Design of Coin Sensor based Mobile Charging System

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Abstract—Today, mobile phones play an important role not only in the modern world of communication, but also in our daily lives. The mobile phone business is currently worth billions of dollars and supports most features of all mobile phones with different operating systems. Therefore, running these phones requires a public charge, which should be useful to the general public. Hence, keeping mobile phones charged has become a more significant task. In this project, we designed a prototype for mobile battery charging on coin insertion. A coin-based mobile charging system provides an alternate solution to all mobile users for charging their mobile phones during travelling or emergency where they may not have access to conventional power banks. This system can be used by shop owners, the general public and can be implemented in public places like railway stations and bus stand to provide mobile charging facilities. This system can also be implemented in commercial complexes, colleges, and offices. This coin based mobile charging system charges the mobile phone when the valid coin is inserted. So the coin acceptor used recognizes the coin inserted and signals the Arduino Uno for further action. When a coin is inserted, it signals the Arduino Uno and starts charging the mobile phone providing a 5V power supply through the charging slot. The Arduino Uno starts a reverse countdown timer to display the charging time left for that mobile phone using LCD display. Further the user adds another coin, the Arduino Uno adds to the currently remaining time and once again decrements the countdown. Keywords: Arduino Uno, coin-based mobile charging system, LCD display, mobile phone.

Index Terms—Arduino Uno, coin-based mobile charging system, LCD display, mobile phone.

I.INTRODUCTION

In today's fast-paced world, mobile phones have transcended their traditional role as mere communication devices, evolving into indispensable tools that permeate every aspect of modern life. The exponential growth of the mobile phone industry, boasting billions in revenue and a myriad of features across diverse operating systems, underscores the significance of these devices in contemporary society. With such ubiquitous reliance on mobile phones, ensuring they remain charged has emerged as a paramount concern for users worldwide. However, accessing reliable power sources can prove challenging, particularly during travel or emergencies when conventional charging solutions may not be readily available. Recognizing this need, our project endeavors to introduce a novel approach to mobile

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charging through the development of a coin-based charging system. By harnessing the simplicity and accessibility of coin-operated mechanisms, we aim to provide a convenient and reliable solution for mobile users to replenish their device's battery life on the go. The coin-based mobile charging system represents a paradigm shift in how users interact with charging infrastructure, offering a versatile alternative to traditional power banks or wall outlets. By integrating seamlessly into public spaces such as railway stations, bus stands, commercial complexes, colleges, and offices, this system democratizes access to charging facilities, catering to the diverse needs of mobile users across various settings. At the heart of this innovative solution lies a sophisticated yet user-friendly design that leverages the synergy between a coin acceptor and an Arduino Uno microcontroller. Upon insertion of a valid coin, the system initiates the charging process, delivering a stable 5V power supply to the connected mobile device through the designated charging slot. An intuitive interface, featuring an LCD display, provides users with real-time updates on the remaining charging time, enhancing transparency and user experience. Through meticulous design and rigorous testing, our project aims to demonstrate the feasibility and efficacy of the coin-based mobile charging system in meeting the evolving needs of mobile users. By fostering accessibility, convenience, and reliability, we envision this system as a game-changer in the realm of mobile technology, empowering individuals to stay connected and productive regardless of their location or circumstances. In essence, our endeavor represents a bold step towards reimagining the future of mobile charging, one coin at a time.

II.LITERATURE REVIEW

"COIN BASED MOBILE CHARGING SYSTEM" is a research paper proposed by V. Murali Krishna, I. Vidhya, G. D. S. N. L. Jayasri, G. Madhubala, K. Arun Kumar which was published in April 2023.The proposed system involves in the image processing techniques to recognize and classify images based on their visual features. The system uses Python program for image processing and Arduino board for controlling charging time. Image processing is a technique for manipulating and analyzing images using mathematical algorithms. The process involves converting an image in to digital form and applying various operations to it to extract useful information. In this project, we trained SVM (Support Vector Machine) on a dataset of different images of Indian coins. This SVM helps in detecting the value of the coin form the photographs captured from the camera. "MOBILE CHARGING ON COIN INSERTION" is a paper proposed by Satendra Pratap Singh, Preeti Kumari Gupta, Pratik Kumar Shukla, Sarvesh Patel in 2020.The proposed system involves a Power source for gadget charging is a 12V battery which is connected with Solar panels as well as with a 230V AC adapter. When any pre-calibrated coin is inserted in the coin sensor, it generates certain set of frequencies based on certain parameters of coin like thickness, diameter, fall time. Microcontroller (arduino UNO), based on input signal provided by the coin sensor, activates the relay for certain period of time.USB port gets activated as soon as relay activates and thus, One can charge his/her gadget by using a USB cable. Different Charging intervals can be allotted to the calibrated coins. In this project they have designed a charger which can be installed in public places or rural areas to help people charge their mobile phones especially during the time of emergency. It is cost effective and secure. It will minimize carrying of power banks everywhere we go , if installed at places where standard charging conditions are not available. "A COIN ACCEPTOR - MOBILE BATTERY CHARGING USING SOLAR PANEL" is a paper proposed by Ammu Anna Mathew, Anoop J R, S. Vivekanandan , published in 2020. This system can be placed at public places, thus everyone can access the mobile charging facility [7]. The system consists of a coin recognition module that recognizes the valid coins and then generates a signal to the ARDUINO ATMEGA 328 for further action. When the valid coin is recognized, it will provide a 5 V supply to the mobile phones. Once the charging starts, the ARDUINO starts a reverse countdown timer to display the charging time for that mobile phone. If the customer needs more power, another valid coin has to be inserted to the system thereby making the ARDUINO controller to add extra time to the system

for charging. This system can be placed in public places for the use of everyone and it can be a profitable earning for the provider. The sun rays falling on the panel are converted to energy and it is passed through a LM317 regulator IC and also is stored in a battery. The specialty of this circuit is that if the solar energy is sufficient then it can be directly used by passing through the regulator. If solar energy is not sufficient for charging we can take the energy from the battery. For this switching process, a change over switch is also provided. The main circuit diagram for the coin based system is designed in two ways. In first circuit, a direct is given to the USB ports from battery and microcontroller. In the second circuit, the energy for the USB ports is given by separate switches. "MOBILE CHARGING USING COIN INSERTION" is proposed by T.Sri Navya, K. Harika, T. Prasanna, SK. Ashitha is published in 2023 . In this the Atmel 89c51 microcontroller only supports 5 volts, so 230 volts of AC power is supplied to the step-down transformer. The AC voltage is then converted to a DC voltage using a rectifier. The fixed DC voltage is then adjusted using a voltage regulator. Here you will get a fixed 5-volt DC power supply. This DC power is supplied to the Atmel 89c51 microcontroller, which is an LCD display. In this system, the power supply is used to power the entire circuit, like a microcontroller. Relays, transformers, resistors and capacitors are the main components used in system design. The coin sensor for inserting coins is also powered. This proposed system used an Atmel 89c51 microcontroller. The MAX 232 chip is used to connect various components. To display the charging time, the microcontroller is programmed through the software interface using kill software. This will be shown on the 16 * 2 LCD display. Software Implementation: We used "Keilu version 4" software to implement the software. In the software implementation, the main part is programming the Atmel89c51 microcontroller and connecting each device. LCD display, relay, transformer with microcontroller, etc. When power is supplied, the hardware circuit will be initialized. "Mobile Charging Station based on Coin Insertion System"is proposed by Shaikh Mohd Shakeeb ,Shaikh Mohd Ahsan , Fahad Khan ,Tanvir Salmani and is published in 2021 .In this they used Arduino Mega Microcontroller., Coin Insertion Module, Keypad, Liquid crystal display (LCD), Mobile Charging Adapter, Relay Module, Power supply. 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 resetmanually, the following user has to press one and then keep on inserting the desired amount for charging but will not see the welcome message. "COIN BASED MOBILE CHARGER USING SOLAR PANEL"is proposed by Varada Priyanka, Gosukonda Ramya, B. Harika is published in 2020. At whatever point a coin is inserted the IR sensor will recognize the coin and assurance implanted coin is correct. If the correct coin is implanted LCD demonstrates the information to the customer for next technique. The data power which is made through Solar Energy to the circuit. Microcontroller is the middle period of the structure which accept a critical activity in the undertaking. Microcontroller works exactly when the request gets from IR sensor .LCD show shows all the strategy of controller on the screen and number of moves depends on the amount of connectors we used in the system. The yield stage is known as the charging methodology or finish of charge. The smoothly from the exchange is given to the flexible charger pin. By interfacing the mobile

phone to the flexible charger pin the amount of coins can be installed by this whole the fulfillment of charge occurs.

III.SYSTEM ARCHITECTURE

The system architecture is described in the figure 3.1. A sequence of modules are used in the architecture namely Arduino UNO board, LCD 16x2 display, transistor, resistors, power source for arduino, battery and USB Port. The Arduino can "talk", (transmit or receive data data) via a serial channel, so any other device with serial capabilities can communicate with an Arduino.

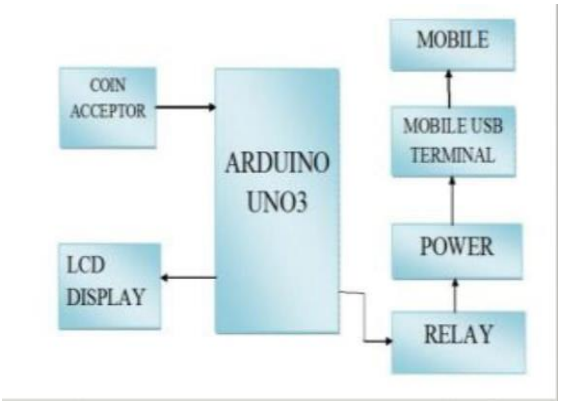

Fig1.1: System Architecture

IV. MODULES

This section describes the modules for the proposed system.

- Input stage-To accepts the valid coin.
- Controller-To control the voltage using relay.
- Power-To supply the power based on the requirements.
- Output and display-To display the output information.

1. Input Stage: The user inserts a coin to the coin insertion slot. The sensor is attached to the coin insertion slot and the coin is validated based on the diameter of the coin inserted. Initially the LCD display a message as “Please insert coin”. If the inserted coin is valid, the message is displayed in the LCD and signal is sent to the arduino. If the coin is not valid, it is returned back.When the coin is accepted, the arduino and relay is activated and the battery starts getting charged by the software of relay.

2. Controller: The system performs according to the input signal from the circuit. Based on the diameter of the coin, the coin is either accepted or rejected. If the coin is accepted, it sends signal to arduino along with LCD interface. Once the arduino receives the signal from the coin insertion slot, it sends signal to the relay. The relay generates the voltage of 5v, which in turn charges the mobile phone through the mobile USB terminal.

3. Output and Display: The LCD connected displays the messages as and when required. Initially, when the mobile charger is connected the LCD displays as, “Please insert coin”. When the mobile phone is charging, it displays “Charging” and the duration of charging based on the coin inserted.

4. Power: This coin based mobile charger draws power from the arduino through relay. The voltage is regulated based on the type of the mobile phone connected for charging. The following list describes the various mobile phones and their charging requirement

Table 1:Charging Requirements of mobile batteries.

SL.No	Mobile type	Max. Charging Voltage(V)	Max. Charging Current(mAh)
1	Samsung	5.7	3400
2	Sony Ericson	4.8	900
3	Nokia	4.8	1500
4	LG	5.5	2100
5	Panasonic	3.7	1200
6	HTC	5.5	1800
7	Black Berry	3.7	1300

V. COMPONENTS

• CH-916 MULTI COIN ACCEPTOR

Fig2: MUTLI COIN ACCEPTOR

•SINGLE-CHANNEL RELAY MODULE

Fig3:SINGLE-CHANNEL RELAY MODULE

•**ARDUINO UNO**

Fig4: ARDUINO UNO

•**16 × 2 STANDARD LCD SCREEN**

Fig5: 16 × 2 STANDARD LCD SCREEN

Minimum logic voltage:	4.5 V
Maximum logic voltage:	5.5 V
Typical LED backlight voltage drop:	4.2 V
Typical LED backlight current:	120 mA
Supply current:	2 mA

Fig5.1: General Specifications of 16 x 2 LCD screen

•**12V TO 5V DC CONVERTER WITH TWO USB JACK**

Fig6: 12V TO 5V DC CONVERTER WITH TWO USB JACK

•I2C SERIAL INTERFACE ADAPTER

Fig7: I2C SERIAL INTERFACE ADAPTER

•IC 7812 Voltage Regulator

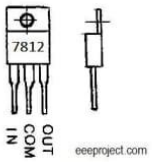

Fig8: IC 7812 Voltage Regulator

•POWER SUPPLY

Fig9: POWER SUPPLY

Nominal Voltage	12V
Nominal Capacity	1.20Ah @ 20 hour rate F.V.(1.75V/cell)
Terminals	T1
Internal Resistance	≤100mΩ (Fully Charged)
Max. Discharge Current	18 A (5 sec.)
Max. Charge Current	0.36 A

Fig9.1: Specifications

• USB CABLE

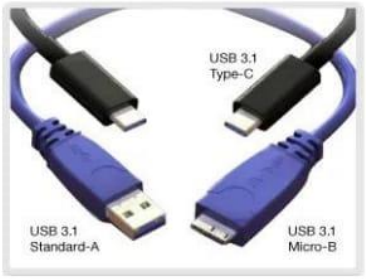

Fig11: USB CABLE

•JUMPERS

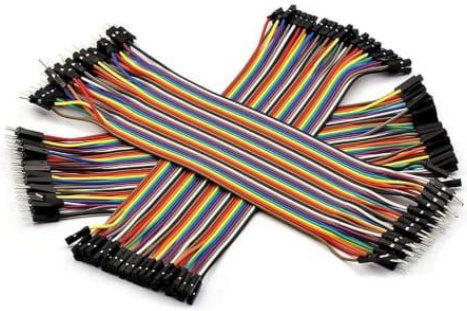

Fig12: JUMPERS

VI. TRAINING CH-916 MODULE

•It has Add key, minus key and Set key.

• Press the Add and Minus keys for a second , then ‘A’ is displayed.

• Then press the Set key ,then it displays ‘E’, and the channels can be added or subtracted by pressing the add/minus key (for example, if 9 values needed, add 9 channels; the default is 3 channels).

• E- How many coins we would like to use.

• After selecting the number of coins to be used, press Set key again then it displays ‘H1’.

• Then it asks number of samples for identifying a coin, the quantity of sample coins is 15-20, the default is 20 pieces.

• Press the Set key again, and ‘P1’ will be displayed. The P-parameter will denote the values of coin.(1 rupee coin – P1,2 rupee coin – P2, 5 rupee coin – P5).

• Press the Set key again ,and 'F1' will be displayed to set accuracy 1-20,set the frequency as 8.
••Press the Set key again,and the system will automatically jump to the second channel.
The rest can be done in the same manner ,until all channels have been setup.

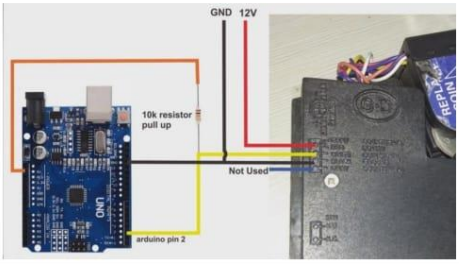

Fig13: Connecting Arduino to CH-916 Module

•An external 12V power supply is to connected to CH-916 module.
• Connect the Pin 2 in Arduino to Coin Pin in CH-916 module via 10k resistor to 5v.
• Connect the Ground terminals of both CH-916 and Arduino to the Ground.

VII. INTERFACE I2C 16X2 LCD WITH ARDUINO UNO

First solder the I2C Module. There is no label on the I2C Module for connecting to 16x2 LCD.
After soldering connect the I2C Module to Arduino Uno.
• Analog Pin 4 – SDA
• Analog pin 5 - SCL
• 5V - Vcc
• GND – GND
• Give the 5V power supply to LCD.

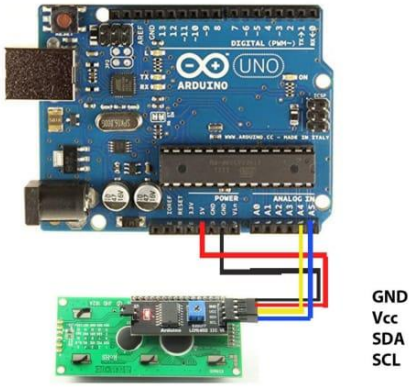

Fig14: Interface I2C 16x2 LCD with Arduino Uno

VIII. INTERFACING 5V RELAY WITH ARDUINO

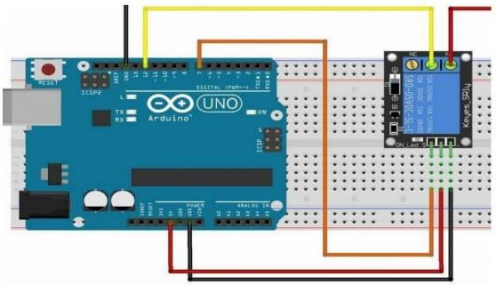

Fig15: Interfacing Arduino with Relay
•Connect the Signal pin to the pin 7 of Arduino UNO.
• Connect the relay VCC to 5v pin in the Arduino UNO.
•Connect the Ground pins of both the relay and the Arduino UNO.
•Guve the External 5V power supply to relay module.

IX. PROPOSED WORK

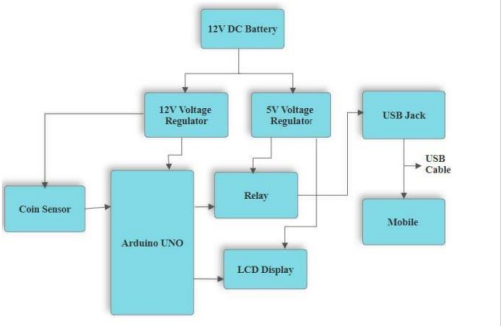

Fig16: Block Diagram

Working Principle

"Coin Based Mobile Charging" message is displayed on LCD Screen. Then with in a Second "WaitFor Coin Charging OFF" message is displayed. The user now have to insert the coin. The user has the option to insert as many as they want but only to insert an INR 1 or 2 or 5-ruppee coin. Any other coin the user inserts will not be accepted by the system and is returned to the user. The time keeps on adding itself as the user keeps on inserting on inserting the coin. For example, if the user inserts a 1-ruppee coin the time starts from 60 seconds and it decrements while charging and if he then inserts 2 ruppee coin the time will update from 60 to 180 seconds. The charging time is related to the amount of money entered into the system. For 1 ruppee, the user will be allotted a 1-minute time slot to charge their device, and for 2 rupees, 2 minutes will be allotted, and for 5 ruppees ,5 minutes will be allotted. After the charging time has elapsed, the controller resets automatically in this prototype. If it does not reset automatically then it can be reset manually by pressing reset button on the arduino board. Then again the process starts form starting.

X.FLOW CHART

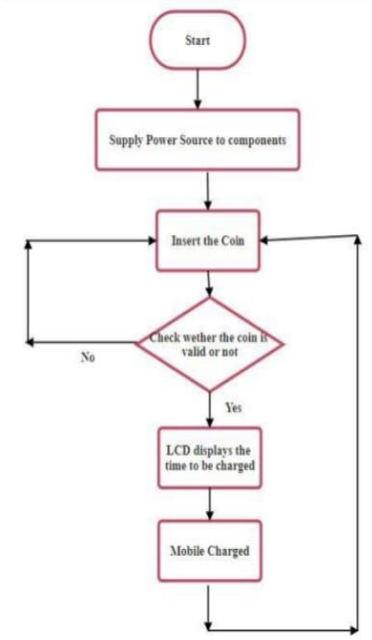

Fig17: Flow Chart

XI.RESULTS AND DISCUSSION

HARDWARE SETUP

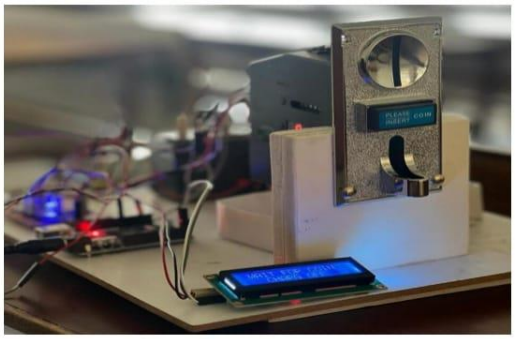

Fig18: Front View

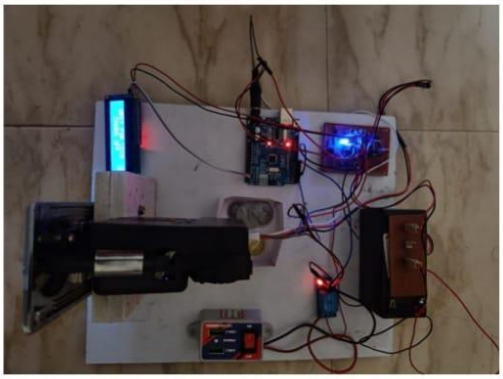

Fig19: Top View

RESULTS

When 1-ruppee coin is inserted :

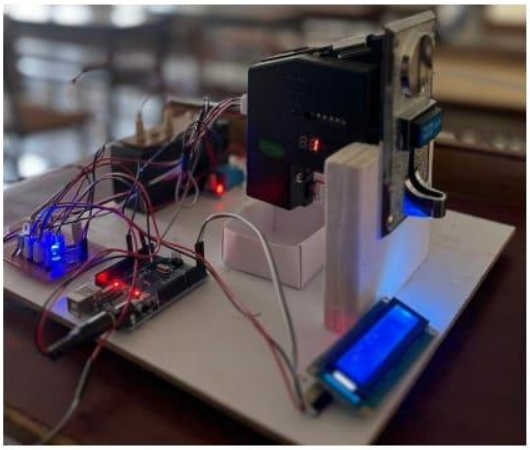

Fig20: 1-ruppee is inserted

Then 60 seconds will be charged. While charging the timer on the LCD will be decremented from 60 to 0 seconds.

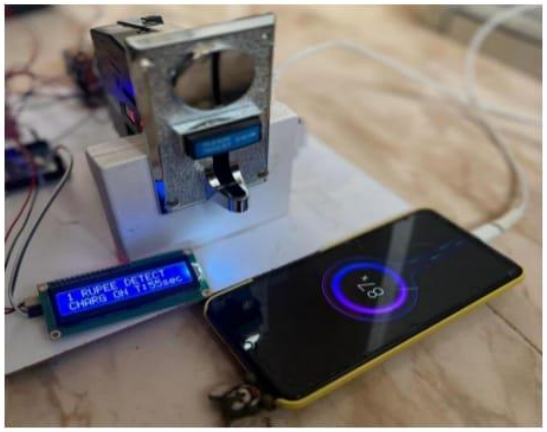

Fig21: Charging on for 1minute

When 2-ruppee is detected:

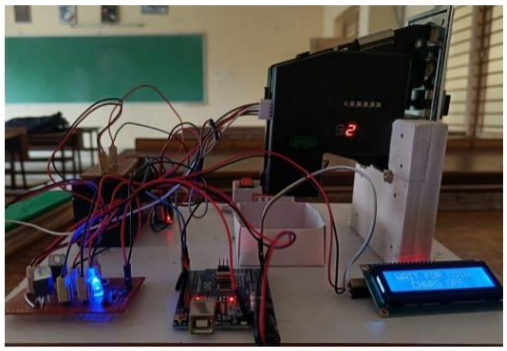

Fig22: 2-ruppe is inserted

Then 120 seconds will be charged. While charging the timer on the LCD will be decremented from 120 to 0 seconds.

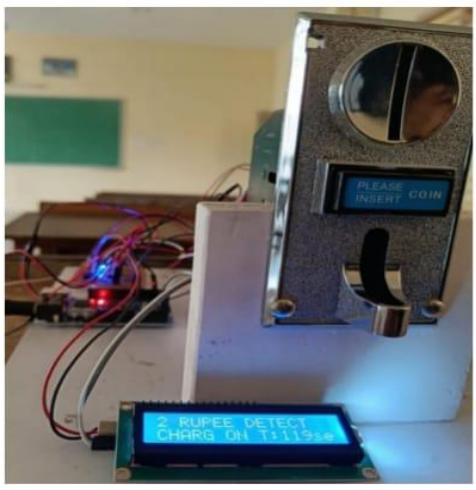

Fig23: Charging on for 2 minutes

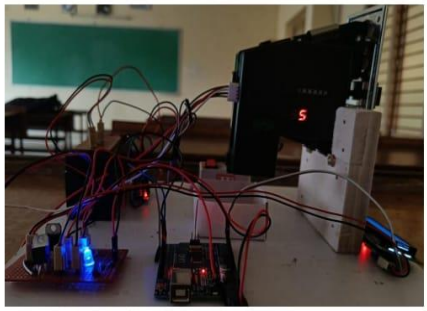

Fig24: 5-ruppe is inserted

Then 300 seconds will be charged. While charging the timer on the LCD will be decremented from 300 to 0 seconds.

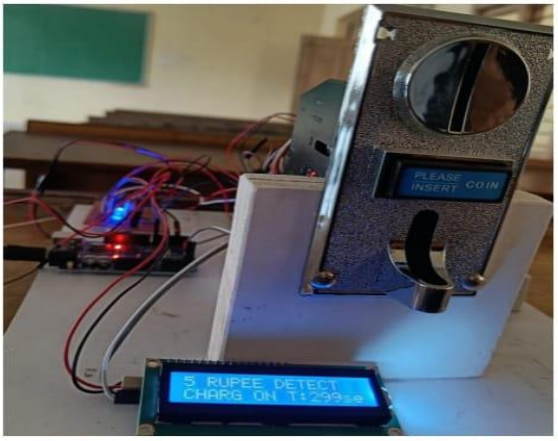

Fig25: Charging on for 5 minutes

XII.CONCLUSION

In conclusion, the growing significance of mobile phones in daily life necessitates innovative solutions for ensuring continuous access to charging facilities, especially in situations where conventional power sources may be unavailable. The Design Of Coin Sensor Based Mobile Charging System prototype developed in this project offers a practical and accessible solution for users to charge their devices while on the go or during emergencies. By leveraging a coin acceptor mechanism and Arduino Uno technology, this system enables users to initiate charging by simply inserting a valid coin, providing a convenient and reliable charging option in various public settings such as transportation hubs, commercial complexes, colleges, and offices. With its potential to enhance accessibility to mobile charging facilities, this coin-based system holds promise for

addressing the evolving needs of mobile users in today's interconnected world.

XIII. FUTURE SCOPE

This project addresses the challenge of charging mobile phones in public places by offering a coin operated solution. Upon valid coin insertion, the Arduino Uno activates a 5V charge and displays remaining time on an LCD. Adding coins extends charging duration. This portable system targets public spaces like bus stops and train stations, providing a convenient charging option for mobile users. Future iterations could explore solar power integration for sustainability. Not only solar power integration but it can include some security system when installed in public places like communicating with the prototype through some keyboard switches. This project can also be integrated and developed by using insertion of notes like 10rs,20rs,100rs,500rs,etc,.

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