

Coin Based Solar Mobile Charger Using MATLAB

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Abstract: This paper describes coin based solar mobile charger using MATLAB. Mobile phone's become a major source of business/personal communication in this era; the mobile phone business is currently worth billions of dollars, and supports millions of phones. The need to provide a public charging service is essential. Many critics argued that a public mobile phone charging service is not a lucrative business because most users can charge their phones at home, in their office or in their cars. Coin operated mobile phone charger is new business milestone because many are attending business conventions and forgetting their charger at home or work place. Students and many people use the public transportation that don't know that their level of their battery is low are prospective customers for coin operated mobile phone charger service. Recommended locations include: Hotels, Conference centres, Exhibition halls, Serviced offices, Exchange halls, Motels, Leisure centres, Health clubs, Training centres, Golf clubs, Retail outlets, Shopping malls, Internet cafes, Universities, Colleges, Hall of residence, Airports, Train terminals, etc., so that the mobile phone users can reactivate a low or dead battery by simply plugging in and charging for one, two or five rupee. This is designed based on PIC16F877A a 40-pin micro controller which works on the basis of the coin detection MATLAB codes.

Key terms: Webcam, LDR, LCD Display, Solar Panel, Relay, Microcontroller, Motor Driver, USART, Mobile Phone, Solar panel.

1. INTRODUCTION

Usually ordinary solar panel is always faces only in one direction. Because of this reason the solar panel may not get sufficient sun rays to work. In this work SOLAR PANEL CONTROLLER AND POWER OPTIMIZATION is done in order to overcome this defect. Here the panel will rotate according to the readings read by the LDR. So it will utilize the full sun light to work & power optimization is also done by using the LDR.

This work mainly designed to control the solar panel automatically, maintains face of the solar panel towards the sun. This is done by controlling the mechanical movement of the solar panel. Usually sun rises at east and sets at west. In ordinary system, if it faces towards east then it cannot change the direction towards sun during sunset. Because of this reasons solar panel may not get sufficient sun rays to work.

These problems are overcome by using this work. In this work we also build a very good micro controller based solar charger. The coin based mobile battery charger developed in this work providing a unique service to the rural public where grid power is not available for partial/full daytime and a source of revenue for site providers. The coin-based mobile battery charger can be quickly and easily installed outside any business premises.

The mobile phone [1] market is a vast industry, and has spread into rural areas as an essential means of communication. While the urban population use more sophisticated mobiles with good power batteries lasting for several days, the rural population buy the pre owned mobile phones that require charging frequently [2].

Many times battery [3] becomes flat in the middle of conversation particularly at inconvenient times when

access to a standard charger isn't possible. The coin-based mobile battery chargers are designed to solve this problem. The user has to plug the mobile phone into one of the adapters and insert a coin; the phone will then be given a micro-pulse for charging. It does not bring a mobile from 'dead' to fully charged state.

The charging capacity of the mobile is designed with the help of pre defined values. It is, of course, possible to continue charging the mobile by inserting more coins. This compact and lightweight product is designed to cater for the growing number of rural mobile users worldwide. A suitable microcontroller is programmed for all the controlling applications. The source for charging is obtained from direct power grid and solar energy [4] in case of non availability of grid power.

2. BASIC ASSUMPTIONS

The design of coin based universal mobile battery charger is based on the following assumptions:

- Maximum solar energy is used for charging the lead acid battery inside the mobile battery charger to keep it charged fully all the time
- Provision to charge maximum 10 different types of mobiles is provided.
- Charging Current is required up to
- 4.8AH@ 6VDC
- Solar Panel having size 650x565x40 mm, 38WP capable of supplying up to 3.0 amp is used.
- Web-Cam; which is used for coin detection using image processing.
- LDR (Light Dependent Resistor) for getting maximum sun energy.

- Microcontroller; PIC16/18F877A family is used.
- Battery; for power storage.

3. PROPOSED SYSTEM ARCHITECTURE

3.1. Solar Tracking System

The mechanical movement of the solar panel is controlled through the stepper motor [5]. 3 LDR's will be placed on arch. So according to the sun movement LDR intensity will be varied where the sun light intensity is more LDR intensity will be less and depending upon LDR intensities stepper motor will be rotated to the side where the LDR intensity is found to be less so that solar panel is also rotates. Power optimization is done by using LDR. If the surrounding light is less then, LDR reads maximum. According to the value of LDR the ADC shows the reading. The ADC will send this value to microcontroller. According to the value sent by the ADC the microcontroller glows the LED through relay. If the intensity of the light is more means all the LED array will be OFF. Depending upon the intensity of the light LED arrays will be switched ON or OFF.

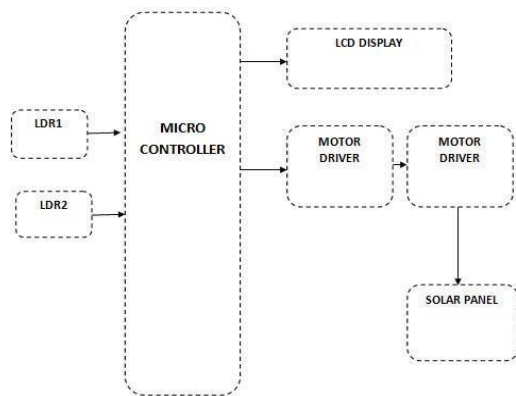


Fig 1: Block diagram for solar tracking

3.2. Power Supply

The input to the circuit is applied from the regulated power supply [6]. The AC input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating DC voltage. So in order to get a pure DC voltage, the output voltage from the rectifier is fed to a filter to remove any AC components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant DC voltage.

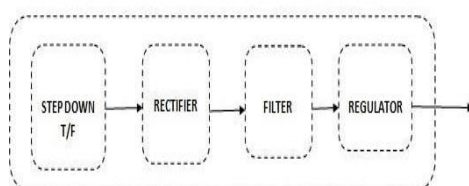


Fig 2: Power supply

3.3. Coin Based Mobile Charger

The basic block diagram of the mobile battery charger is given in Figure 3.

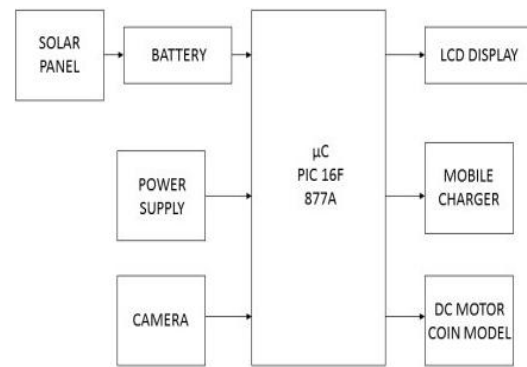


Fig 3: Block diagram for coin based mobile charger

3.3.1. Input Stage

The mobile battery charger starts charging a mobile connected to it, when a coin is inserted at the coin insertion slot at the input stage. The detection of coin is done with the help of webcam. The type of coin and the size will be displayed at the LCD display for the user, so as to ensure correct coin insertion. Any other coin, if inserted in the slot will be returned to refund box. Using MATLAB codes the microcontroller will detect whether the coin is one, two or five rupee. Then the coin insertion slot accepts the coin into the battery charging unit and start charging the mobile battery for a specific period controlled by the software of the microcontroller [1].

3.3.2. Controller

This section acts according to the input signal from the sensor circuit. Coin accepted or rejected is based on the diameter of the coin. This invokes microcontroller along with LCD interface displays the selection of mobile option if particular mobile is selected for charging the corresponding routine is activated and charge the mobile for a particular duration of time .When the routine completes, it indicates charge complete message through LCD display. Similarly the same procedure is followed for charging more than four different mobiles simultaneously [1] .The simple routine is indicated through flowchart as shown in the Fig 4.

3.3.3 Output and Display

The LCD displays all the information to the customer as and when required. When the mobile battery is connected, 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 [7] and 7 of them are internally connected for charging mobile batteries of different make as shown in Table 1 [1] below:

Table 1: Charging Requirements of Mobile Batteries

S. NO	Mobile Type	Maximum Charging Voltage (V)	Maximum Charging Current (mAh)
1	Samsung	5.7	3400
2	Sony Ericsson	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

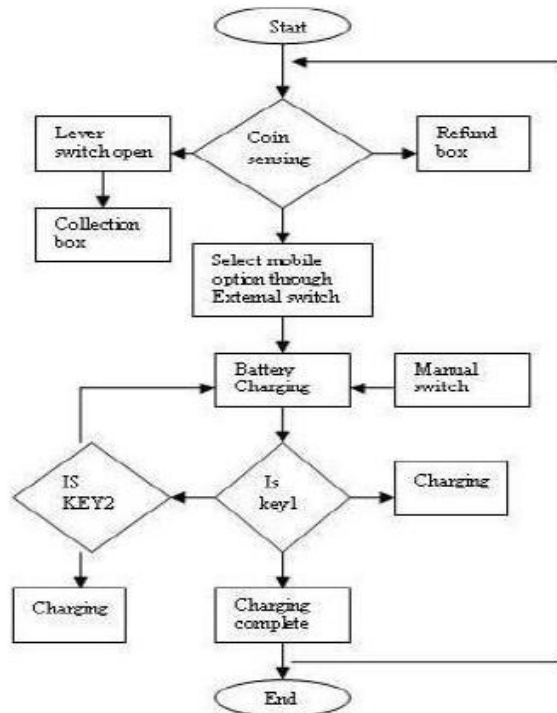


Fig 4: Flow Chart for the Coin Based Universal Mobile Battery Charger

3.3.4. Power

The salient feature of the universal 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 inverter [8], [9] has been designed for supplying 230V, 50Hz so that both grid power and the solar power are connected in parallel with a switch to changeover from one to the other.

4. IMPLEMENTATION OF THE WORK

4.1 Results



Fig 5: Hardware setup for Coin based mobile charger using solar panel

We have implemented the setup and measured the power availability and charging rate. By using varying coins of Rs.1, 2, 5 we have measured the charging time. We have test a circular disc of Rs.5 size but our system recognised the coin is not correct. Hence we could achieve the expected result.

4.2 Advantages:

- Effectively receive maximum energy from sun towards earth rotation
- More useful to save energy from sun and intelligent tracking solar energy
- Simple and hand efficient
- Less expensive
- Reduced man power
- Low power consumption

4.3 Applications:

- Solar Systems
- Power Management systems
- Industrial applications
- The coin based mobile phone charger is very useful to public for using coin to charge for the mobile phone in any places

5. CONCLUSION

In this work a novel method of charging mobile batteries of different manufacturer using solar power has been designed for rural and remote areas where the power supply is not available at all the time. This paper is very useful in today’s life. In this work we could design a solar power tracker with coin based mobile charger. We have verified the function of the system with coins of different denominations. We can implement this system in common places and can provide the required power to all kind of mobile phones of different manufactures.

REFERENCES

- [1] S.B.Shridevi, A.Sai.Suneel, K.Nalini “Coin based mobile charger using Solar tracking system”, IJAREC, pp 741-745,Sept. 2013.
- [2] K. M. Trautz, P. P. Jenkins, R. J. Walters, D. Scheiman, R. Hoheisel, R. Tatavarti, R. Chan, H. Miyamoto, J. G. Adams, V. C. Elarde, and J. Grimsley “Mobile Solar Power”, IEEE, pp 535-541,Jan. 2013.
- [3] F. Boico, Brad L. K. Shujaee, “Solar Battery Chargers for NiMH Batteries” IEEE Trans. Power Electronics, vol. 22, no. 5, pp 1600-1609, Sept. 2007.
- [4] J. Eakburanawat, I. Boonyaroonate, “Development of a thermo electric battery-charger with microcontroller based maximum power point tracking technique”, Applied Energy 83,pp- 687-704 , ELSEVIER, 2006.
- [5] Dan Dai, Jing Liu. “Design of a Practical Human Powered Contactless Charger for Cellphone” IEEE Trans. Consumer Electronics, pp 11601165Aug. 2013.
- [6] Y. Yadav, A. Sood, “A Comparative Survey on Various Coin Recognition Systems Based on Image Processing”, pp- 3272-3277, 11 Nov. 2013, IJECS. [7]A Hefner, A. Magdaleno, “Cell Phone Charger for the DC House Project”, California Polytechnic State University, 2012.
- [8] H. Dai, X. Wu, G. Chen, L. Xu, S. Lin, “Minimizing the number of mobile chargers for large-scale wireless rechargeable sensor networks.” Computer Communications 46, pp-54-65, ELSEVIER, 2014.
- [9] M.S. Varadarajan, Dr. RR and Dr.SR, “Coin Based Universal Mobile Battery Charger”, ISSN: 22503021 Volume 2, Issue 6 (June 2012), PP 1433-1438, IOSR Journal of Engineering (IOSRJEN).
- [10] Thesis- Catherine Conaghan, “Solar powered battery charging system”.