ISSN No:-2456-2165

IoT Controlled Solar Panel Cleaner

Anna Baby[1], Sarath Krishna C. S[2]., Ajay Antony[3], Darsana Biju[4] Sarang Soori S.[5]
Asst. Professor, Electrical and Electronics Engineering
Adi Shankara Institute of Engineering and Technology,
Kalady Ernakulam, India

Abstract—With growing costs of electricity and concern for the environmental impact of fossil fuels, implementation of eco-friendly energy sources like solar power are rising. The main method for harnessing solar power is with arrays made up of photovoltaic(PV) panels.Accumulation of dust over solar panel reduces their efficiency in energy generation considerably and emphasizes the need to keep the panel's Surface as clean as possible. Current labour-based cleaning methods for photovoltaic Arrays are costly,time consuming and lack monitoring capabil-ities.This paper describes about an IoT controlled solar panel cleaner that provides a cost effective and scalable solution for the removal of soil and dust.Water is used for cleaning the panel surface and a cooling system is also implemented. By this,efficency and output increases.

Keywords:- *Solar PV panel,Cleaning.*

I. INTRODUCTION

Today, both renewable and nonrenewable resources are used to produce energy. Power produced from renewable resources is more natural and less damaging than electricity produced from non-renewable resources. Solar panels make it possible to generate power using solar energy. The influences of the environment, such as dust collection, temperature changes, and humidity, ostentatously reduce the effectiveness of solar panels.An effective method to increase the overall efficiency of the solar PV panel is by cleaning pv panels.

II. LITERATURE SURVEY

In this paper, the writers discuss the pressing issue of clean solar energy. This study examined the choice of an engine, an electric drive for it, and the software environment for an autonomous and dependable device for cleaning solar panels. The findings are presented in this document. Solar panel cleaning systems' primary benefits and drawbacks are taken into account. The final design was for a system with low power usage and no provision for panel shading[1].This study's goal was to investigate how dust buildup affects the efficiency of solar PV panels.To test the electrical output and efficiency of solar panels, experiments were carried out utilising dust particles on solar panels with a constant-power light source. According to the study, the effectiveness of a photovoltaic solar panel might be reduced by up to 50 percent by dust buildup on its surface[2].The autonomous robotic cleaner plays a crucial role in cleaning the floating solar panels because human cleaning is virtually impossible in these situations. The robot is propelled by gear motors, a motor driver, and another motor that has a cleaning membrane attached to it so that it can be washed with water. For damage and cleaning references, the camera records footage of the solar panels and sends it to the cloud[3].This paper presents a novel notion that, if used, might produce significantly better outcomes. This solar panel has a completely pre-programmed, removable exterior setup that can clean the panel surface with or without water. It contains a set of strong but gentle nylon brushes to clean the panels, and two squeegees are located on either side of each brush to blot away any remaining water. The configuration may be employed as updated panels in solar power plants, private residences, and business settings. The primary goal of this paper is to keep the solar panel surface free of dust particles so that it can produce an even amount of electricity throughout its working hours, i.e., the efficiency rate and output[4].According to the study, dust characteristics have an impact on how much power the solar panels produce. For the purpose of simulating and illuminating the impact of dust on the I-V and P-V characteristics of the solar module's performance parameters, a synthetic experiment was carried out[5]. In order to maintain a PV module array, this study looked into a weekly cleaning schedule from February through May. The findings showed a notable gradual loss of power, therefore frequent weekly water washing was necessary to sustain performance losses of between 2.5 and 2.7 percent. The ability to wash the surfaces of the modules with water makes them more reliable at recovering power loss[6]. In this paper, we talk about a brand-new ambient moisture-based PV module cleaning technology. Similar to how solar stills work, clean water is collected from the salt solution. To separate the pure water from the mixture, a glass pyramid is employed. It can be seen that the produced water has very low salinity and chloride levels and is of high quality. For the purpose of cleaning PV modules, a prototype utilising this method of ambient water capture is created. On PV modules, water is typically sprayed first, then wiped off by a device that either uses electricity or is typically operated by a human[7].This paper technique allows for vibration-free, multiple-row cleaning while reusing water. By removing all types of dust, the research aims to boost the efficiency of solar panels. In the future, it may be offered as a permanent cleaning robot coupled with a panel frame, a dust detection sensor, a temperature sensor, and a centrally networked video monitoring at the time of installation[8]. In order to address a pressing issue, such as the pollution of solar panels' front surfaces, this article explains the outcomes of developing new equipment. The authors have created an energy-efficient, dependable, and autonomous cleaning approach that does not require panel shading. In connection with the mentioned criteria, an automated system was developed with a quick payback period. The designed cleaning tool for solar panels is described in the paper. The use of such a gadget will reduce the amount of human involvement in PVP cleaning[9].This article examines the impact of various pollutants on the energy produced by solar panels as well as promising locations for the construction of solar plants in Russia's climatic and geographic conditions,

ISSN No:-2456-2165

taking into account potential pollutants that could result in annual economic losses of up to 15 million rubles[10]. With the help of a thorough, systematic literature review, an effort has been made to investigate novel and creative IoT applications in this paper research work[11].By automatically adjusting the equipment to get the most sunshine, this project aids in electricity generation. Maximum light intensity is what this technology is aiming for. This system automatically changes its orientation in response to a decrease in light intensity in order to obtain the brightest illumination possible. Another goal of this technology is to minimise the need for humans to rotate and clean solar panels[12].In this paper, a flexible cleaning tool that travels the entire length of the solar panel is designed. The method described can also be used to monitor the amount of electricity produced by the solar cells, and when cleaning instructions are needed, Internet of Things (IOT) mobile applications can be used to activate them. The outcomes showed that the solar panel's performance could be decreased by external resistance by up to 22 percent[13].

III. PROBLEM IDENTIFICATION

The impact of dust and high temperatures on a PV panel's surface can result in a decrease in overall efficiency and a reduction in total power production.

IV. OBJECTIVES

The entire efficiency and output of a PV panel could be increased by cleaning the surface of the panel.The PV panel cleaning is done using water, which could help in cooling of PV panel ,which can increase the efficiency and output given out. Reduction of the labour cost and the overuse of water for cleaning pv panels can also be controlled ,as we use smidge water.

V. PROPOSED METHODOLOGY

The cleaning unit oscillates back and forth on the panel's middle portion. The wiper positioned on the fixture and tool unit moves back and forth in a reciprocating motion. The wiper and cleaning unit travel along the centre panel while spraying water droplets in the direction of the opposite end of the panel. The dust is eventually forced to flow away near the edge of the panel in the direction of the cleaning unit's activity. The water spraying stops until the cleaning unit reaches the opposite end, and it then turns around and heads back. when it has arrived at the home position.The duration of cleaning can be set using a timer circuit and also we can control the cleaner remotely by using IoT.

VI. MAJOR COMPONENTS

A. Block diagram

The block diagram of IoT Controlled solar Panel cleaner is given below.

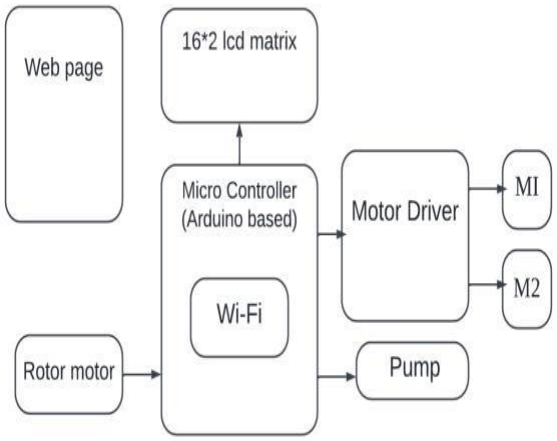

Fig. 1: Block diagram of IoT controlled Solar Panel Cleaner.

B. Components

The main components used in IoT controlled Solar Panel Cleaner are

- Node MCU
- LCD driver
- Pump
- Rotor
- Dual Motor drive IC
- LCD display
- Transistor BC547
- Solar Panel

Node MCU is a low cost open source IoT platform and it is a combination of Arduino and Wi-Fi.Water needed for cleaning is supplied by a pump. Solar energy is captured by photovoltaic panels, which use that energy to produce electricity. A motor controller breakout board called Dual H Bridge Motor Driver is frequently used to regulate the speed and direction of motors.Dual Motor Drive IC (H-bridge) also controls up to two motors simultaneously. A flat panel display known as an LCD (Liquid Crystal Display) operates primarily on liquid crystals.

C. Flowchart

The flowchart of IoT Controlled Solar Panel Cleaner is given below.

ISSN No:-2456-2165

VII. SIMULATION DIAGRAM

The simulation diagram of IoT controlled Solar Panel cleaner is given below.

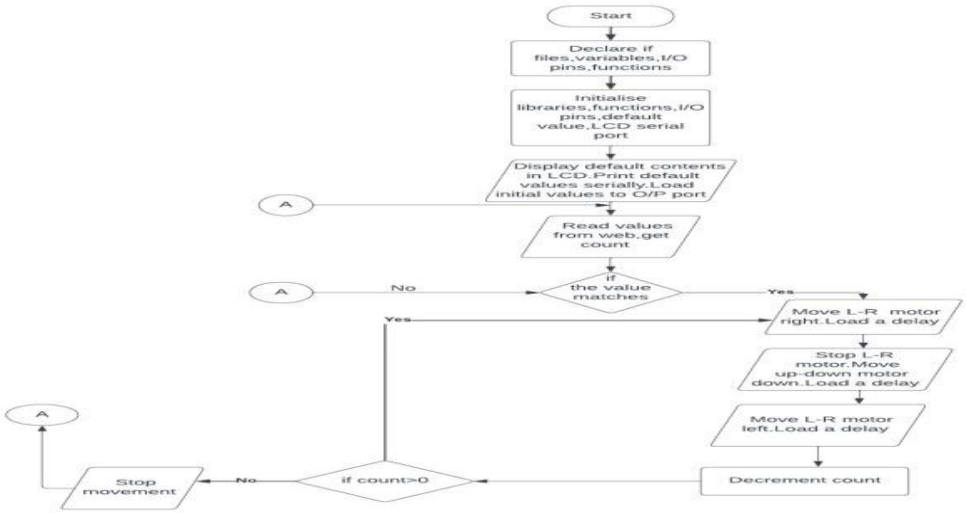

Fig. 2: Flowchart

The first step is to declare if files, variables, I/O pins, functions and the initialise libraries, functions, I/O pins, default value and LCD serial port. Then display default contents in LCD.Print default values serially.Load initial values of O/P port and read values from web, get count. Read values from web, get count, if the value matches move L-R motor right.Load a delay.Then stop L-R motor. Move up-down moor down. Load a delay.Then move L-R moor left.Load a delay and decrement count.If the count¿0 then move L-R motor right again.If No,then stop movement.

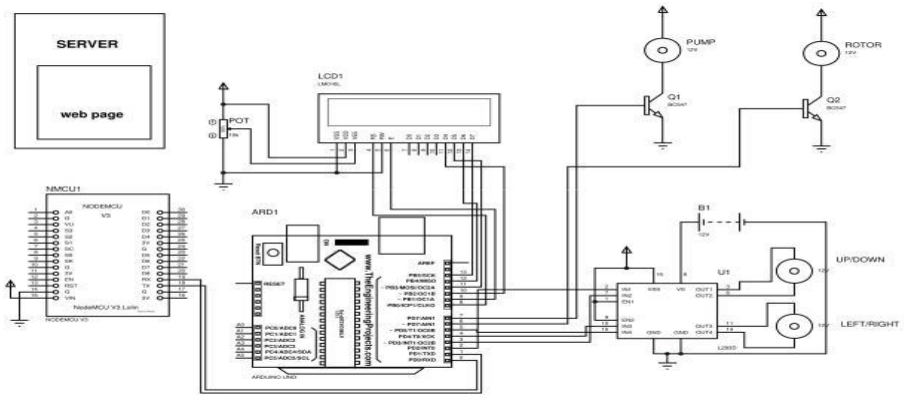

Fig. 3: Simulation Diagram of IOT controlled solar panel cleaner.

VIII. CONCLUSION

The key results may be summed up as follows: dirt and bird droppings cause a hotspot in the panel, which can lead to temporary failure. Dry cleaning can remove the topmost layer of dust, but it cannot get rid of all the dust on the solar panel's surface. By eliminating most of the dirt that has been deposited on the solar panel, water cleaning improves cleaning effectiveness. The self-cleaning technology uses the solar panel's battery for power, so no other sources are needed.Since this device is built of lightweight materials, it uses less electricity. When comparing the expenses of cleaning by manual operation and automated operation, it is found that the cost for automatic cleaning is more reasonable and a great deal less time-consuming, especially in systems with several solar panels. Additionally, regular periodic cleaning makes sure the solar panel operates consistently with good transmittance.

REFERENCES

[1.] Solar Panel Cleaning System Based on the Arduino Microcontroller", Yuliya Zatsarinnaya; Denis Amirov; Maksim Elaev.

[2.] Rajput and K. Sudhakar, "Effect Of Dust On The Performance Of Solar PV Panel," Academia.Edu, vol. 5, no. 2, pp. 1083–1086, 2013.

[3.] Design and Implementation of Automatic Robot for Floating Solar Panel Cleaning System using AI Technique,"Jaswanth Yerramsetti; Dhatri Sri Paritala; Ramesh Jayaraman.

[4.] Programmable-Logic-Controller Based Robust Automatic Cleaning of Solar Panel for Efficiency Improvement", Sayak Roy;Manali Mandal;Chitralekha Jena;Pampa Sinha;Tarakanta Jena. 2021 International Conference in Advances in Power, Signal, and Information Technology (APSIT).
[5.] Modeling Effect of Dust Particles on Performance Parameters of the Solar PV Module", Paresh G. Kale, Kaushal Kishor Singh, Chintu Seth.
[6.] O. Mohamed and A. Hasan, "Effect of Dust Accumulation on Performance of Photovoltaic Solar Modules in Sahara Environment," J. Basic. Appl. Sci. Res, vol. 2, no. 11, pp. 11030– 11036, 2012.
[7.] J. J. John, "Characterization of Soiling Loss on Photovoltaic Modules , and Development of a Novel Cleaning System," p. 146, 2015.
[8.] Solar Panel Automated Cleaning (SPAC) System . Shajan K. Thomas,Shelvin Joseph,Sarrop T S,Sahad Bin Haris,Roopak R.
[9.] New equipment for cleaning solar panels. To cite this article: Yu N Zatsarinnaya and D I Amirov 2020 IOP Conf. Ser.: Mater. Sci. Eng. 971052005
[10.] Analysis of the environmental factors influence on the efficiency of photovoltaic systems. To cite this article: J N Zatsarinnaya et al 2019 IOP Conf. Ser.: Mater. Sci. Eng. 552 012033
[11.] CRAIoT : Concept, Review and Application(s) of IoT Sapna Chaud-hary,Rahul Johari,Riya Bhatia,Kalpana Gupta,Aditi Bhatnagar.
[12.] Design and Development of Solar Tracking System And Clean-ing System. Palve Nikhil,Nikam Akshay,Lahane Ankush, Nyaharkar Dhananja, P.C. Bhavsar
[13.] Design and Development of Smart Self-Cleaning Solar Panel Sys-tem.Nurul F. Zainuddin1, M. N. Mohammed1 S. Al-Zubaidi2 and Sami I. Khogali1