Solar Panel Cleaning Device

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Abstract: Dust and dirt particles which fall on solar panel decreases the output of solar panel. Hence the cleaning of solar panel is one of the biggest challenge of engineering. In this paper the problem is discussed and a device for cleaning the surface of solar panel is disclosed. The device is portable in nature which is controlled by using a microcontroller and a feedback from a sensor for proper movement over the surface of solar panel. Initial test of the prototype device show some great result.

Keywords: Dust, solar panel, cleaning device, microcontroller, prototype, sensor

I. INTRODUCTION

The cleaning of solar panel is big challenge and require a hard labour[1]. The cleaning device is designed by using many different components for removing dust particles form the solar panel for increasing the solar power generation output of solar panel. The device uses a micro controller for controlling the device[2], motor for providing mobility and rotating the cleaning arm, cleaning brushes for removing the dust from the panel. The whole device is portable and designed for cleaning multiple solar panel effectively and efficiently.

II. TECHNOLOGIES USED IN CLEANING DEVICE

Arduino Uno: The Arduino Uno is a microcontroller which uses Atmega328P IC for function and the Arduino Uno is programmable via Arduino IDE software. The microcontroller have multiple digital and analogue pins which are used for controlling components or taking input from any component/sensor[3].

Motor: The motor is an electrical machine which is used for converting electrical energy into mechanical energy by using rotor and stator embedded inside the unit. The stator is fixed and rotor produces rotation motion. When electrical current passes through coil it generates a magnetic field which is used for rotating the rotor[4].

Infrared Sensor: The infrared sensor is used for various applications for sensing change in surroundings. It consists of three unit infrared emitting LED, photodiode and an operational amplifier. The IR LED transmits the light and photodiode sense the change in light intensity or any other detail which show the changes in surrounding and the operational amplifier increases the output[5].

Motor Controller: Motor controller is used for controlling the different function of motor such as speed of motor, starting and stopping the motor, cut the power supply in case of any fault in device, and many more[6].

III. SYSTEM DESIGN AND WORKING

The device is designed for cleaning the surface of solar panel and this device is designed for cleaning multiple panel of solar farm thus removing necessity of multiple cleaning device installed in a solar farm.
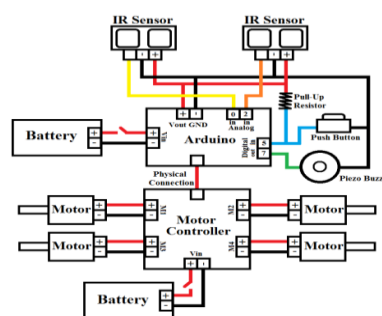

Figure 1: Device control schematics

In this device a microcontroller is used for controlling all the operations and working of the device. Multiple IR sensors are installed and connected with microcontroller for sensing the surrounding area and sends information about the border of solar panel to microcontroller for saving device from any harm. Four motors are implemented in the device for controlling the movement and rotating the brushes used for cleaning the solar panel, both microcontroller and motors are powered by battery which is rechargeable and provide better mobility to device. A switch is connected with device for turning on and off the device.
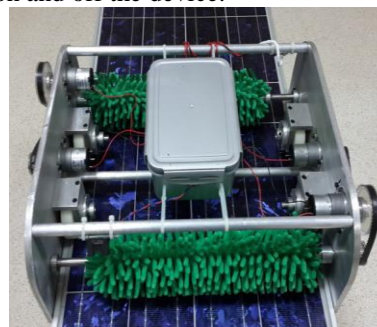

Figure 2: Device Prototype

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In figure 2 prototype of solar panel cleaning device is shown. When user turn on the device IR sensors start the sensing the surface left for movement and sends this data to microcontroller. The microcontroller than provides the signal to motor controller unit which is responsible for the functioning of motors. The motor provides mobility to the device for proper working and rotates the brushes installed in device for removing dirt/dust from the surface of solar panel.
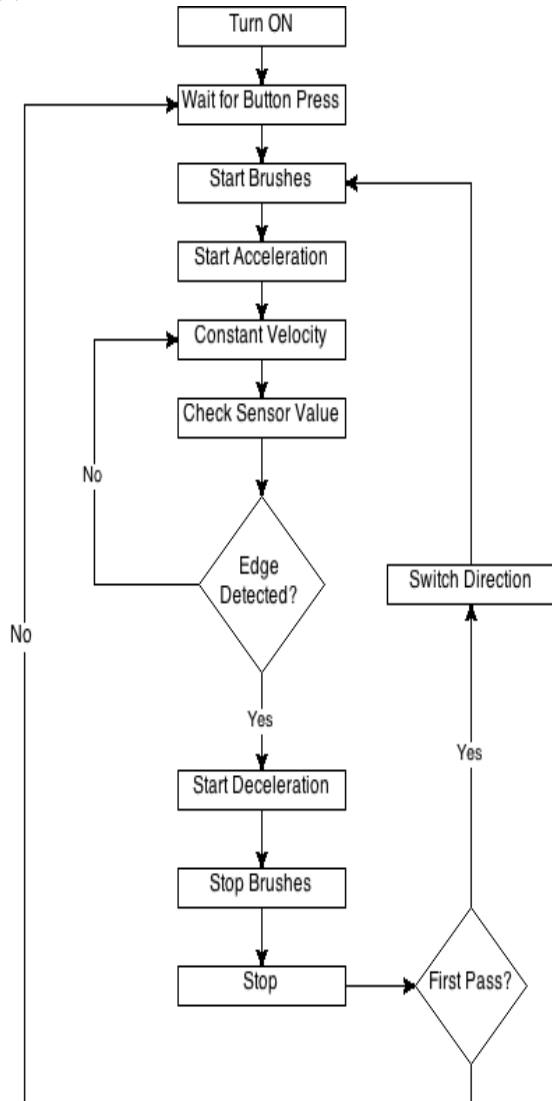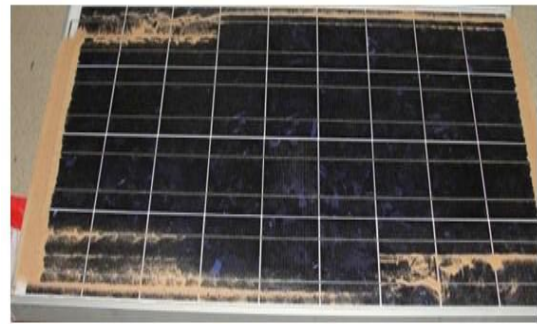

Figure 3: Operation Flow Chart of device

IV. TESTING RESULT

The device is tested by putting dust/dirt on solar panel surface artificially. The device cover the whole length and width of solar panel and removed about 90% of the dust from the surface of solar panel.

(a)

(b)

Figure 4: device test 1 (a) dusty panel (b) after cleaning

In second test cleaning device we check device ability for working on tilted surface. The cleaning device is placed on solar panel and an angle measuring sensor is installed on panel[7], as cleaning device starts we start tilting the surface and measured the angle of inclination of surface the device optimally worked between 0^0 to 47^0.

Figure 5: Test 2

V. CONCLUSION

This project is designed by keeping in mind all the needs of consumer of solar farms. The system worked accurately and performed all the tasks in time, in this project device is test in all the related conditions. In future the device can be used for cooling the surface of solar panel by spraying water on the surface of solar panel for increasing the efficiency of solar panel and the system accuracy will be improved in upcoming prototypes.

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