AN IOT BASED SMART SOLAR PHOTOVOLTAIC REMOTE MONITORING AND CONTROL SYSTEM

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Abstract: **The world economy is growing rapidly, and global energy demands are predicted to increase even more in the future. Energy is expected to get more expensive, in turn affecting the economic development. Energy demand can be reduced by employing efficient Energy Management Systems. The required infrastructure cost for EMS is often quite high, making it an unviable solution. Using the Internet Of Things Technology for supervising solar photovoltaic power generation can greatly enhance the performance, monitoring and maintenance of the plant. With advancement of technologies the cost of renewable energy equipments is going down globally encouraging large scale solar photovoltaic installations. This massive scale of solar photovoltaic deployment requires sophisticated systems for automation of the plant monitoring remotely using web based interfaces as majority of them are installed in inaccessible locations and thus unable to be monitored from a dedicated location. The discussion in this paper is based on implementation of new cost effective methodology based on IoT to remotely monitor a solar photovoltaic plant for performance evaluation. This will facilitate preventive maintenance, fault detection, historical analysis of the plant in addition to real time monitoring. The current wireless technologies, such as ZigBee, Bluetooth, and Wi-Fi, that are being used for wireless sensors are not suitable for industrial use where the number of connected devices is significantly higher, and reliability is of dire need.**

Index Terms: **Solar panel, microcontroller ATmega328, LDR sensor, DC servo motor, DC gear motor**

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I. INTRODUCTION

The word photovoltaic techniques photo light and volt is started from Greek-arrange, and the photo voltaic burden are contained surface known as semiconductor. The generally used semiconductor is silicon. Each voltaic-chamber can make by putting the PV cells in consecutive and parallel. Modified photovoltaic board cleaning and following structure is used to control and set the depictions of the sun fueled board and it will pursue the best power position. The PV board cleaning development will improve the execution by methods for putting off soil and degradations from the outside of the board. This system consolidates both mechanical and electric regions. The device that used by P-N convergence explicitly convert sunlight to electric power the device used is sun based PV-cells. While this, plate end up chaotic as result the cleaning system will reduce it. The execution of the PV board is reduced buildup to the buildup accumulation, shadow, snowfall, winged creature dropping buildup and earth. Electrical part contains programming which works and controls the circuit of oneself cleaning development. The yield of the board is evaluated when cleaning and viability is resolved with the assistance of voltage and contemporary outlines. Daylight based essentialness is a developing supportable wellspring of imperativeness. it is a non ordinary source, we have made sun situated sheets with the objective that we can fulfill our capacity require. Daylight based tracker is a mechanized sun arranged board that truly seeks after the sun to grow the power. The daylight based tracker can be used for a couple of utilization, for instance, sun fueled cells, sun arranged day like lightning system. The sun based tracker is outstandingly useful for device that needs more light for high efficiency. The board is working at the best viability to get the most extraordinary capability for the sun controlled board. Sun following system uncommonly planned for private used for negligible exertion sun fueled cell. LDR or light ward resistor has been picked as the sensor in light of the fact that, LDR is generally used for following structure. LDR is tricky to the light. The block of LDR will decreases with extending event light power. For the controller Atmega238 had been picked. The programming will give the beat to the driver move to the motor. For the driver, bi-directional DC motor control using exchange has been used. The motor controller had been picked in light of the way that it can control the motor to rotate clockwise course. LM7805 is used to change over the information voltage from the wellspring of 5v yield. The sun arranged board is made to turn in all of the headings standing up to the light. The principal thought of the assignment is to fabricate the viability of the great bodies. The turn of the DC motors through the perfect point is cultivated by using topwin6 compiler. This structure uses DC motor to control the purpose of transformation of the sheets. Daylight based essentialness is rapidly advancing and greater imperativeness is conveyed by following the sun based board to remain changed in accordance with the sun at a right point to the light emissions. This paper depicts in detail the arrangement and improvement of a model for sun fueled after system with two degrees of chance, which recognizes the sunshine using photo sensors. This is altered to distinguish the sunlight through the photo sensors and after that actuate the motor to position the sun controlled board where it can get most outrageous light. The hardware part includes microcontroller ATmega328, HMC5883L sensor, motor driver, LDR dust sensor, servo motor, etc. Microcontroller ATmega328 is a heart of the circuit. The item part includes a program for the microcontroller is created using low dimension figuring build and microcontroller getting ready programming.

II. LITERATURE REVIEW

A sun oriented cell is a gadget which changes over light vitality into electric vitality through photovoltaic impact. Sun powered cells are the structure square of photovoltaic modules known as sun based board. In sun powered following framework, the module's surface tracks the situation of the sun consequently as the days keeps running by [1]. The situation of the sun differs as the sun moves over the sky. For a sun oriented fueled gear to work best, it must be put close to the sun and the sunlight based tracker can build the effectiveness of that hardware at any fixed position. In light of modernity, expenses and execution [2]. One basic kind of tracker is the heliostat, a portable mirror that mirrors the situation of the sun to a fixed area. A sun based trackers exactness relies upon the application. Concentrators, particularly in sun oriented cell application in sun based cell applications, require a high level of precision to ensure that the concentrated daylight is coordinated precisely to the controlled gadget, which is near the point of convergence of the reflector or focal point [3]. Without following, concentrator framework won't work by any means, hence single-hub following is obligatory [4]. Non-concentrating applications required less exactness, and many are probably going to work with no following. Be that as it may, following incredible impact can both the measure of complete yield control created amid basic framework request periods (generally late evening in hot atmosphere) [5]. Examines have been done to improve the vitality creation of sun oriented boards. The inquires about have been done to improve the vitality creation of sun powered boards [6]. These investigates incorporate; twofold sided boards, change stages improvement [7], building boards joining geometrically [8], etc. Most extreme vitality is created by a sunlight based PV board when it is situated at the correct point of sun. consequently, a few looks into created changed sorts of sun powered board following framework [9] and . Subsequently, the main role of this work is to build up a sun powered board tracker dependent on arduino progresses in order to upgrade the vitality creation of sun oriented board [10].

III. PROPOSED SYSTEM
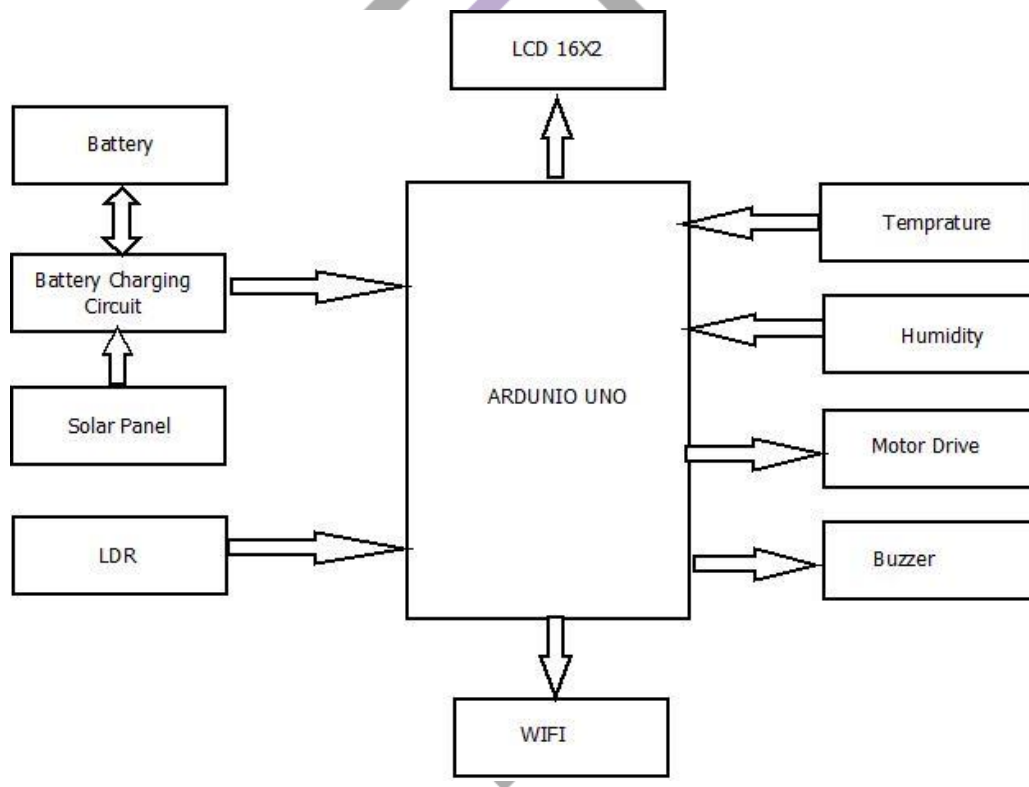
Fig.1. Proposed System

The PV sun oriented cleaning hardware comprises of a DC engine, gear framework or transport line framework, battery, sun based board, moving bursh. In this, supply is given by the battery is being charged by the sun's energies. Through the sun based board which gives supply to the product framework, DC engine. When the supply is given to the dc engine, gear framework begins to work, in this manner moving the moving bursh and along these lines cleaning sun powered board where the activity is constrained by the product framework being provided by a battery. This task contains a straightforward planning of electronic circuit. It contains the fundamental segments which manage the sunlight based board, DC engine, DC gear engine or transport line, Microcontroller (Arduino nano) and battery. Sun based board PV board utilized as a power source each sunlight based cells produces yield of 12V. Sun based board might be ON framework process or OFF lattice process. ON framework process where the sunlight based board yield is given to the MPPT converter. In MPPT converter is utilized to change over the fluctuating yield of sun powered cell into fixed yield. The yield of MPPT converter is given to inverter where 12DC into 230AC.thus the 230AC is given to net meter and this is associated with the electric board ON framework is conceivable just on the nearness of daylight. The power is taken from inverter itself and abundance control is given to the electric board through Net meter. Amid evening time, control is taken from electric meter through net meter from electric load up. OFF network is same as of ON lattice and the main contrast is as opposed to enabling to net meter it is put away in battery for further use. From sun based board the yield given to converter and to driver circuit which is

unidirectional. MOSFET is utilized in converter and turn on and off procedure of MOSFET is constrained by prearranged microcontroller.

IV. AUTOMATIC SOLAR TRACKER WORKING AND HARDWARE DESCRIPTION

It is the one which seeks after the sun's improvement for the term of the day and gives ceaseless reflection to the sun arranged board. The sun shafts will fall on the sun situated board in two distinct ways, which is they will fall explicitly on the sun based board and besides reflect the event pillars on the sun fueled board. Expect as the sun tine of sun rise the sun is in uncommon east reflector will alter itself in some circumstance by which the scene bars will fall on the daylight based board. Right when the earth turns and the sun get moved from its before position the impression of the scene bars will moreover change. Along these lines in like manner light will fall on the sensors kept on each side of the sun arranged board. The accompanying circuit is intended to the point that when reflection falls on the sensor associated with one side of the board, the tracker will fall move towards the course. Practically identical for the circumstance when the reflection falls on the sensor joined at to the board, circuit will make the tracker to move downwards.

The genuine bit of this equipment structure is the littler scale controller. All of the assignments are constrained by it. With the help of little scale controller, you can alter the sun based board as demonstrated by the power of the sunlight of the sunshine. Another portion is the battery-controlled battery which is used to store imperativeness which is gotten from the board. The inspiration driving the charge control is to control the charging of the battery. Little scale controller unit gets the status of the battery by the charge control unit. It has two sensors, each made up of LDR. Four LDRs involve on unit and are set at the four corners of the board. LDR resources the power of light and controller gets the yield. Control unit picks in which heading the board must be swing to get most extraordinary light. Another unit of the sensor furthermore contains LDRs and used for the control of lightning load. The board can be turn in the perfect heading by the server motor.

V. AUTOMATIC SOLAR CLEANING TECHNIQUES

There are different techniques for cleaning accumulated buildup, model, cleaning method which includes sliding brushes on PV board surface. Also electrostatic cleaning is used where the buildup is shaken off the PV board when an electrically charged wave breaks over the outside of the PV board. Another framework is wet cleaning. One of the wet cleaning models join Heliotex, which is a modified cleaning system that washes and flushes sun based board surface. The mechanized cleaning structure for PV modules was created considering the sort of buildup area or checking framework, method for cleaning and the cleaning instrument. Thusly, the cleaning writing computer programs was shown to work inseparable with the proportion of irradiance conveyed from the sun and the item action as layout. The item execution was written in C and exchanged to a microcontroller using Arduino and the generation was finished. The system involves the DC motor related with the arduino UNO by methods for control circuit of the L293D motor drive. The checking circuit and the light sensor were moreover related the arduino UNO board. The sensor was used to recognize the proximity of the microcontroller will response to this by evaluating the yield control from the board in case it is radiant morning or the yield is "HIGH". The cleaning instrument will be dynamic exactly when efficiency or the yield control is low.

CLEANING MECHANISM

• Sprinklers are regularly utilized in the dry region to keep board clean. It has indistinguishable cleaning impact from precipitation and will clean board at a moderately ease.

• Brushes-Different sort of brushes can be joined to the front of the board so as to brush away any residue, residue, sand, and earth which heap up on the sunlight based board. The cleaning instrument will clean varieties of PV boards by moving a vertical brush on a level plane over the boards.

• Wipers-Wipers are commonly used to evacuate rain, snow, ice and trash from the outside of the boards. Thus in blustery and frigid territories where snow heaps up on sun based boards, wipers can be valuable in expelling all the snow from the outside of the boards.

VI. CIRCUIT OPERATION

In our endeavor we have use sun controlled board to change over the light imperativeness into the electric essentialness. The sun change its circumstance for the span of the day that is the reason we can't prepared to utilize the whole light imperativeness we have made a following system wherein sun arranged board can be turn as indicated by the sun changes its position. We have use four LDR sensor to recognize the light and if the sun change its position, specific LDR sensor sense the light and produce the most outrageous yield voltage. Microcontroller get the voltage movement from the any information stick of the controller and takes a gander at the each LDR yield banner to with each LDR sensor yield. Right when the controller find the most shocking voltage measurement of any LDR sensor gives the direction to the motor through the motor driver circuit to turn the sun put together board with respect to the single rotate toward the LDR sensor which are making most prominent yield power. By using external motor and by affecting relationship in parallel we to can move the sun situated board toward any way. As by turning the sun arranged board toward the sun we utilize the most outrageous essentialness of the light.
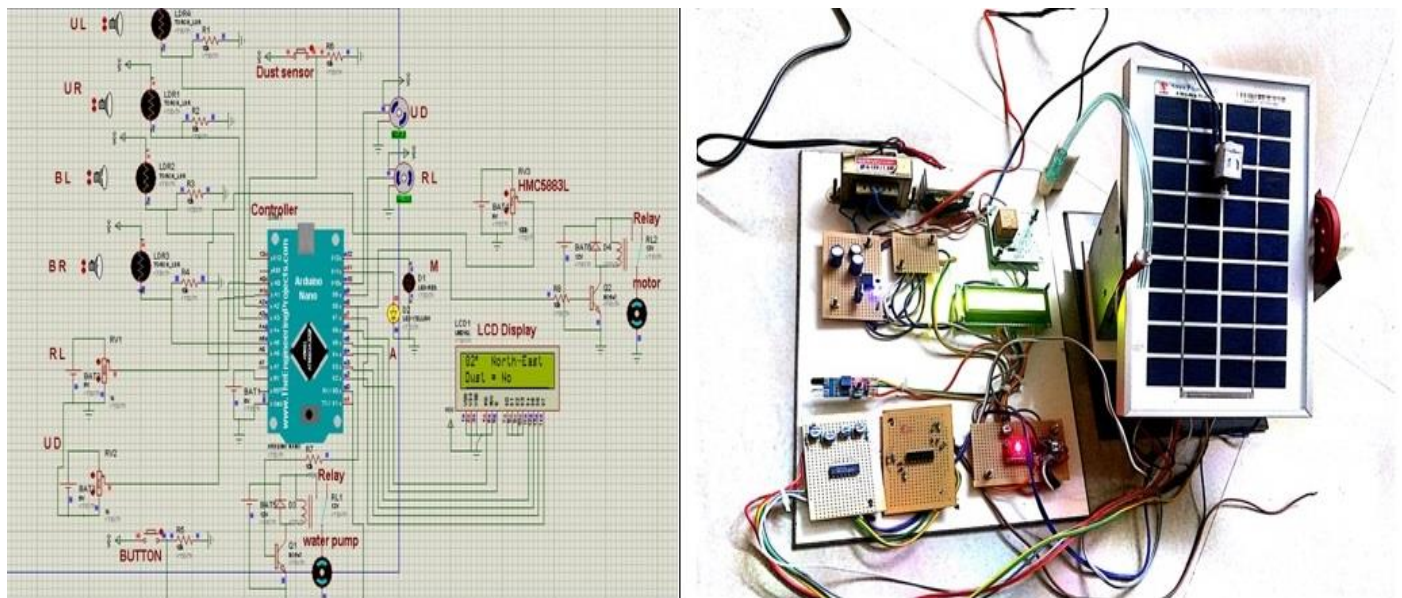
Fig.2. Circuit and Hardware

VII.   RESULT AND DISCUSSION

The framework is concentrating on the controller structure. The built framework has been tried and a few information from equipment estimation have been gathered and talked about. Regular sun powered board has been utilized and reason just to demonstrate the structured framework can work in like manner. In this way the encompassing impact, for example climate condition are not truly considering amid equipment testing.

VIII.   CONCLUSION

Sun arranged after and cleaning system was successfully made. This structure can pursue and seek after the light power to accumulate most extraordinary yield. The arranged system is revolves around organizing controller part and the standard concern is to design fitting circuits and the circuits accept to have the ability to control DC adjust motor turning course without contemplating motor speed. The examination of the execution is totally established on the proportion of power made on the dusty board and a cleaned board. Wiping can clear out the dusty particles externally anyway the effective cleaning on wet cleaning. No external power supply is required for the cleaning the cost is reasonable and having gigantic number of daylight based board. Our proposed structure is just an invigorate of modified daylight based trackers with cleaning system. The paper propels the use of sun based board is dynamically commonsense and capable way. The cleaning instrument is done by the DC servo motor that is changed and invigorated by the microcontroller. Thusly any kind of DC adjusted motor can be used this system paying little regard to motor speed controller unit as long as the speed. The created structure model can be associated in neighborhood for elective power age especially for non essential and low power devices.

ACKNOWLEDGMENT

REFERENCES

[1] Ashish Saini, Abhisek Nahar, Amit Yadav, "SOLAR PANEL CLEANING SYSTEM" Imperial Journal of interdisiciplinary Research, vol-3, issue-5, 2017. ISSN: 2454-1362.

[2] Mark Anderson, Ashton Grandy, Jeremy Hastie, Andrew Sweezey, Richard Ranky, Constantinos Mavroid, " ROBOTIC DEVICE FOR CLEANING PHOTOVOLTAIC PANEL ARRAYS" Journal of Emerging Technologies and Innovative Research. Vol-4, Issue-09, September 2009.

[3] Kelebaone Tsamasase, Tapologo Ramasesane, Kagiso Motshidish, "AUTOMATED DUST DETECTION AND CLEANING SYSTEM OF PV MODULE" ISRO Journal of Electrical and Electronics Engineering. vol-12, Issue-6, Dec-2017, DOI:10.9790/1676-1206029398.

[4] Kiran M R, Rekha G, Pradaki, "SELF-CLEANING TECHNOLOGY FOR SOLAR PV PANEL" International Journal of Scientific Development and Research, vol-1, Issue-9, ISSN: 2455-2631.

[5] S.B.Halbhavi, "MICROCONTROLLER BASED AUTOMATIC CLEANING OF SOLAR PANEL" International Journal of Latest Trends in Engineering and Technology, vol-5, Issue-4, July-2015.

[6] Shaikh Mohammed Sadiq Yunus, Y G Dilip Kumar, "AUTOMATIC CLEANING OF SOLAR PANELS USING DELTA PLC", Imperial Journal of interdisiciplinary Research, vol-3, issue-7, 2017. ISSN: 2454-1362.

[7] Pradhan Ariyadharal, Ali S.M, Jena Chitralekha, " ANALYSIS OF SOLAR PV CELL PERFORMANCE WITH CHANGING IRRADIANCE AND TEMPERATURE", International Journal of Engineering and Computer Science, vol-2, Issue-1, Jan-2013.

[8] Soumya Das, Pradip Kumar Sadhu, Nitai Pal, "SINGLE AXIS AUTOMATIC SOLAR TRACKER SYSATEM USING MICROCONTROLLER", Telkomnika Indonesian Journal of Electrical Engineering", VOL-12, Issue-12, DOI-10.11591/telkomnika.v12i12.6725.

[9] Yiwang Wang, Jia Song, "DESIGN OF A DIGITAL SOLAR PANEL AUTOMATIC TRACKING CONTROLLER FOR PHOTOVOLTAIC GENERATING SYSTEM", IEEE, 2012.

[10] Aditya Sinha, Ambuj Preet, "AUTOMATIC SOLAR TRACKER WITH PRE-INSTALLED PANEL CLEANER", International Journal of Advanced Research, Ideas And Innovations in Technology, vol-3, Issue-5.

[11] Mayank Kumar, Lokhande, " AUTOMATIC SOLAR TRACKING SYSTEM", International Journal of Core Engineering and Management, vol-1, Issue-7, October-2014.

[12] David Appleyard, "SOLAR TRACKERS FACING THE SUN", Renewable Energy World Magazine, UK: RALPH BOON, June 1, 2009.

[13] Anindita Sinha, Moushumi Das, "DESIGN of A SUN TRACKER WITH POSITION DISPLAY", International Journal of Engineering and Computer Science, volume-4, ISSUE-9, SEP-2015, Pg no. 14079-14083.

[14] Sharma R, "PERFORMANCE ANALYSIS OF ELECTRODYNAMIC SELF-CLEANING TRANSPARENT FILMS FOR ITS APPLICATION TO MARS AND LUNAR MISSIONS", Industry Application, IEEE Transactions On, vol-45, March-2009, PP-591-596.

[15] Syed Arsalan, "SUN TRACKING SYSTEM WITH MICROCONTROLLER 8051", International Journal of Scientific and Research. June 2013.