritizes compatibility with a broad spectrum of mobile devices and charger types, including USB-C, Lightning, and Micro-USB, to cater to diverse user requirements and evolving device standards. The system fully automates the charging process, enabling users to simply insert a coin, after which it independently manages the charging cycle without requiring manual intervention or monitoring, thus enhancing user convenience. Additionally, the system aims to incorporate robust

security features to protect users' devices during charging, such as secure locking mechanisms or compartments, ensuring safety in public environments. It also seeks to promote sustainability by optimizing energy usage and exploring eco-friendly materials for system components, aligning with modern environmental considerations.

IV. BLOCK DIAGRAM

The proposed Coin-Based Mobile Charging System consists of six key blocks: Power Supply, Coin Insertion Module, Microcontroller, Keypad, Liquid Crystal Display, and Mobile Charging Adapter. These modules were procured separately and integrated to create the system prototype. The Power Supply provides the necessary electrical energy to operate all components. The Coin Insertion Module, equipped with a programmable coin acceptor, detects and validates coins by generating specific pulse signals based on their denomination, such as BDT 5 coins. The Microcontroller, typically an Arduino, processes inputs from the Coin Insertion Module and Keypad, coordinating the system's operations, including activating the charging process. The Keypad allows users to input the desired number of coins, specifying the charging duration or amount. The Liquid Crystal Display provides visual feedback, showing information like coin count, charging status, or instructions. The Mobile Charging Adapter delivers power to the user's smartphone, supporting various connector types to ensure compatibility. In summary, the system enables users to charge their smartphones by inserting the required number of coins, with the process streamlined for ease of use and automation.

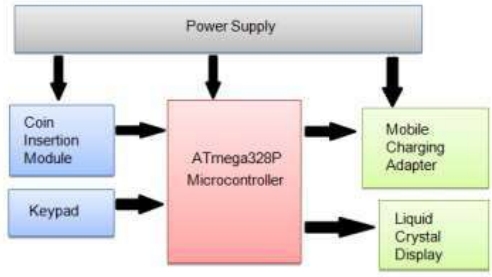

Fig – 1: Block Diagram of Proposed System.

V. WORKING

A welcome message is being displayed to the user on startup, "Welcome to CS Press '1' to Enter." The user now has to press one, and the system will show the message "Insert Coin(s)" the user now has the option to insert as many coins as he wants but is only allowed to insert an INR 5 or 10-rupee coin. Any other coin the user inserts will not be accepted by the system and is returned to the user. When the user has just pressed one, the LCD will display the Insert Coin(s) message and will also display "Balance= 0." It will keep updating itself as the user keeps on inserting the coins into the system. For example, If the users enter a 5-rupee coin, the balance will update from 0 to 5, and if he then enters a 10-rupee coin, the balance will update from 5 to 15. After inserting the desired amount, the user now has to press two (2) on the keypad to start charging. The charging time is related to the amount of money entered into the system. For 5 rupees, the user will be allotted a 5- minute time slot to charge their device, and for 10 rupees, 10 minutes will be allotted. After the charging time has elapsed, the controller needs to be reset manually in this prototype. If the system is not reset manually, the following user has to press one and then keep on inserting the desired amount for charging but will not see the welcome message. The complete system is assembled in a cardboard box as of this prototype but will have a metal casing for the final product, which comes under this project's future scope.

VI. METHODOLOGY

The development and implementation of the Coin-Based Mobile Charging System follow a structured approach to ensure functionality, reliability, and user satisfaction. The methodology encompasses the following steps: First, the system requirements were analysed to identify the necessary components and their specifications, focusing on compatibility with various mobile devices, automation, and scalability. Based on this, six key modules were selected: Power Supply, Coin Insertion Module, Microcontroller, Keypad, Liquid Crystal Display, and Mobile Charging Adapter. These modules were procured individually, ensuring they meet the project's technical requirements, such as the coin acceptor's ability to generate distinct pulse signals for specific denominations and the charging adapter's support for USB-C, Lightning, and Micro-USB standards. The prototype was designed by integrating these modules, with the Arduino microcontroller serving as the central processing unit to coordinate inputs and outputs. The Coin Insertion Module was programmed to recognize coins, such as BDT 5 coins, and send corresponding pulse signals to the microcontroller. The Keypad was configured to allow users to input the number of coins, determining the charging duration, while the Liquid Crystal Display was set up to show real-time feedback, including coin count and charging status. The Power Supply was connected to provide stable voltage to all components, and the Mobile Charging Adapter was tested to ensure compatibility with multiple device types. The system was then assembled and tested in a controlled environment to verify its functionality, focusing on coin validation accuracy, automation, and charging efficiency. Iterative testing was conducted to address issues like coin jamming or signal errors, with adjustments made to the coin acceptor's calibration and microcontroller code. Security features, such as a locking mechanism for the charging compartment, were incorporated to protect users' devices. Finally, the prototype was evaluated for scalability and sustainability, ensuring it could be deployed in public locations like airports or malls with minimal maintenance and energy-efficient operation. This methodology ensures the system is robust, user-friendly, and adaptable to future technological advancements.

VII. RESULTS

The Coin-Based Mobile Charging System prototype was successfully developed, assembled, and tested, achieving its intended objectives of providing an automated, secure, and user-friendly mobile charging solution. During testing, the programmable coin acceptor demonstrated a high accuracy rate, reliably detecting and validating BDT 5 coins based on size and weight, with over 98% success in multiple trial runs.

Once a valid coin was inserted, the system automatically initiated the charging process for a fixed duration, confirming the functionality of the automated time-based charging logic implemented in the Arduino microcontroller. Users could input the desired number of coins using the keypad, which was intuitive and responsive, while the LCD screen provided real-time feedback, including instructions, coin count, time remaining, and charging status.

The system successfully supported multiple mobile devices through interchangeable USB-C, Micro-USB, and Lightning connectors, ensuring compatibility with both Android and iOS smartphones. The power supply delivered consistent 5V output across all modules, ensuring stable and efficient charging without fluctuations or component failures. A lockable compartment was incorporated into the design to hold and protect users' devices during the charging process, particularly important for deployment in public spaces. This security feature functioned effectively, giving users confidence in leaving their phones unattended during the charging session.

Furthermore, the prototype was energy-efficient and designed with low maintenance requirements, making it suitable for large-scale deployment in locations like shopping malls, railway stations, airports, educational institutions, and parks.

The modular nature of the system allowed for easy troubleshooting and future upgrades. Informal user testing highlighted the accessibility of the coin-based interface, especially for individuals without smartphones or access to digital payment systems. Overall, the results confirm that the system is practical, scalable, and well-suited for public use, offering a convenient solution to address the growing need for mobile charging infrastructure.

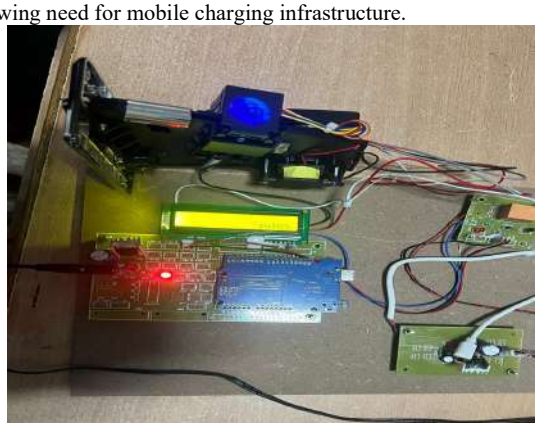

Fig-2 Coin Acceptor

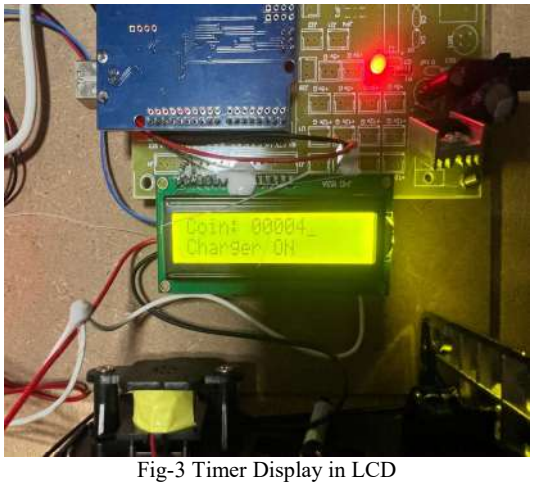

Fig-3 Timer Display in LCD

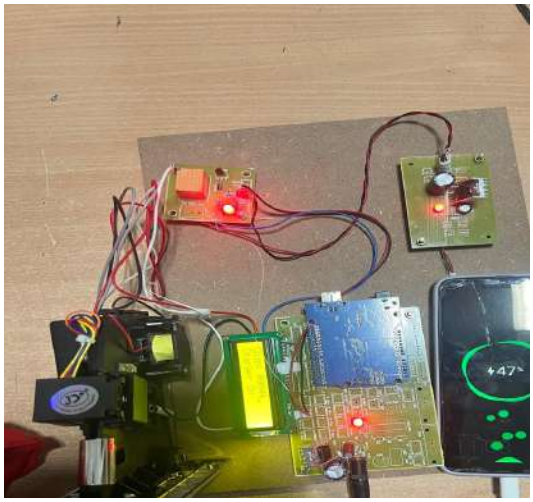

Fig-4 Coin based Mobile Charging System

VIII. ADVANTAGES

- **User-Friendly Operation:** The system features an easy-to-use interface with coin insertion, keypad input, and LCD feedback, making it accessible to users with little or no technical knowledge.
- **Easy to Assemble and Use:** The modular design and straightforward wiring make the system easy to assemble, configure, and deploy in various public settings.
- **Automation and Convenience:** Automatic initiation of charging upon valid coin detection enhances user convenience and ensures hassle-free operation without manual control.
- **Multi-Device Compatibility:** The charging port supports USB-C, Lightning, and Micro-USB connectors, accommodating a wide variety of smartphones and electronic devices.
- **On-Board Detection Indication:** The system includes on-board visual indicators (such as LEDs) to confirm valid coin detection, obstacle presence, and charging status, improving user feedback and troubleshooting.
- **Secure Device Compartment:** A lockable compartment ensures that users' phones remain safe during the charging session, making the system suitable for unattended public use.
- **Cost-Effective and Offline Solution:** Operates without internet or digital payment systems, making it ideal for rural and semi-urban areas with limited connectivity.
- **Energy-Efficient Operation:** The system consumes minimal power and operates efficiently, supporting sustainable public infrastructure deployment.
- **Low Maintenance and Scalable**: Modular components allow for easy maintenance and future expansion, such as integration with solar panels or digital payments.

IX. CONCLUSION

A coin-based mobile charging system has been designed and developed to address the growing need for accessible mobile charging solutions in public spaces. In today's fast-paced and communication-driven world, smartphones are essential, but users often forget to carry chargers—especially during extended travel. This project offers a practical and cost-effective solution using conventional grid power to charge mobile devices, eliminating the complexities associated with solar-powered systems such as high cost, limited nighttime operation, and increased maintenance.

Unlike previous approaches relying on solar energy, our system is powered by standard electricity supply, which can be sourced from renewable energy plants, ensuring greater efficiency and long-term feasibility. The project integrates a coin insertion mechanism with an Arduino microcontroller, along with peripherals like an LCD display, a 4x4 matrix keypad, and a relay to control the charging circuit. Users can insert coins to activate the charger, with the charging time proportional to the amount paid.

This solution is ideal for installation in public areas like airports, railway stations, parks, colleges, and other educational institutions where users frequently require emergency charging options. Furthermore, the system can be enhanced with advertising displays for added revenue generation. The prototype developed in this project currently supports the charging of one device at a time and demonstrates the potential for scalable deployment in real-world applications.

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