Automatic Solar Panel Cleaning System

[1]K.Deepika, [2]S.Divya, [3]A.Hema, [4]R.Meena, [5]V.Deepika, [6]S.Saravanan.
[1,2,3,4]*U.G.Scholar,* [5]*Assistant Professor,* [6] *Professor*
Department of Electrical and Electronics Engineering, Muthayammal Engineering College (Autonomous), Rasipuram, Tamilnadu, India.

Abstract - Over 90 percent of the energy used by all life forms on Earth comes from the sun. It serves as the foundation for all energy sources other than nuclear energy. But compared to other energy sources, solar technology has not advanced as much. It has several difficulties, including expensive costs, irregular and unpredictable nature, storage requirements, and poor efficiency. By addressing the issue of dust build-up on solar panel surfaces, which reduces plant output and overall plant efficiency, this initiative intends to increase the efficiency of solar power plants.It suggests creating a solar panel cleaning system that could regularly clear the built-up dust from its surface and preserve the output of the solar power plant. The system is a robotic one that can move independently on solar panel surfaces using pneumatic suction cups and use dry cleaning techniques like rotating cylindrical brushes and hoover cleaning systems while taking into account the limited water supply in areas where such plants are primarily located. As cleaning solar panels by hand is dangerous for people in the hot sun, this idea also attempts to minimise human participation in the process.The improvements in systemic technology have greatly facilitated and enriched human life. This system provides a smart solar panel cleaning system that makes it possible to clean the solar panel by automatically sending the system sensor-based instructions. This device uses a wireless holistic cleaning system to make cleaning solar panels quick and simple. This wireless system is made up of a sensor application that utilises LDR light prediction and enables it to carry out user-given controller commands. The suggested system consists of an effective cleaning systematic arm and an Arduino UNO controller with fourteen digital input/output pins.When the Arduino UNO receives commands from a sensor device through a controller receiver, it decodes the instructions before controlling the motors to accomplish the intended result.

Keywords: Solar Panel, Arduino Micro Controller, ATMEGA 8A, Silicon Brush, LDR, Relay, DC Gear Motor, Voltage Sensor.

I. INTRODUCTION

A robot is a machine that has the capacity to perform a number of tasks automatically using information from its surroundings and preprogrammed commands. Unmanned Robot According to the following principles, an autonomous robot has the capacity to execute tasks and commands with a high degree of precision. Unless specifically trained, has the capacity to avoid circumstances that might be detrimental to humans or it. Although cleaning is a crucial part of everyday life, it is also one of the least appealing tasks, according to the cleaning robot. Cleaning may become dangerous for people in particular areas. Therefore, machines have been developed several times to help us with this essential evil of cleaning. The newest trend that has emerged in recent years is robotic cleaning. An autonomous robot cleaner may go about and clean surfaces using a variety of methods, including vacuuming, mopping, or just scouring them with a revolving brush. The suggested solar panel cleaning system belongs to the class of cleaning robots, but it is intended for use in large-scale solar power plants for industrial cleaning. It is an autonomous robot that uses vacuum suction cups to travel over the solar panels' slanted surface and uses a revolving cylindrical brush to clean the panels' surface.

II.EXISTING SYSTEM

A system vacuum cleaner is an autonomous systemic vacuum cleaner which includes self-drive mode and cleans the solar panel autonomously without human control. This system vacuum cleaner consists of spinning brushes, mopping, UV sterilization and security cameras for cleaning purpose. This vacuum cleaner had some drawbacks like colliding with obstacles and stopped at a shorter distance from walls and other objects. It was not able to reach to all corners and edges of the room and left those areas unclean [3]. An automatic solar panel cleaner system has brushes attached to its sides to collect the dust.This system uses ultrasonic sensors to avoid obstacles and change its direction and it has a suction unit that sucks in the dust while moving around the room freely. But the drawback of this system is that it cannot clean the wet solar panel.

III.PROPOSED SYSTEM

The solar panel cleaning system consists of two basic system unit depending on their functioning, namely Locomotion Unit and Cleaning Unit. Locomotion Unit Locomotion Unit is responsible for the movement of robot on the surface of the solar panel. Since the solar panels are mounted at an angle to ground level so as to capture maximum solar irradiance, the robot cannot rely entirely on the conventional wheel-based system for its movement. The inclined surface of the solar panel demands for a movement mechanism that can stick to the surface of the panel and prevent the robot from sliding on the surface. So the pneumatic suction system was used along with a double rack and pinion mechanism.

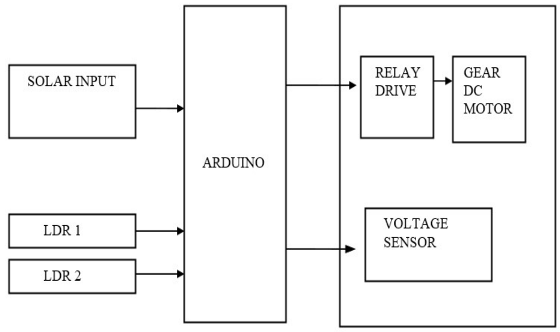

Fig 1: Block Diagram of Proposed System

The design consists of two legs that are located at the top and bottom of the robot, each with two moving platforms that move parallel to one another with the aid of a double rack and pinion mechanism and a pair of suction cups mounted on the base of each platform that are connected to a vacuum pump. In the figure, the function of the legs is shown. Each of the moving platform's individual legs has a suction cup that is alternately activated. On every moving platform, a rack is fastened. Platform 1 becomes stationary when the suction cup in it is activated. The pinion spins on platform 1 thanks to a motor linked to it, which rotates in a clockwise direction. This causes the platform 2's associated rack to go forward as well. The engine shuts off after the pinion has reached the end of the first rack, and platform 2's suction cups activate to stop it in place. Platform 1 becomes movable at the same moment as the suction cups that are linked to it disengage.

The platform has a timing belt attached to it that the stepper motor drives. The linear actuator is utilised in computer peripherals, industrial machinery, valves, dams, and dampers. A number of Riser Rack 1 Rack Note on 2 Pinion Motion Anti-Clockwise Fixed Mobile Rack 1a forward-moving direction Pinning towards the very end Two mobile, fixed anticlockwise racks 2 makes forward movement Midpoint Pinion Three Mobile Fixed Anti-Clockwise Racks 2 come to an abrupt end Pinion at the very end 4 Portable Fixed Clockwise Rack 1 is in a forward motion. Pinning towards the very end 5 Mobile Fixed Rack in Clockwise Order 1 is in a forward motion. Midpoint Pinion 6 Portable Fixed Clockwise Rack 1 attain the uttermost Pinion at the very end Table 1 illustrates how 11 different groups of linear actuators, depending on the mechanism, operate utilised and power source, including linear motors and telescoping linear actuators, as well as mechanical, hydraulic, pneumatic, piezoelectric, and electro-mechanical actuators. We suggest using an electro-mechanical linear actuator for this project, which operates on the idea of translating the rotating motion of an electric motor into a linear motion.

At one end of the aluminum rail, a stepper motor is installed as the actuator. V-wheels and an idler pulley are used to move a platform along a rail. The motor's circular motion is transformed into linear motion. The central spine that joins both legs serves as another function of the linear actuator. The cylindrical brush is likewise carried by the platform. Therefore, the brush linked to the platform moves "to and for" along the rails. Brush The brush is in charge of cleaning off the dust that has gathered on the solar panel's surface.It is fastened to the linear actuator-moving v-slot gantry plate platform. A 12 volt DC motor is used to rotate a radial bearing on which the brush is placed. By merely flipping a switch, the robot completes the task. Additionally, less work is required to clean the solar panel in manufacturers as a result.

IV.SIMULATION

MYSQL INTRODUCTION

Because of its consistently quick speed, great stability, and simplicity of use, the MySQL database has grown to become the most widely used open-source database in the world. It is used by both individual web developers and many of the biggest and fastest-growing companies in the world to power their high-volume Web sites, mission-critical systems, and packaged software while saving time and money. These companies include market leaders like Yahoo!, Alcatel-Lucent, Google, Nokia, YouTube, and Zappos.com. Not only is MySQL the most widely used open-source database in the world, but a new generation of developers has started to favour itsoftware programmes created using the LAMP stack (Linux, Apache, MySQL, PHP/Perl/Python). MySQL may be used on more than 20 different operating systems, including Linux, Windows, Mac OS, Solaris, HP-UX, and IBM AIX, providing you the freedom you need to take charge. Whether you're a beginner or an expert in database technology, MySQL offers a wide selection of certified software, support, training, and consultancy to help you succeed.

FEATURES OF MYSQL

Even though MySQL may be manually created and installed from source code, most people choose to install it from a binary package unless certain adjustments are needed. The package management system on the majority of Linux distributions can easily download and install MySQL, while further setup is frequently needed to modify security and optimisation settings. Despite its humble beginnings as a less expensive alternative to more potent proprietary databases, MySQL has steadily developed to meet higher-scale requirements as well. The majority of the time, it is still deployed as a single server in small to medium deployments, either as a standalone database server or as a part of a LAMP-based web application.

The relative simplicity and use of MySQL, made possible by an ecosystem of open-source tools like phpMyAdmin, are a big part of what makes it so appealing. By installing MySQL on more potent hardware, such a multi-processor server with gigabytes of RAM, it can be scaled in the medium term. On bigger sizes, multi-server MySQL deployments are necessary to provide greater performance and reliability because there are limits to how far performance can expand on a single server. A robust master database that manages data writing operations and is replicated to several slaves that handle all read operations might be part of a typical high-end arrangement.

In order to minimise downtime in the case of failure, the master server continuously syncs with its slaves. This allows a slave to be promoted to become the new master. Additional speed gains can be made by utilising Memcached to store database query results in memory or by slicing databases into smaller units called shards that can be distributed over a number of distributed server clusters.

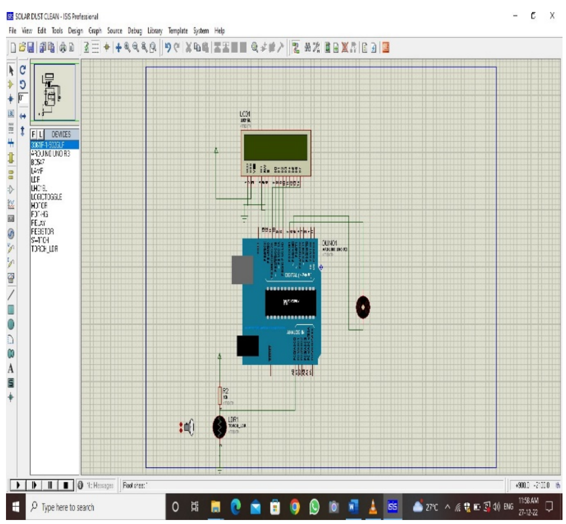

Fig 2: Simulation Diagram

FORWARD PROCESS

When the solar panel becomes dusty, a dc motor is automatically started to move forward, and the dust must then be cleaned up. The solar panel is then adequately supplied with voltage. The technology for cleaning solar panels will then be used in the procedure. The red hue in the solar panel system's reverse orientation is then indicated by the negative sign.

REVERSE PROCESS

When the solar panel becomes dusty, a dc motor is automatically started in the reverse direction, and the dust must then be cleaned. The solar panel is then adequately supplied with voltage. The technology for cleaning solar panels will then be used in the procedure. The solar panel system's negative indication then flashes the colour red in the opposite way. The computer generated image of the electrical controller. The primary Induction motor is used to calculate the overall threshold value. The ladder logic functional elements can convert the system's timing in minutes per second by changing the rotation level of the system. When clicking the start push button to initiate the process, the individual customers should be started when the individual controllers' set values have been changed from red to green so that the process may proceed. Automatic closure occurs when the set value is reached. The set value is computed by reducing the amount of labour required, and the amount of time needed to reach the set value should be divided by the number of pulses counted during that period.

Thus, using the simulation tool Siemens TIA portal software, the complete SCADA simulation of the system can be tested. The graphical design and animations that are built into the programme should be used to create the screen design.This project uses PLCs to regulate the bearing, induction motor belt, and rotating mechanism in washing machines as part of the PLC Based Asset Management of Appliances in the Textile Industry. This chapter covers the hardware outcomes of the project that used PLC and SCADA to monitor and manage the whole system.The Siemens TIA portal software is used to examine the output of the Asset Managemant of Appliances In Textile Industry system screen in relation to the hardware model of the system.

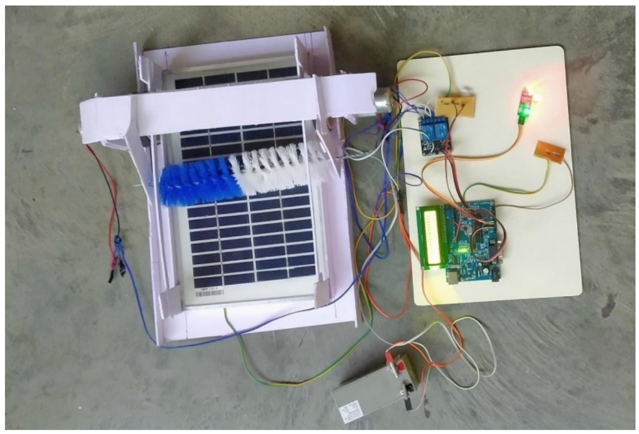

Fig.3.Hardware Implementation

V.CONCLUSION

The purpose of this project is to monitor and manage the Programmable Logic Controller used to manage the assets of textile industry equipment. This research concentrated on portable controls for crucial washing machine characteristics including temperature and belt runtime. In the electrically operated washing machine, the number of belt rotations and the number of counts in the Induction Motor bearings are counted. When the system reaches the bearing count threshold, the associated individual controllers in the washing machine enable the attained counted values. While the spinning of the induction motor belt is time-based, the bearing value is based on speed. For process monitoring, supervisory control and data acquisition are used. The system is controlled using PLC ladder logic programming, which is linked to the SCADA's graphical user interface. Automatic alarm alerts the maintenance team to take the proper corrective action. The prototype model is therefore economical and effective.

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