Advance Solar Panel Maintenance System

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Abstract— As Solar Industry in India is a very fast developing in India. The manufacturing industries of solar panel is growing very rapidly. This paper presents the practical problems and its solution methods occurs after installation of solar panel in country like India like accumulation of dust in panel module and problem related to other environmental factors like rain, wind, temperature and pollution. Due to above mention problems the efficiency of power generation of panel may be reduced up to 50%. So an Arduino Uno based system is developed which is able to monitor the panel and operate a cleaning system as per the cleaning requirement of the panel. Also GPS and GSM system is employed for getting the information related to maintenance requirements of the panel.

Keywords: Solar Panel Maintenance, Arduino Uno, GSM, Photovoltaic

I. INTRODUCTION

Sun is the main source of energy in the world, directly or indirectly al the forms of energy in the world is solar energy. In direct electricity generation most of the energy demand around 65% is met by fossil fuels and other conventional methods. However fossil fuel is going to run out by 2060 also it creates lots of pollution to the environment. So it is demand of the time to switch on direct energy conversion of solar energy into generation. Solar Energy has a great potential in country like India and also it is pollution free.

In India solar power industry is a rapidly growing industry. India's present solar installed capacity is 34.045 Giga Watt. To install solar power plants globally, India has the lowest capital cost per MW.

There are two methods for conversion of solar energy into electrical energy. First one is photovoltaic which use the principle of semiconductor principle and second one is solar thermal electric conversion.

The chart shows the development of solar industry in India.

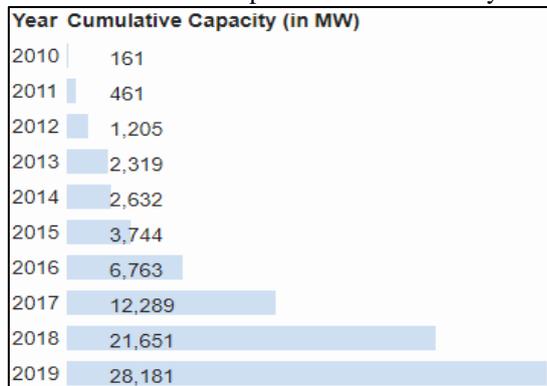| Year	Cumulative Capacity (in MW)
2010	161
2011	461
2012	1,205
2013	2,319
2014	2,632
2015	3,744
2016	6,763
2017	12,289
2018	21,651
2019	28,181

Fig. 1: Development of Solar Industry in last 10 Years in India

The photovoltaic method is very popular and efficient in India. Along with large scale power plant it is used for domestic off grid generation for local energy needs like rural electrification, street lightning etc. However, in country like India the panel has to bear problems due to environmental factors like rain, wind, temperature, humidity dust and pollution. Due to these natural conditions the efficiency of solar panel is limited so it is very necessary to take care of these factors.

Generally in most of the solar systems presently working use manual cleaning methods in which a person physically check the panel and clean it as per requirement but in this method there are some disadvantages like risk of accidents, risk of panel damage, accuracy is low and continuous monitoring.

So to overcome these problems a method is proposed in this paper for automatic cleaning and monitoring of solar panel. The cleaning system is developed which is based on microcontroller and monitoring system is based on GPS and GSM techniques.

After using this system an observation is taking and a comparison is made between two methods i.e. automatic and manual method and it is seen that the automatic method is most efficient of cleaning.
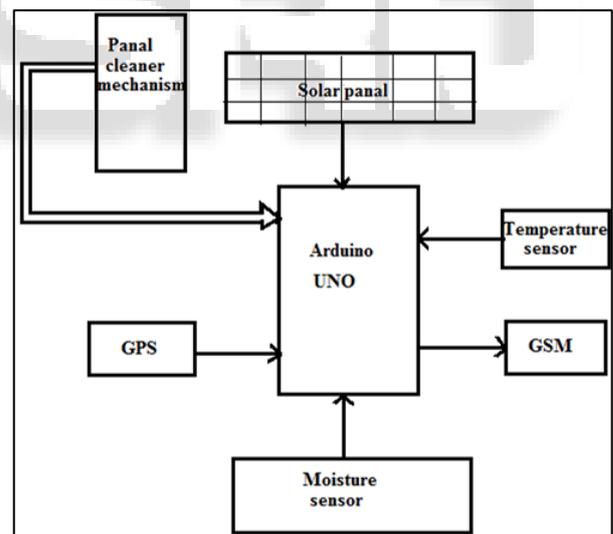
II. METHODOLOGY

Fig. 2: Block Diagram of Advance Solar Panel Maintenance System

The above diagram represent different parts of our proposed cleaning system.

A. Solar Panel

Solar panels are made of solar cell arranged in the form of bunch. Solar cell work on the principle of semiconductor physics. Solar cells absorbs the solar energy from sun and convert it into DC electric energy.

It can be used in large scale for a solar power plant or stand alone on the roof top.

Fig. 3: Solar Panel

B. Aurdino UNO

Aurdino UNO is the heart of this project. It contains a microcontroller Atmega328. It contains USB interface by which programming is provided. It contains analog pins to connect input (sensors) and digital pins to connect output (LED, LCD, relay etc.).
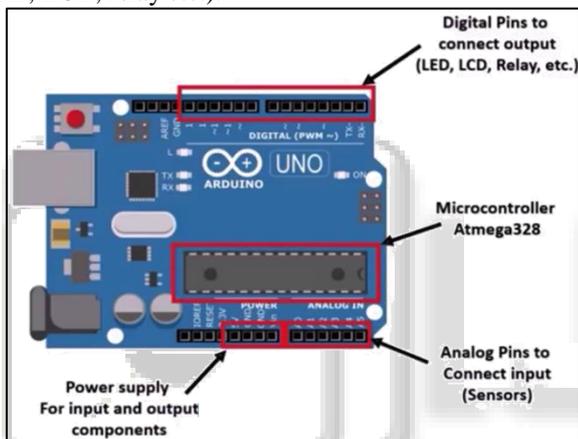

Fig. 4: Aurdino UNO

C. Panel Cleaning Mechanism

Panel cleaning Mechanism contains brushes driven by DC motor.

D. Temperature & Moisture Sensor

These sensors are connected with analog pins of Aurdino UNO and send information's as input for the controller.
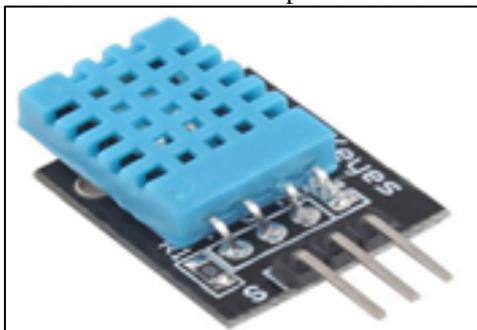

Fig. 5: Temperature & Moisture Sensor

E. GPS

It is Global Positioning System which is used to identify the exact location of any panel. Basically in this system its works to identify the accurate location of the panel which is facing the problem.

F. GSM

It is used for monitoring purpose and for notifying the owner about the problem in the system if any.
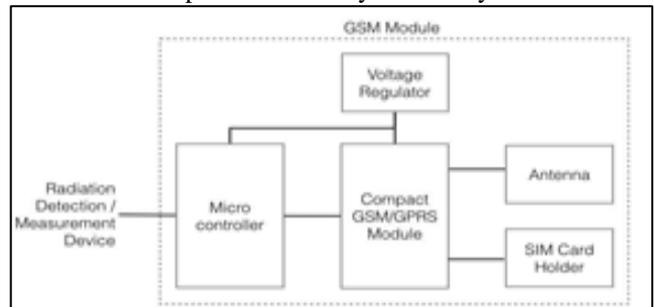

Fig. 6: Block Diagram of GSM

III. COMPONENTS USED

Following components are used for this complete system
1) Mild steel frame.
2) Rolling brush.
3) Aluminium L frames.
4) Running lengths (Rack).
5) DC gear motors
6) Rubber wheels.
7) Gear wheels
8) Aluminium channel.
9) Arduino Uno board.
10) Driver boards.

IV. WORKING OF PROJECT

In this system for driving the cleaning system DC motor is used. Brushes are selected depend on the dimension and application. These brushes are driven by DC motor and the functional actions of DC motor is controlled by signal generated by Arduino UNO.

The brush situated in aluminium frame moves vertical along the panel and its mopping action on the solar panel cleaning the panels.

There is also one other DC motor fixed in the frame.

The rotational motion of this motor is converted into linear motion with the help of a rack system. This action is controlled by Arduino UNO by providing signals. The shifting of frame from one solar panel array to other solar panel array is also carried with the help of gear motors. The frame is shifted in horizontal direction of nine ft cleaning 3 sets of solar panel arrays. All this cleaning actions will consume a time of 300sec for mopping action for both movements of cleaning system in horizontal direction and vertical directions. After cleaning one array it moves to another array and hence the cleaning process of the complete system is done.
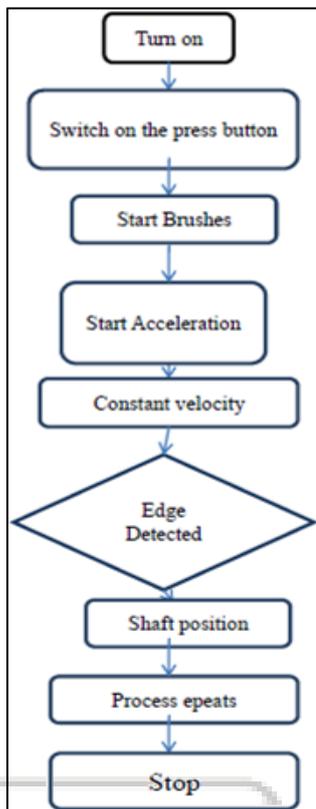
Fig. 7: Working of Cleaning System

If the temperature is very much high the temperature sensor sense through the temperature sensor then it will interact with Arduino and Arduino passes the instruction to panel cleaner mechanism that mechanism covers the panel from access heat.

Moisture can effect on the efficiency of the solar panel system so, moisture sensor senses the moisture in atmosphere and if the moisture participated on the panel then the panel mechanism will work and clean it. It also notify the user through GSM system.

Also this system contains GPS module interfaced with Aurdino UNO used for monitoring the cleaning process. The solar panel system is monitored by the monitoring authority all the problems and dis- functioning of the system is handled by monitoring authority. If any problem occurs related to issues like low efficiency, moisture and other temperature related problem then the GPS related to that system will turn on and send the location to the service authority they get the exact accurate location of the system through the GPS embedded in the system.

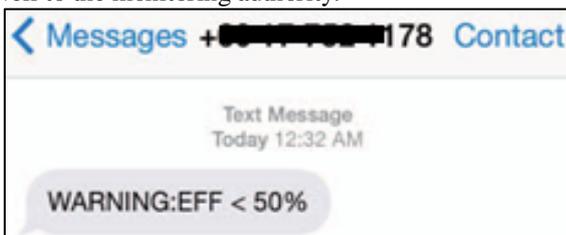GSM will work and notify the owner of that system as well to the monitoring authority.

Fig. 8: Message to Owner

After that service provider will visit in that location and resolve the problem related to that.

V. CONCLUSION

Existing automatic cleaning systems focuses on large solar power plants. For those with limited space this means that a smaller array only needs to be installed, hence our idea serves as a huge advantage for those smaller sites. This system can be installed for roof top solar panels.

This solar panel cleaning system was designed for rooftop system and certain observations are made by us.

Our cleaning system is able to clean dust of panel efficiently with the help of brush drive by DC motor.

After applying this method the efficiency of the solar panel is increased.

An Aurdino operated covering system provided for the safety of the system from environmental aspects.

With the help of GSM the cleaning system can be accurately monitored.

In this way a complete and efficient maintenance and monitoring system for solar panel can be developed using Aurdino UNO.

Fig. 9: Cleaning System for Single Panel

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