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Coin Based Mobile Charging System

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***Abstract*—** In the modern communication environment and day-to-day life, mobile phones now play a significant role. The mobile battery charger on coin insertion is described in this paper. When a normal charger is not available, the battery frequently runs out in the middle of a conversation, especially during inopportune times. Mobile battery chargers that use coins are created to address this issue. So this model, totally work and get charged by the solar power, which is to be mainly used at the metro stations by the people who want to connect with someone on urgent basis. After inserting a coin and plugging in a mobile device, the user will receive a micro pulse that will start the charging process. The battery will charge upto 30 minutes in one rupee coin. If the number of rupee is double, then the charging time limit will also get doubled. This small and lightweight solution is made to accommodate the increasing number of mobile users on metro stations and other places around the world. For each controlling application, a suitable microcontroller is programmed. The solar power serves as the source for charging.
Keywords— Arduino Nano.

I. INTRODUCTION

Mobile phones have become an indispensable part of modern life. The power supply is an essential component of every electronic system. Mobile phones are used for the majority of daily tasks, so they must be charged in order to function. Therefore, the fundamental concept under consideration here is the creation of a charging system for coin insertion. The most important thing is that the above system will be accessible at any time in public areas. Since electricity is a resource that may or may not be available, so we used solar power supply for working. The user must place the coin in the coin acceptor and connect the appropriate adapter to the phone. The microcontroller will specify predetermined values for the amount of charging. This system is useful for people who travel long distances and is simple to install.

Therefore, this model operates completely and is powered by solar energy. It will primarily be utilized at metro stations by individuals who require immediate communication. The user will receive a micro pulse that will initiate the charging process after plugging in a mobile device and inserting a coin. The mobile battery will begin to be charged as soon as a rupee coin is inserted. One rupee coin can charge the battery for up to thirty minutes. The charging time limit will also double if the rupee amount is increased. The charging capacity of the mobile device is calculated using pre-set values. We will, of course, be able to continue charging the phone[1] if you add more coins. The relay will also be at the ON condition, to serve the system specific voltage such as 5V for working. To accommodate the growing number of mobile users in metro stations and other locations worldwide, this compact and lightweight solution was developed. A suitable microcontroller is programmed for each controlling application. The power from the sun is used to charge the device.

The number of people using mobile phones is skyrocketing. As a result, charging mobile phones has become a more difficult task in recent years. When purchasing new mobile phones, battery power is the primary concern. The primary objective of a mobile charger is [2] to reduce the amount of electrical power wasted by users due to carelessness. The coin acceptor determines whether the coin is valid after it is inserted. The power is only available for a short time for each price unit. The number of coins inserted can be used by the Arduino to calculate the time.

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II. Methodology

A coin acceptor machine is used in the system to look for a valid coin. The LCD display is connected to the coin acceptor after it is connected to the Arduino board. The Arduino will send a signal to LCD [1] to display the amount of time remaining to be charged if a valid coin is discovered. The charger's power supply will be controlled by the relay, which will stop supplying power after a predetermined amount of time has passed. The charger's SMPS (Switch Mode Power Supply) is used to control energy conversion. The LCD screen will show how much time is left for charging. If the user wants to extend the charging time, he or she will need to add another coin, and the microcontroller will add that time to the time that is still left.

III. Working of the Model

A Solar panel, a DC power supply, and a battery on a regular basis is used to provide power. The 12V DC power supplied by the solar panels is used to charge the rechargeable battery, and the 12V DC power supplied by the grid is used to power the system. This entails utilizing two standby power supplies. Now, to get a pure, constant DC voltage, this voltage is fed into a voltage regulator. The implemented coin based solar operated charging system that makes use of a solar panel is depicted in the figure.

When a coin is inserted [2] into the coin insertion slot during the input stage, the mobile battery charger begins charging the mobile device that is connected to it. In order to guarantee that the coin is inserted correctly, the size and type of the coin will be shown to the user on the LCD screen. In the coin insertion slot, a mechanical slot with electrical triggering is attached. If the right coin is inserted, it sends a pulse to the control unit to start charging the device's mobile battery. After that, the coin is inserted into the coin insertion slot of the battery charging unit, and the software of the microcontroller starts charging the mobile battery for a predetermined amount of time [3]. The locking mechanism is activated when the microcontroller receives the input signal, and the servomotor rotates and opens the charging system window to place the mobile device for charging. After a few seconds, the motor rotates and closes the window for security purposes.

The LCD provides the customer with access to all of the information they require at any time. When the battery of the mobile device is connected, the message "Insert Coin" appears. During charging, it displays "Charging" and "Charge Completed" respectively. To continue charging, the coin must be inserted when the display shows "Charge Completed."

The mobile charger receives power from the relay via pin. By connecting the phone to the mobile charger pin, the number of coins inserted is read, and based on these values, the charge is completed. When the charging process is finished, the servomotor rotates so that the user can disconnect the phone from the charger. Once more, the motor rotates, and the window closes.

A. Assembling the hardware components

The equipment parts utilized in this undertaking are microcontroller Arduino Nano, LCD Display, Coin Detecting Machine, Power Supply, Voltage Regulator, Solar Panel, Buck Converter [5] etc. The coin detecting mechanism detects the presence of coins inserted in the system which is then attached to the Arduino Nano microcontroller by which the phone’s battery is charged.The charging level is shown on the LCD screen. All the components are attached in an appropriate manner. The connection of the components is shown in Figure 1.

B. Modules of the System

This section describes the modules for the proposed system.

Input stage- To accept 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.

- **Input Stage**

When a coin is inserted into the coin insertion slot during the input stage, the mobile battery charger begins charging the mobile device that is connected to it. In order to guarantee that the coin is

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inserted correctly, the size and type of the coin will be shown to the user on the LCD screen. If you put another coin in the slot, it will be returned to the refund box. In the coin insertion slot, a mechanical slot with electrical triggering is attached. If the right coin is inserted, a pulse is sent to the control unit to start charging the device's mobile battery. After that, the coin is inserted into the coin insertion slot of the battery charging unit, and the software of the microcontroller starts charging the mobile battery for a predetermined amount of time.

- **Controller Stage**

The mechanical detection input signal directs this section's actions. The diameter of the coin determines whether it is accepted or rejected. This calls a microcontroller, and the LCD interface shows the mobile option. If a particular mobile is selected for charging, the appropriate routine is run, and the mobile is charged for a certain amount of time. When the routine is finished, the LCD display shows a charge complete message. In a similar vein, the process for simultaneously charging more than four mobile devices is the same.

- **Power Supply**

The two power systems in this project are the solar power system and the ac supply system. The main power source is the solar power, which charges the 12 volt battery. The switch for the two power systems is used. Using a rectifier, AC power is converted into dc power in an AC supply system, which is controlled by a regulator whose output is connected to the battery.

- **Output and Display Module**

All of the information is shown to the user on the LCD whenever it is needed. The message "Insert Coin" appears when the mobile battery is connected. It shows "Charging" during charging and "Charge Completed" at the end of the charging cycle. When the display says "Charge Completed," the coin must be inserted to continue charging.

C. Recover the information from the system and send to the LCD display

The system works appropriately to avoid any inconvenience. The system works smarts with the help of coin detecting mechanism, LCD, Relay, Battery, Solar Panel. Arduino Based languages is used to create a website for coin based solar operated charging system based on the Internet of Things. The results are properly checked and are accessible by everyone.

D. Advantages of the Proposed System

- Power Management System
- Industrial Application
- Metro Stations
- Shops
- Railway Station
- Hospitals
- Laptop and camera can be charged

E. Features of Proposed System

The following assumptions were made in the development of the proposed method:

1. Observe the presence of coins inserted in the machine.
2. It is very helpful in terms of mobile phone charging system.
3. The intensity of the mobile charged is displayed on the LCD screen and the Mobile application via internet.

F. Components Used

The components used in the system are as follows:

1. Arduino Nano

It is one kind of microcontroller board. This microcontroller is based on Atmega168 or Atmega328p. It is fairly similar to Arduino Uno board but when it comes to pin-configuration and features, this Nano board has replaced Arduino Uno due to small in size. As we know that while designing an embedded system small size components are preferred. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino Uno. It is a small size

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board and also flexible with a wide variety of applications. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straight connected to the pins like VCC & GND. This board can be supplied with 6 to 20 volts using a mini USB port on the board.
Arduinonano pin configuration mentioned below:

- **Power Pin (Vin, 3.3V, 5V, GND):** These pins are power pins.Vin is the input voltage of the board, and it is used when an external power source is used from 7V to 12V.5V is the regulated power supply voltage of the nano board and it is used to give the supply to the board as well as components.3.3V is the minimum voltage which is generated from the voltage regulator on the board.GND is the ground pin of the board.
- **RST Pin (Reset):** This pin is used to reset the microcontroller.
- **Analog Pins (A0-A7):** These pins are used to calculate the analog voltage of the board within the range of 0V to 5V
- **I/O Pins (Digital Pins from D0 – D13):** These pins are used as an i/p otherwise o/p pins. 0V & 5V
- **Serial Pins (Tx, Rx):** These pins are used to transmit & receive TTL serial data.
- **External Interrupts (2, 3):** These pins are used to activate an interrupt.
- **PWM (3, 5, 6, 9, 11):** These pins are used to provide 8-bit of PWM output.
- **SPI (10, 11, 12, & 13):** These pins are used for supporting SPI communication.
- **Inbuilt LED (13):** This pin is used to activate the LED.
- **IIC (A4, A5):** These pins are used for supporting TWI communication.
- **AREF:** This pin is used to give reference voltage to the input voltage

Features:

- ATmega328P Microcontroller is from 8-bit AVR family
- Operating voltage is 5V
- Input voltage (Vin) is 7V to 12V
- Input/Output Pins are 22
- Analogi/p pins are 6 from A0 to A5
- Digital pins are 14
- Power consumption is 19 mA
- I/O pins DC Current is 40 mA
- Flash memory is 32 KB

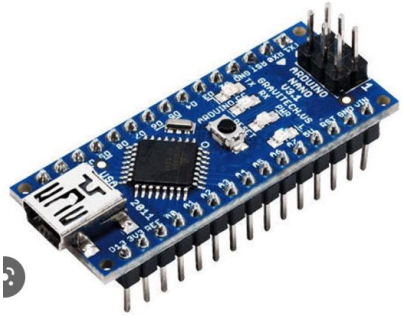

Figure I: Arduino Nano

2. LCD Display

Liquid crystal display is spelled LCD. It is one kind of electronic display module that is used in a wide variety of circuits and devices like computers, mobile phones, televisions, and others. Seven segments and multi-segment light-emitting diodes are the primary uses for these displays. The principal advantages of using this module are its low cost; basically programmable, activities, and there are no limits for showing custom characters, exceptional and even movements, and so on.

- **Pin1 (Ground):** This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.

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- **Pin2 (VCC):** This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- **Pin3 (VEE):** This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- **Pin4 (Register Select):** This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- **Pin5 (Read/Write):** This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- **Pin 6 (Enable):** This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- **Pins 7-14 (Data Pins):** These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- **Pin15 (+ve pin of the LED):** This pin is connected to +5V.
- **Pin 16 (-ve pin of the LED):** This pin is connected to GND.

Features:

- It has two rows, each of which can write 16 characters.
- It displays a few custom-generated characters
- Uses 1 mA current without a backlight.
- The alphanumeric LCDs display alphabets and numbers.
- These are available with blue and green backlights.

Figure II: LCD Display

3. Voltage Regulator

Due to variations in the circuit, no voltage source can produce a constant output. Voltage regulators are used to obtain a constant and steady output. Voltage regulator integrated circuits (ICs) are electronic devices used to control voltage. Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 Voltage Regulator, a member of the 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC).

PIN 1-INPUT

The function of this pin is to give the input voltage. It should be in the range of 7V to 35V. We apply an unregulated voltage to this pin for regulation. In this pin of the IC positive unregulated voltage is given in the regulation.

PIN 2-GROUND

We connect the ground to this pin. For output and input, this pin is equally neutral (0V). In this pin where the ground is given. This pin is neutral for equally the input and output.

PIN 3-OUTPUT

This pin is used to take the regulated output. The output of the regulated 5V is taken out at this pin of the IC regulator.

Features:

- 3-Terminal Regulators.
- Output Current up to 1.5A.
- Internal Thermal-Overload Protection.

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- High Power-Dissipation Capability.
- Internal Short-Circuit Current Limiting.
- Output Transistor SAFE-Area Compensation.

Figure III: Voltage Regulator

4. Relay (5V/SPDT)

High-quality sealed Single Pole Double Throw (SPDT) relays are available. Use them to switch devices that use a lot of current or voltage. Switching between two circuits is done with the SPDT relay.

Table 1: Pin Configurations of Relay 5V/SPDT

Pin	Pin Name	Details
1	End 1	The relay SPDT is used for switching in between two circuits.
2	End 2	This pin is used to activate the Relay.
3	Common	This pin is connected to the main terminal of the Load to make it active.
4	NC (normally closed)	This second terminal of the load is connected to either NC/ NO pins. If this pin is connected to the load then it will be ON before the switch
5	NO (normally open)	If the second terminal of the load is allied to the NO pin, then the load will be turned off before the switch.

Features:

- The voltage across the coil for the trigger: 5V DC.
- Nominal current for the trigger: 70 mA
- A compact five-pin arrangement with plastic moulding
- Time spent running: Time to release: 5msec.

Figure IV: Relay 5V/SPDT

5.Solar Panel

A solar panel, also known as a PV panel, is a device that turns the sun's light, which is made up of energy particles called "photons" into electricity that can power electrical loads. Remote power systems for cabins, telecommunications equipment, remote sensing, and, of course, the production

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of electricity by residential and commercial solar electric systems are all possible uses for solar panels.

Features:

- Low Maintenance.
- Zero Noise Pollution ·
- Durability ·
- Conversion efficiency ·
- Temperature Coefficient

Figure V: Solar Panel

6. Battery Charge Controller

The transfer of electricity between the PV generator and the battery is controlled by a BCC. Its job is to control the PV array's voltage and current to keep the battery from being overcharged and undercharged.

Features:

- Accept incoming power from solar panels.
- Control the amount of power sent to the battery.
- Monitor the voltage of the battery to prevent overcharging.
- Allow power to flow only from the solar panels to the batteries.

Figure VI: Battery Charge Controller

7. Power Supply

A battery provides the wheelchair's DC motors with power. There are rechargeable batteries and non-rechargeable batteries. The one that can be recharged is also known as a secondary cell, storage battery, or accumulator. Electrical batteries of this kind can be charged, discharged during use, and recharged multiple times. The primary battery, also known as the non-rechargeable battery, is provided fully charged and then castaway after being discharged. One or more electrochemical cells make up the rechargeable battery. The term "accumulator" refers to the process of accumulating and storing energy through an electrochemical reaction that can be reversed. Batteries come in a variety of sizes and shapes. From button cells to megawatt systems, they are available. By connecting them together, they are used to stabilize an electrical distribution network. When compared to disposable batteries, rechargeable ones are initially more expensive, but their total cost of ownership and impact on the environment are significantly lower because they can be recharged inexpensively multiple times before needing to be replaced. Some types of rechargeable batteries are available in sizes and voltages that are comparable to those of disposable batteries; they and they can be used interchangeably.

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IV. Block Diagram

All the components are connected in the block diagram given below. Initially, the system is given in Figure 10. The solar panel is connected to the battery which will get charged due to solar and then to ArduinoNano, which will control and monitor the system. The relay driver will check the working of the system. After the coin is inserted into the system, the battery of the mobile phone will get charge. Then the percentage of the battery charged will be shown on the LCD screen for the user to get aware of the charging of phone. This system will be helpful in any emergency and also will be ease to use at any public place.

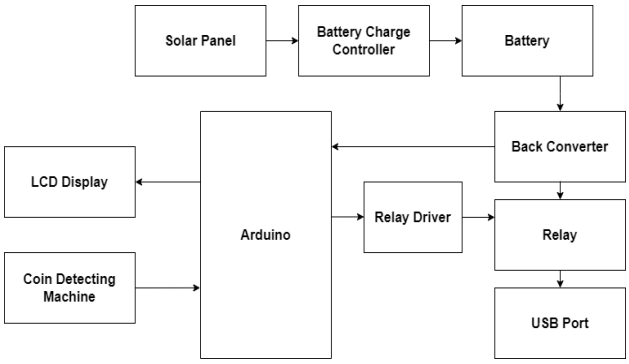

Figure VII: Block Diagram of Coin Based Solar Operated Charging System

V. Circuit Diagram

The circuit diagram of the coin based solar operated charging system is shown below in figure 11. The battery, which will be charged by the sun, which is connected to the solar panel. The Arduino Nano, which will control and monitor the system, is next. The system's operation will be checked by the relay driver. The phone's battery will be charged when the coin is inserted into the system. The user will then be able to see how much of the phone's battery is charged by looking at the percentage on the LCD screen. This system will be easy to use in any public place and will be useful in any emergency.

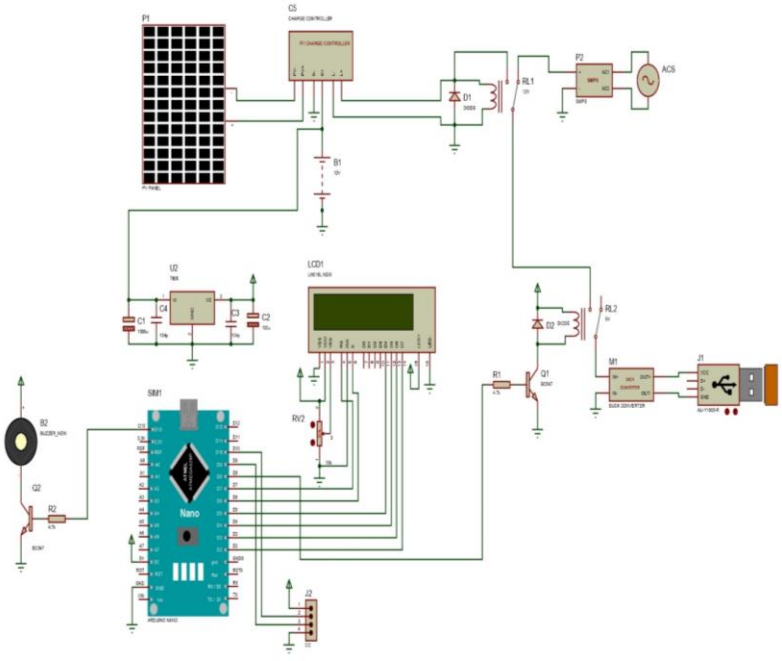

Figure VIII: Circuit Diagram of Coin Based Solar Operated Charging System

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VI. Flowchart

The flowchart of the coin based solar operated charging system is as follows through all the process is done.

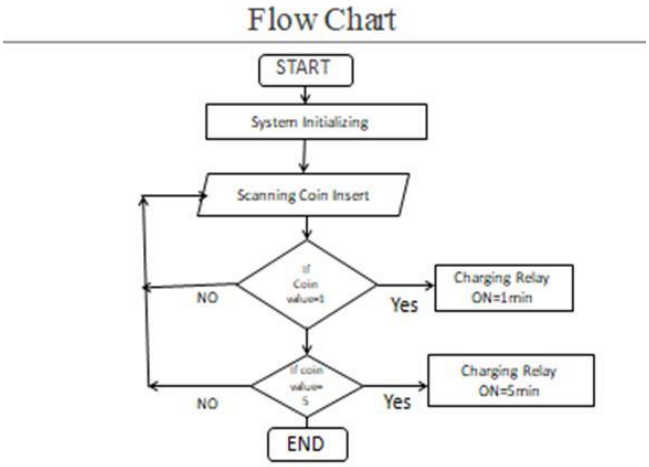

Figure IX: Flowchart of transmitter section

Conclusion

The creation of a coin-based mobile charger is the primary objective of the project. This charger provides a one-of-a-kind service to the public in both urban and rural areas where grid power is intermittently unavailable and will also serve as a source of revenue for establishment site providers. The coin-based mobile battery charger can be installed quickly and easily outside of any business, and solar energy is one of the abundant and free sources of energy in nature. The primary purpose of this solar panel system is to harness that energy so that it can be used to charge the phone. A coin-based mobile charger is designed and developed in the event of unpredictability in grid power and abundant solar power. The user must plug the phone into one of the adapters and insert a coin to charge at a constant current for a predetermined amount of time with this device, which functions similarly to kiosk battery charging vending machines. By inserting more coins, charging can be increased; RFID is also used by people who do not have coins and can also require a longer charging time. Solar chargers convert light energy into DC current that can be used to charge the battery at a variety of voltages. They can be mounted as well as carried around in most cases.

Whenever it was necessary, a method for charging mobile batteries of various manufacturers was designed and developed. This project is extremely significant and beneficial to life. It's possible that we'll always forget to bring a phone charger when we go on long tours. By using a coin-based charger, this project is very helpful in helping the people. Additionally, given the prevalence of smartphones and the internet in modern times, projects of this kind are extremely useful.

A solar-powered charging system for a variety of mobile battery brands is proposed. The system is suggested for rural and remote areas where the current supply isn't always or for a long time available. In these kinds of locations, where people are experiencing power outages, this project is very helpful. Cell phone charging is one of the issues that users face because of the importance of communication these days. In situations where there is no access to electricity, the proposed system will provide a means of charging the phone. Because solar power is used, it would be less expensive and advantageous to travellers travelling long distances. For the convenience of mobile users, this coin-based mobile charging system can be installed in a variety of public locations. This system aims to assist mobile phone users by providing coin-based charging that can be easily obtained at

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any time. Although, the amount of battery charged will also be shown on the LCD screen, if person fails to see the mobile charged percentage.

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