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Design and Implementation of Efficient Solar Power System for Multi Mobile Charger

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Abstract

The major issue at present is the scarcity of energy because, the energy resources are very less and the corresponding energy production is not appropriate to the consumption requirement. Hence, there is a lot of demand in the production of energy due to natural resources. To reduce the dependency on conventional resources, natural resource like solar energy is preferred. The aim of this project is to utilize the maximum solar energy through solar tracking panel and thereby increasing the efficiency of the system. The system consists of light sensing, tracking, charging, processing, controlling and display units. It consists of solar tracking mechanism which allows more energy capturing and the corresponding energy production is more because the solar panel movement is almost normal to the sun light. This rotation of the solar panel is done by DC motor and its rotation is controlled by using processing and control units based on the light sensing unit. The captured solar power is stored in a battery. In the proposed system, a display unit is used to display the available power in the battery. The stored power is utilized in various applications such as home appliances and industry appliances. In the proposed system, an application- multi mobile charging system was included. The multi mobile charger is used in railway stations, bus stands and all public places like hospitals and parks etc.

Keywords: 1.Renewable Energy, 2. Multi Mobile Charging System, 3. Single Tracking, 4. Multi Mobile Charger (MMC).

1.Introduction

Energy exists freely in nature. The measure of improvement of any Nation is its production and usage of Energy. Every day, amount of energy is produced, supplied and utilized in the World. The electrical energy production is done by two sources: Renewable Energy and Non-Renewable Energy sources. Major percent of total energy production is by using Non- Renewable Energy sources. Non renewable energy production is from fossil fuels like coal, crude oil, natural gas and uranium. But, the continuous utilization of these resources becomes difficulty as they get reduced day by day. Hence, there is a necessity of producing electrical energy due to renewable sources like solar, wind, thermal and tidal. Fig.1. shows percentage of energy production from different energy sources.

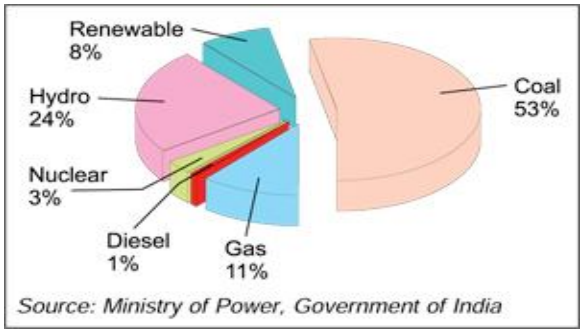

Figure 1: Percentage of generated power from Different Sources

The Solar light is most preferred due to the following reasons: Without impact on the global climate, solar energy can be used to generate power. The Sun energy is limitless while other energy sources like crude oil, natural gas and coal are showing their end. By having a system for alternate power production, the utility cost can be reduced.

At present scenario, the solar energy production is done by fixed panel system. To improve the efficiency of the solar energy system, tracking mechanism can be implemented. Hence, an idea is made in the proposed system, single tracking mechanism, which is from East to West direction, is used. At present, mobile phone is an essential thing for every person and therefore, there should be a charging facility of mobiles in public places is required. As there is no continuous power supply (24 hours) from the electricity board, the continuous charging facility cannot be provided. Hence, an idea, solar power based multi mobile charger system is implemented in the proposed system which can be used in public places like railway stations, bus stands, hospitals and parks etc.

Types of Tracking Systems:

Solar trackers may be active or passive and may be single axis or dual axis. Single axis trackers usually use a polar mount for maximum solar efficiency. Single axis trackers will usually have a manual elevation (axis tilt) adjustment on a second axis which is adjusted on regular intervals throughout the year. Compared to a fixed mount, a single axis tracker increases annual output by approximately 30%, and a dual axis tracker an additional 6%.There are two types of dual axis trackers, polar and altitude-azimuth[2].

2. WORKING PRINCIPLE

In this project various hardware units are used for different purposes such as sensing of sunlight, data acquisition, controlling of entire system using DC motor and its driving circuitry, storage and Multi Mobile Charging unit (MMC). Kiel and Willpro software are used for compiling and program loading purposes. The proposed system is a closed loop system, where the output is fed back based on the outputs from the three sensors. The diagram showing different units from sensing unit to application unit MMC in single axis solar tracking system is as shown in Fig.2.

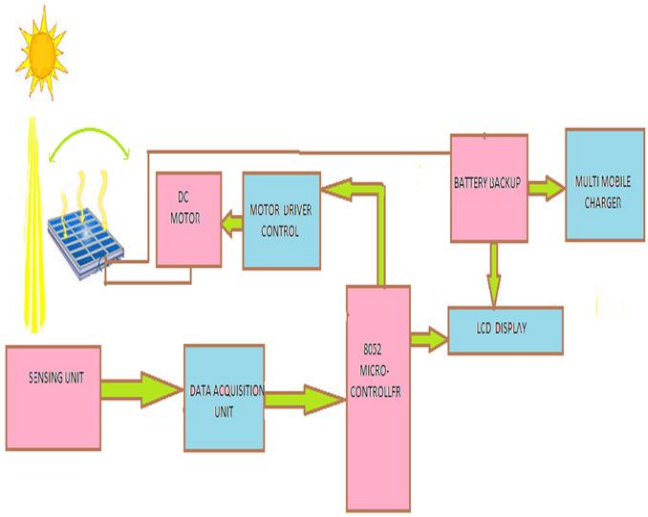

FIGURE 2 BLOCK DIAGRAM OF SOLAR POWER SYSTEM FOR MMC

Here we used three sensors to sense the direction of maximum intensity of light. Each time the outputs from the three sensors is taken and is given to the three channels of data acquisition unit to get digitized output to be given as input to the microcontroller unit which directs the motor to rotate the solar panel in the direction in which we are getting maximum intensity of light by selecting the one sensing unit giving maximum output among three.

3. Multi Mobile Charger

In this project, we include the application is MMC. The MMC is very useful and portable and it connects the five mobiles at a time. The MMC is connected to the battery. This charger is used for Samsung, micro USB, mini USB, Nokia old and Nokia new mobile phones. The MMC is shown in Fig.3.

Figure.3: Multi Mobile Charger ports

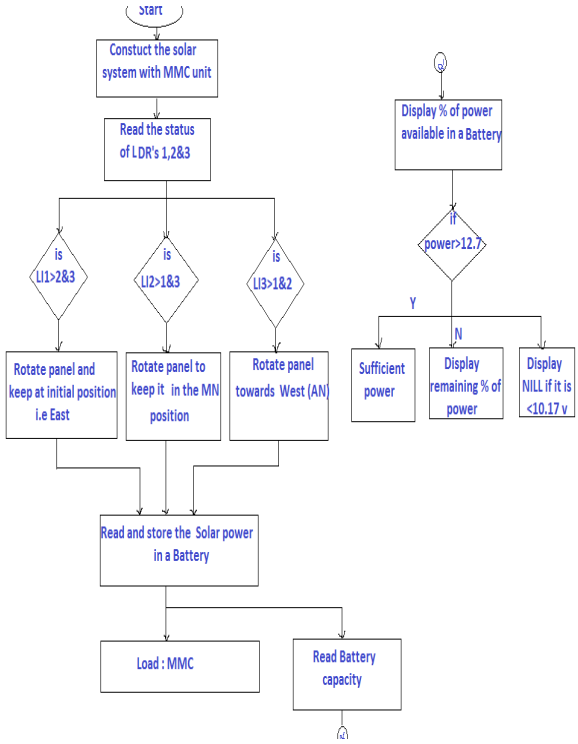

Figure.4: Flow Chart of Solar Power System for MMC

ALGORITHM

1. At first construct the solar system with application which is nothing but multi mobile charging (MMC) unit.
2. In second step have to read the status of 3 LDR's to indicate the light intensities at forenoon, mid noon and after noon positions. Those are named as 1,2&3.
3. Compare the LDR's from one to other remaining ones. When the LDR1 is greater than the 2&3 then rotate the panel and keep at its initial position. i.e; East.
4. Again rotate the panel to keep it in the middle noon position when the LDR2 is greater than the 1&2LDRs.
5. When the LDR3 is greater than the 1&2 LDRs then rotate the panel towards the West.
6. By rotating the panel we can grasp the power from the sun. the grasping power should store in a battery.
7. Then connect the MMC unit to the battery.
8. The stored power in the battery should read. That means how much of power is available in the battery after connection of MMC unit.
9. Display the power available in the battery in terms of percentage.
10. If power is available in the battery is greater than the 12.7V then display in LCD as "sufficient power".
11. If power is not available in the battery that means less than the 12.7V then display available power in the battery in terms of percentage.
12. Finally displays NILL when battery power is less than the 10.17V.

4. RESULTS AND DISCUSSION

The verification of the solar power based Multi Mobile Charger System is done for the usefulness of the system. The voltage, current and power measurements of developed system, obtained at different time intervals for both fixed panel and single axis solar tracking system are shown in Table.3. The plots of obtained power versus time for both fixed panel and single axis solar tracking system are as shown in Fig.4.

Table.3: Power Calculations of Fixed Panel versus Single Tracking System

POWER RATINGS OF FIXED PANEL SYSTEM					SINGLE AXIS TRACKER		
S. NO	TIME Hours	VOLTAGE (V)	CURRENT (A)	POWER (W)	VOLTAGE(V)	CURRENT (A)	POWER (W)
1.	6.00	0.36	0.45	0.162	12.56	0.45	5.652
2.	6.30	1.4	0.45	0.63	14.38	0.45	6.471
3.	7.00	3.5	0.45	1.575	18.02	0.45	8.109
4.	7.30	5.7	0.45	2.565	18.5	0.45	8.325
5.	8.00	8.0	0.45	3.6	18.82	0.46	8.657
6.	8.30	10.23	0.45	4.60	18.81	0.46	8.652
7.	9.00	11.46	0.45	5.157	18.76	0.46	8.442
8.	9.30	13.4	0.45	6.03	18.83	0.46	8.629
9.	10.00	14.8	0.45	6.66	18.6	0.45	8.370
10.	10.30	15.46	0.45	6.957	18.72	0.46	8.611
11.	11.00	16.82	0.45	7.569	18.92	0.46	8.703
12.	11.30	17.98	0.45	8.091	18.97	0.46	8.726
13.	12.00	18.3	0.45	8.235	19.12	0.46	8.795
14.	12.30	18.95	0.46	8.717	19.34	0.46	8.896
15.	13.00	19.34	0.46	8.896	19.32	0.46	8.887
16.	13.30	19.28	0.46	8.868	19.30	0.46	8.878
17.	14.00	18.72	0.46	8.611	18.76	0.45	8.442
18.	14.30	16.19	0.45	7.285	18.58	0.45	8.361
19.	15.00	14.4	0.45	6.48	18.36	0.45	8.262
20.	15.30	11.9	0.45	5.355	17.22	0.45	7.749
21.	16.00	8.15	0.45	3.66	16.09	0.45	7.240
22.	16.30	3.56	0.45	1.602	15.47	0.45	6.961
23.	17.00	2.9	0.45	1.305	15.12	0.45	6.804
24.	17.30	1.8	0.45	0.81	14.11	0.45	6.349
25.	18.00	0.36	0.45	0.16	12.89	0.45	5.800

The various advantages of proposed system are: Simple to construct, low cost, eco-friendly, we can monitor directly using PC, Tracking accuracy is more and also reduce the usage of power from power grid.

Table.4: Typical Power Ratings of the Solar Panel in Morning Position

Power	7.191W
Voltage	15.98V
Current	0.45A

Figure 4: Morning position of Solar Panel

Table.5: Typical power ratings of the solar panel in Noon position

Power	8.442 W
Voltage	18.76V
Current	0.46A

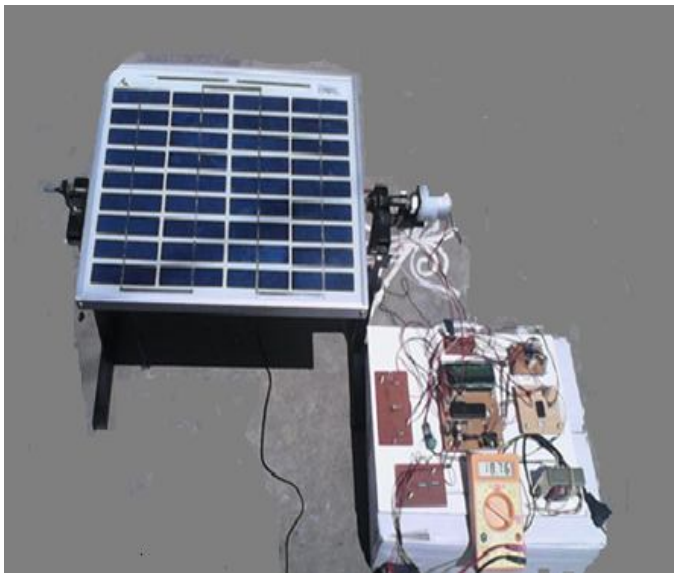

Figure.5: Mid noon position of the Solar Panel

Table.6. Typical power ratings of the solar panel in

Power	6.471 W
Voltage	14.86V
Current	0.45A

Evening position

Figure 6: Evening position of the Solar Panel

From the above experimental results, we can say that the voltage produced in the mid noon position of the solar panel is more when compared to the morning and evening positions of the fixed panel system. The changes in voltage will be frequent but the current variation is very slight from the table. The results of single axis solar tracking system are obviously better than that of the fixed alignment of the solar panel. From the curve drawn for output power vs. time for both fixed and tracking systems, the fixed panel system will give maximum output one time instant which is by default the mid noon position of the panel, and in the remaining time instants the output power is very less. Whereas the curve for proposed tracking system is flat for long duration of time, this means it is giving maximum output for more amount of time. This is due to sensing the direction which is giving maximum Sun intensity and alignment of the solar panel with moving Sun axis by using moving mechanism. This is not the case when clouds come across the Sun, which lower the efficiency of the solar panel. But in most of the cases it is best for producing power from Sun light.

5. CONCLUSION

The design, implementation and verification of solar power based multi mobile charging system is successfully completed. This project gives a means of controlling the Sun with an Embedded Microcontroller system, a working software solution for maximizing solar panel output by positioning a solar panel at the point of maximum light intensity. A method is defined for searching of maximum output by tracking the Sun and resetting itself for next day. A basic Microcontroller 8052 based circuit with a minimum number of components and the use of DC motor enables accurate tracking of the Sun. After examining the information obtained in the data table section and plotted graph, it has been shown that the sun tracking systems can collect maximum energy than a fixed panel system. Here, with reference to the result analysis, 41.8% of more efficiency is achieved than fixed panel system through this proposed system. Therefore, the proposed system is said to be an efficient tracking system.

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