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A Novel Approach for Smart Mobile Charger

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Abstract: In this generation, the efficient use of mobile phones has been phenomenal. The charging of mobile phones are required in most of the times in rural and semi-urban areas the mobile phones have become an essential communication device, it drives the user to charge it for many hours. The urban population use mobiles with good power batteries which last for few days, while the rural population buy pre-owned mobile phones that require frequent charging even three or four times a day. This paper is designed in the event of unpredictable grid power and availability of abundant solar power using coin sensor. This device is like a vending machine which is used for charging mobile batteries where the user has to plug the phone into suitable adapters and insert the coin to charge for a specific duration. It is a pay and use process. This model can be installed outside any business premises even like railway station, bus stands, libraries etc. The coin sensor used in this project evaluates the coin based on its weight, size and magnetism and sends an appropriate electric signal via output connection. In this paper, A Novel Approach for Smart Coin Mobile Charger based on solar power and grid power is discussed and this is prescribed for rural areas where the mobile phones are basic needs for communication and the grid power is not available all the time.

Key words: LCD Display · Solar Panel · Microcontroller · LDR · Motor Driver · Coin Sensor · Mobile Phone

INTRODUCTION

When mobile phones' becoming the major source of business/personal communication, the mobile phone business are currently worth billions of dollars and supports millions of phones. Every basic need to provide a public charging service is essential. The coin-based mobile battery charger is developed in this work providing a unique service to the rural public where cross power is not available for partial & full daytime and a source of revenue is for site providers. The coin-based mobile charger can be quickly installed outside any business premises. The mobile [1] markets have become an huge area where the rural areas use wide range of communication. While the urban grown uses more sophisticated mobiles with good power batteries lasting for several days while the rural population buys the pre-owned mobile phones that requires charging frequently [2].

Many times battery [3] shuts down in the middle of conversation particularly at inconvenient times when access to a charger isn't possible. The coin-based mobile chargers are designed to solve this problem. The user has to plug the mobile into one of the adapters and then insert a coin. It does not bring a mobile from dead to a fully charged state. The charging capacity of the mobile phones is designed with the help of pre-defined values. It is possible to continue charging the mobile phones by inserting more coins. This compact and Lightweight product is designed to cater for the growing number of rural users worldwide. A suitable micro controller is programmed for all the controlling various functions. The source for charging is obtained from a direct power network and solar energy [4].

Literature Survey: The conversion of sunlight in to electrical energy is known as Photovoltaic energy. The converted energy is stored in a photovoltaic cell, also

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called a solar cell or PV, is the technology used for conversion of solar energy directly into electrical power [1]. Sunlight mainly consist of photons, or particles of solar energy. These photons carries various amounts of energy with respect to the different wavelengths of the solar spectrum. When these photons strike a photovoltaic cell, they are reflected, pass right through, or get absorbed. Only the absorbed photons provide energy to generate electricity. The sun has the ability to generate almost unlimited energy that can be converted into electricity using solar panel. The energy that are converted from the sun can be used to power any kind of electricity including intermediate storage battery as solar powered mobile phone charger.

The ordinary solar panel is always faces only in one direction. Due to this, the solar panel cannot able to get sufficient sun rays to work all the time. In this work *Solar Panel Controller and Power Optimization* is done in order to overcome this technical defect. Here the panel will rotate according to the readings read by the LDR. So the sun light can be utilized fully to work & power optimization is also done by using the LDR.

Proposed Work: The growth of mobile market is tremendous in recent times and the need for charging the mobiles are required. In many developing countries the network power is not available for few hours to several hours on a daily basis especially in urban and rural areas where the mobile phones are essential communication device. While the urban grows uses more sophisticated mobiles with good power batteries which last many days while the rural population buys the pre-owned mobile phones that requires charging frequently. In the event of unpredictable network power and availability of abundant solar power, a coin based universal mobile charger is designed and developed in this project. This device is like a vending machine for mobile battery charging at booths and the user has to plug the phone into one of the adapters and insert a coin for charging at a constant current for 10 min duration. The solar power application to battery charging has been studied in our past. Solar chargers convert the light energy into DC current for a range of voltage that can be used to charge the mobile battery. They are generally movable but can also be barely mount. In this design of coin based mobile charger a fixed size solar panel of size 290x185x22mm, 5W is used to charge the battery up to maximum 1.0 amp to bright sun light. In this project, the design and development of a coin based mobile battery charger based on main power and solar power is discussed primarily for rural areas where the mobiles are basic needs for communication and the main power is not available all time. The mobile market is a vast industry and has spread into rural areas as an essential product. While the urban grows uses more experienced mobiles with good power batteries which last for several days while the rural grows buy the pre-owned mobiles that requires charging frequently. Many times battery becomes shut in the middle of conversation when access to a standard charging is not possible. The coin-based mobile chargers are designed to solve this problem. The user has to plug the mobile into one of the adapters and insert a coin. The phone will be given a micro-pulse for charging. It does not bring a mobile from dead to fully charged state. The charging capacity of mobile is designed with the help of predefined values. It is possible to continue charging the mobile phones by inserting more coins. This compact and lightweight product is designed to cater for the growing number of rural mobile users worldwide. A suitable PIC micro controller is programmed for all the controlling applications. The source for charging is obtained from direct power network and solar energy in case of non-availability of network power.

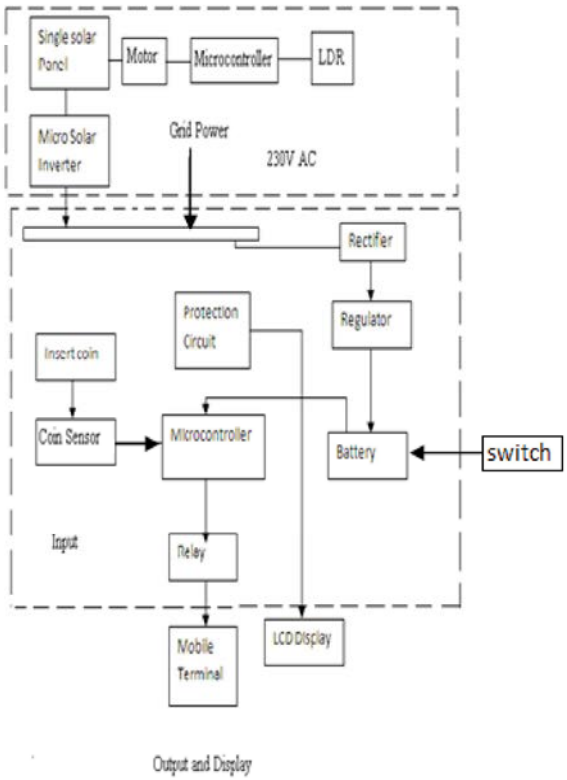


Fig. 1: Block Diagram of Smart Coin Based using Coin Sensor

Technical Analysis

Basic Assumptions: The design of smart coin based mobile battery charger is based on the following assumptions:

- Maximum solar energy is used for charging the mobile battery to keep it charged fully all the time.
- The charging current is up to 4.5AH @ 6vDC and this takes care of the mobiles of first and second generation mobiles.
- A single solar panel of size 635x550x38 mm, 37WP capable of supplying up to 2.0 amps is used.
- Providing to charge maximum 10 different types of mobiles.
- Insertion of a fixed coin size for charging

Solar Panel Section: The movement of the solar panel is controlled through the stepper motor [5]. 3 LDR's will be placed on arch. According to the movement of the sun LDR intensity will be varied where the sun light intensity will be more LDR intensity will be less. Depending upon LDR intensity stepper motor will be rotated to the side where the LDR intensity is found to be less and so the solar panel also rotates. Power optimization is done by using LDR. If the light is less than LDR reads the maximum. According to the value of LDR the ADC shows the reading which then sends that value to microcontroller were it glows the LED. Depending upon the intensity of the light LED arrays will be switched ON or OFF. The most important feature of the smart coin mobile battery charger is that it draws power from the solar energy during the day time for charging the internal battery of the controller. Only if additional power is required, then the grid power is used. A solar micro inverter has been designed for supplying 230v, 50Hz so that both grid power and the solar power are connected in parallel with a switch to change from one to the other.

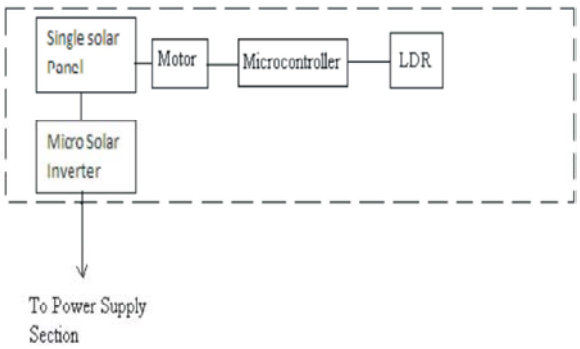


Fig. 2: Solar Panel Section

The solar panel required for the application is given in Fig. 3.

Fig. 3: Solar Panel

The architecture of a micro solar inverter consists of an stable multi-vibrator tuned for 50Hz. This is then converted to a pure sine wave using a converter. This is power amplified and connected to a step up transformer load. The secondary of the transformer gives 230V AC, 50Hz.

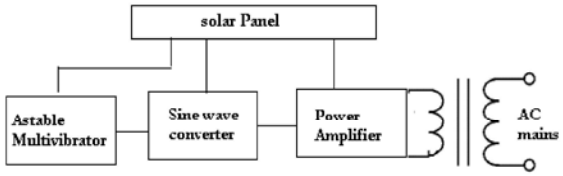


Fig 4: Block Diagram Micro Solar Inverter

Power Supply Section: The basic input to the circuit is applied from the regulated power supply [6]. The AC input 230V from the main power supply is step down by the transformer to 12V and is catered to a rectifier. The output detected from rectifier is a pulsating DC voltage. In order to get a pure DC voltage the output voltage from the rectifier is fed into a Capacitor filter to remove any AC components that are present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant DC voltage.

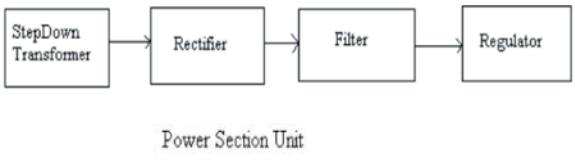


Fig. 5: Block Diagram of Power Supply Unit

Coin Based Mobile Charger: The basic block diagram of the mobile battery charger is given below:

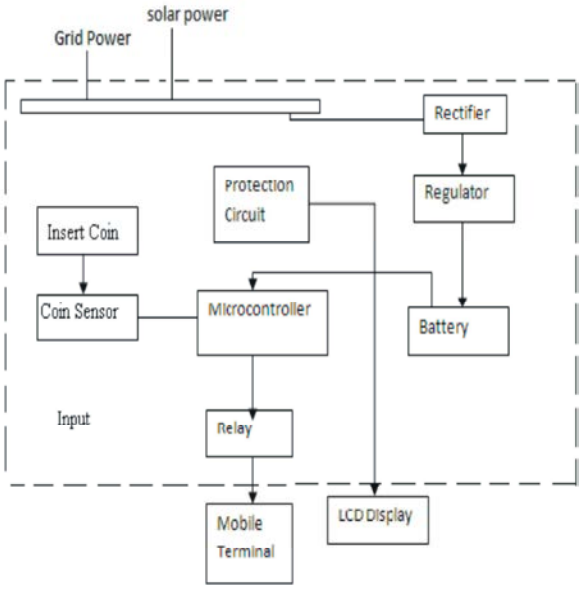


Fig. 6: Block Diagram of Coin based Mobile Charger

Input Stage: The mobile battery charger starts charging when a mobile is connected to it. When a coin is inserted to the slot the type of coin and size will be displayed at the LCD display for the user, so as to ensure about the correct coin insertion. If any other coin is inserted in the slot it will be returned to the refund box. A mechanical slot is attached with electrical triggering in the coin insertion slot, if the correct coin is inserted. It sends a pulse to the control unit authorizing the start of charging the mobile battery when connected to the device. Then the coin insertion slot accepts the coin into the charging unit and start charging the mobile battery for a specific period controlled by the software of the microcontroller.

Fig. 7: Typical Coin Sensor

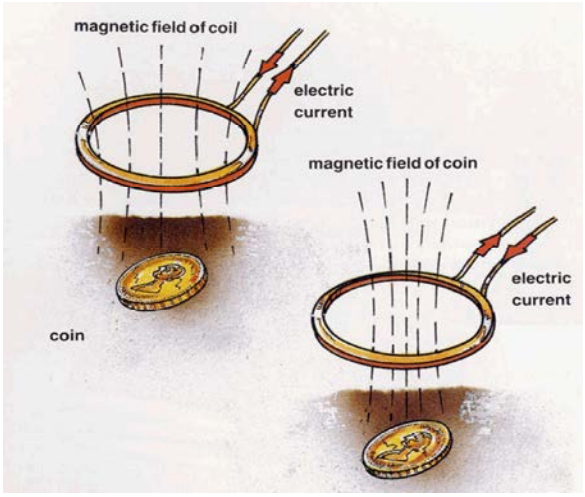


Fig. 8: Coin detection using magnetic field effect

Controller: This process acts according to the input signal from the sensor circuit. Coin acceptance is based on the diameter of the coin. This invokes the micro controller along with LCD interface which displays the selection of mobile option if any particular mobile is selected for charging the corresponding routine is activated and charge the mobile for a particular duration of time. When the routine is completed it indicates the "charge complete" message through LCD display. Similarly the same procedure is followed for connecting more than four different mobiles at a time.

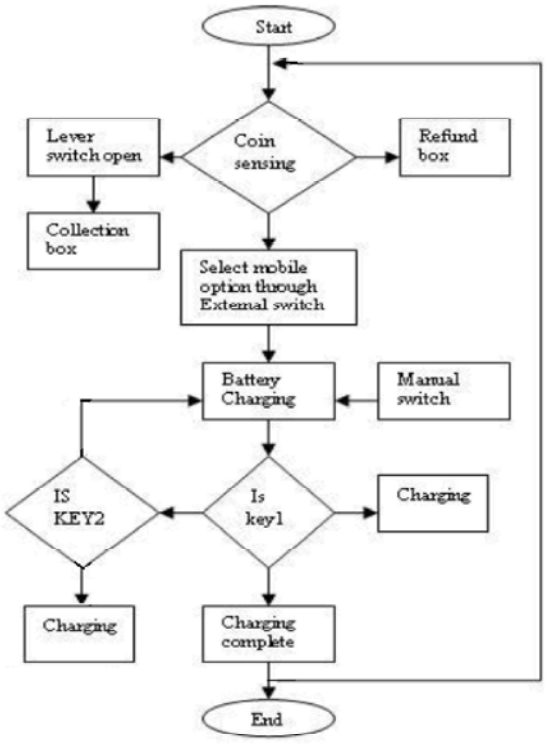
Output and Display: The LCD displays all the information to the customer. When the mobile is connected to the device, it displays" Insert Coin". While charging it displays "Charging" and at the end of charging cycle it displays "Charge completed". For charging continuously the coin has to be inserted when the display shows "Charge Completed". The output has 10 terminals for connecting different types of mobile batteries.

Charging Requirements of Mobile Batteries:

Table 1: Comparison of Charging Current and voltage ratings for various Mobile brands

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

Flow Chart for the Smart Coin Based Mobile Battery Charger:



Conclusion and Future Work: In this paper a narrative method of charging mobile batteries of different manufacturers using solar power has been designed and developed for rural areas where the network power is not available all the time. The mobile communication has become a need even in rural areas and this device is useful for charging mobile batteries as these mobile battery chargers can be installed in booths at various places for the convenience of mobile users [9] In future, Mobiles charging can also be done using Wireless Medium, thereby increasing the number of users charging the mobile unit simultaneously.

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