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Implementation of Solar Based Mobile Charger Using RFID with Secure Locker

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ABSTRACT:

Energy demands in the contemporary years have been recorded to be growing at an exponential rate in the commercial and as well as domestic markets. A Battery charger is a device that stores energy in a battery by an electric current through it. Some battery types have a high tolerance for overcharging and can be recharged by connection to a constant voltage source or constant current source depending on battery type. Solar energy is the most abundant and easy to harness resource through solar panels Solar mobile chargers use solar panels to charge mobile phone batteries. They can be used when no electricity supply or during a disaster time. Rotating solar panel Charge the battery with the help of a solar panel mounted on a platform that can rotate with the help of a motor. The rotating solar panel system scans from one horizon to other to know the current position of the sun and hence the position from which the greater solar energy can be harnessed. In this way, we can harness the most from the solar panel by adjusting it to be incident directly towards the sun consistently. This charging model will be placed in a public place. So, we provide security by using RFID. We use the RFID lock access control system, the user's credential contains unique identifying information called a tag. When the user comes within proximity of the reader, the reader's signal locates the information stored on the user's RFID tag and sends it through antennas and transceivers to authorize the tag in the access control system.

Keywords: Renewable Energy, RFID, Security, Single Axis, Arduino Nano, DC Motor, Solar Power.

Introduction:

Natural Disaster is a major adverse event resulting from natural processes of the Earth, for example, includes firestorms, earthquakes, tsunamis, and storms. and other geologic processes. A natural disaster can cause loss of life or damage to property and typically leaves some economic damages in its wake, the severity of which depends on the affected population's resilience and the infrastructure available. Many peoples were without food. Shelter, drinking water, sewage system. and medical services for days, even weeks. The worst ever thing took place in the national power grid Collapsed. Even, at present days, the failure of power plants. during disaster means a power cut or blackout containing areas for a couple of days even for work. After a disaster, public and private associations conduct reassurance activities and provide food, medicine, shelter, and other needs. Emergency medical services run on fossil fuel-based generators to provide electric power when the utility grid is down. But that is for emergency use only; though the use of fossil fuel is never a fruitful solution for producing electricity. Nowadays, our daily living is technology dependent and the Connectivity of the Internet over mobile phones and overall telecommunication is as necessary as our prime needs. Smartphone gives us all the facilities we need through their various. Built-in applications or gadgets. To run a smartphone or any telecommunication device to get connected with the world. Powering this device is obvious because all of these devices use rechargeable batteries that need regular changing. So, we cannot think even for a day without electricity and the situation gets worst during long load shedding. Hence, Renewable energy is the only solution to this growing crisis. To replace Conventional energy sources, solar photovoltaic systems have been given the highest priority as the most effective among all other renewable sources of energy. Solar systems are highly reliable and have an almost maintenance-free setup. The limitation of higher Investment cost and lower energy conversion efficiency lagging behind its potential to Come in front. Solar energy is harmless, stranded source of energy getting involved in a new implementation of our daily life. This project shows some applications of solar energy; solar power charging units are developed to be used in emergency power supply units.

EXISTING METHODOLOGY

A change that functions using solar power. Change that works by absorbing sunlight from the solar panel or Photo Voltaic Calls that convert solar energy to electricity.[1] This invention can be used for the replacement of electric power. Solan mobile changer is charged by sunlight. The mobile phone is changed by storing power from the sun. These solar mobile changers, change the battery by using a solar panel.[3] Permanently, public solar chargers can be installed in public places like streets, parking areas, parks, etc. Solar chargers have been inbuilt into the same mobile phones and are not Currently available for GSM mobile phone models. These solar mobile chargers are available in various shapes and including rotating folding types.[5]

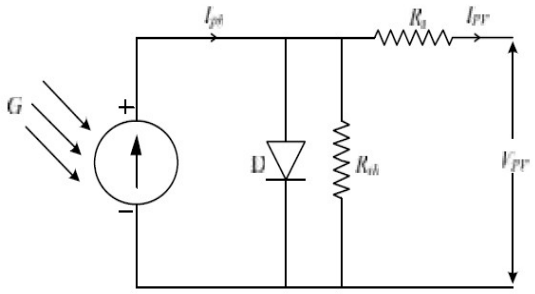

Fig-1: PV Cell

The PV cell diagram is shown in Fig. 1. The PV array is described by the current-voltage characteristic function

$$I_{PV} = n_p I_{ph} - I_{rs}\left[\exp\left(\frac{q(V_{PV}+I_{PV}R_s)}{AKTn_s}\right)-1\right]-\frac{V_{PV}+I_{PV}R_s}{R_{sh}} \quad \ldots.(1)$$

From Eq (1) where ns and np are the numbers of cells connected in series and the in parallel, q=1.602· 10-^{19} C is the electron charge, K=1.3806·10^{-23} J/K is Boltzmann's constant, A=2 is the p-n junction's idealistic factor, T is the cell's temperature (K), Iph is the cell's photocurrent (it depends on the solar irradiation and temperature), I ph = Isc G /G *, I rs, Irs is the cell's reverse saturation current, G is the solar irradiance and Vpv is cell voltage.[7] From Eq (2) The P&O algorithm has the advantage of simple software and hardware realization. In this implementation, the reference voltage (Vmpp) is perturbed in an arbitrary direction. Depending upon the sign of the power change, the direction for further perturbation is decided.

$$V_{mpp}(k) = V_{mpp}(k-1) + \Delta V \times \text{sign}\left(\frac{dP_{PV}}{dV_{PV}}\right) \quad \ldots.(2)$$

where ΔV is steep voltage and k is the iteration.

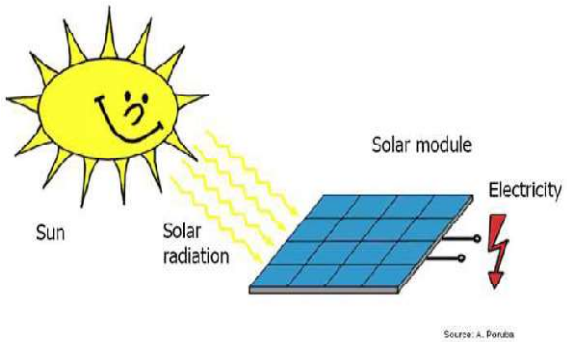

Fig-2: Working Of Solar Panel

PROPOSED METHODOLOGY

SINGLE AXIS SOLAR TRACKER

The tracking system can be defined by the mode of motion. These tracking systems have the PV surface that can be rotated/titled around axes to derive a proper angle that can help them get the maximum sunlight. The adjustment of the PV surface is done by rotating one axis and it is called a single-axis tracking.[4]

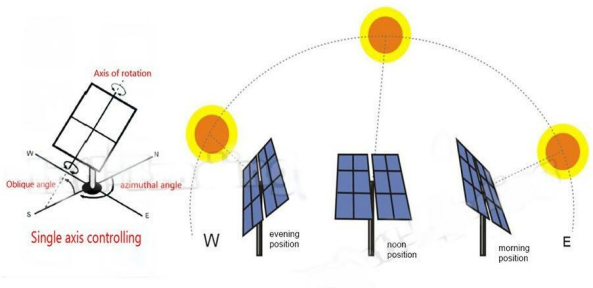

Fig-3: Mechanism of Single-axis tracker

3.1. RFID SECURE LOCKER

Radio frequency identification is a technology for a wide area of applications, from inventor tracking to payment processes. RFID door lock systems are common for access control, they provide reliable, consistent participation with trackable data. Unlike other forms of traditional access control such as swipe cards, RFID locking systems are contactless, meaning that the credential doesn't have to touch the reader for it to work. Similar to a barcode reader, it works by sending and receiving data, instead of scanning a code, data is transmitted over radio frequencies. RFID locker requires an RFID tag, antennas, RFID reader, and transceiver to function as a complete system.[2]

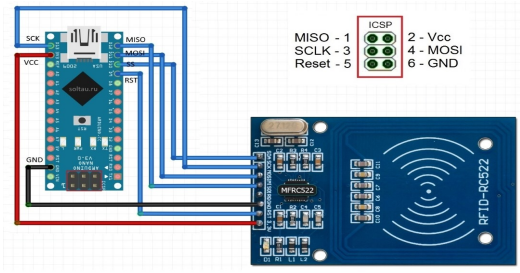

Fig-4: RFID tag Reader

3.2. SOLAR PANEL

A solar panel is a collection of solar cells, which can be used to generate electricity through the photovoltaic effect. Cells are placed in a grid-like pattern on top of the solar panel. It can also be said a set of photovoltaic modules, mounted on part of a building. Photovoltaic is a collection and an assembly of 6 *10 solar cells. These panels are very hard and they can resist any wear and tear. Solar panels were out extremely slow. There is a decrease in one to two percent of its effectiveness in a year. Crystalline silicon solar cell is used in most solar panels.

Fig-5: Solar panel

3.3. ARDUINO NANO

Arduino. cc design a type of microcontroller board and it is called Nano. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. This board is smaller in size and has a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board. This board has many functions and features like an Arduino Due board. However, the packing of this nano board is different. It doesn't have any DC jack so the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. Using a mini USB port this board can supply 6 to 20 volts.

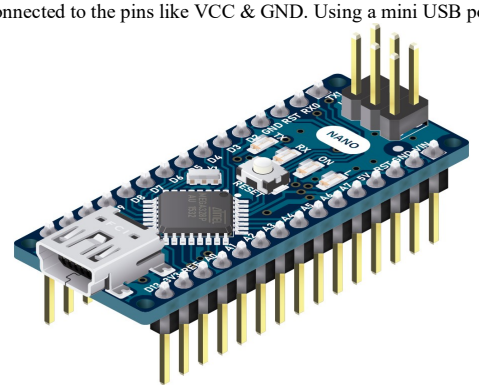

Fig-6: Arduino Nano

Specifications	**Arduino Nano**
Processor	ATmega328P
Input Voltage	5V/7-12V
Speed of CPU	16 MHz
Analog I/O	8/0
Digital IO/PWM	14/6
EEPROM/SRAM [kB]	1/2
Flash	32
USB	Mini
USART	1

Table -1: Arduino nano Features

3.4. RFID TAG READER

RFID uses an electromagnetic field to transfer data over a short distance. RFID is useful to identify people, make a transaction, etc. You can use an RFID system to open a door. [9]For example, Only the person with the right information on his card is allowed to enter. An RFID system uses a tag, attached to the object to be identified, in this example, we have a keychain and an electromagnetic card. Each tag has its identification (UID). Two-way radio transmitter-receiver, the reader that sends a signal to the tag and reads its response.

Fig-7: RFID tag

Specification:

1. Input Voltage: 3.3v
2. Frequency: 13.56 MHz

PROPOSED SYSTEM

The project aims at charging a 12v DC battery with the help of a solar panel mounted on a platform that can rotate with the help of a motor. This motor is getting controlled by Atmega 328 microcontroller mounted on an Arduino Nano board which is in turn mounted on the PCB. The rotating solar panel system scans from one horizon to other to know the current position of the sun and the position from which greater solar energy can be harnessed.[6] The position which has the highest energy capacity is chosen to charge the Battery. In this way, we can harness the most from the solar panel by adjusting it to be incident directly towards the sun consistently. Thus this project makes this process of harnessing solar energy more efficient and hence charges the mobile phones. RFID provides security for charging mobile phones. RFID tag allows users to automatically and uniquely identify and track inventory and assets.

The major components which are used in dual-axis solar tracking systems are:

1. Solar panel
2. Arduino board
3. LDRs
4. Motor driver
5. DC motor
6. RFID Reader
7. Servo Motor
8. Battery
9. USB Port

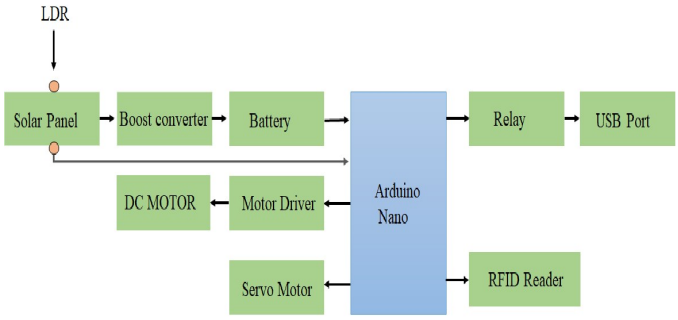

Fig-8: Block Diagram of the System

RESULT AND DISCUSSION

In this project, Two LDR is placed on the two sides side of the solar panel. LDR senses the sunlight and according to the direction of sunlight, LDR gives the input to the Arduino Nano. Arduino Nano gives a command to the DC motor to rotate the solar panel from one horizon to another according to the sunlight. Hence, the output of the solar panel is 40% more. Solar panel absorbs the sunlight and converts it to solar energy. Solar energy is sent

into a battery, and a chemical reaction takes place between the battery components and saves the energy. The reaction is altered when the battery is discharged, permitting the current to exit the battery. From the battery, the current is sent through the USB cables, Mobile starts charging. There is no connection in the USB cable, the battery stores the current until a mobile phone is connected. A radio frequency identification (RFID) reader provides security to the system. The RFID reader is placed inside the locker, when a person needs to charge the mobile, they need a valid RFID tag. For which a certain coding is been installed. When an RFID tag is brought near the locker, The lock opens and the person can charge the mobile with full security. Hence, the mobile is been charged by the rotating solar panel with an RFID reader for security.[10]

Fig-9: Experimental setup.

This system of Rotating solar panel is used for charging the mobile phone more efficient the about fig no-9 shows
The experimental setup of the solar mobile charger with Rotating solar panel and provide security by RFID Reader.

6. CONCLUSION

In this paper, solar act as good power supplies in bright sunlight. The only problem is the unregulated voltage due to the variation in the intensity of light. A voltage regulator is used to solve this problem by regulating the output voltage. The charge is stored in the battery and is distributed to respective loads. We have implemented a digital security system containing a door lock system using RFID. The locking system functions in real-time as when the user puts the tag in contact with the reader, the lock opens. We utilize RFID technology to provide a solution for secure access to space while keeping mobile phones in the locker.

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