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Cleaning the Solar Panel using Robot Made of Firebird-V Microcontroller

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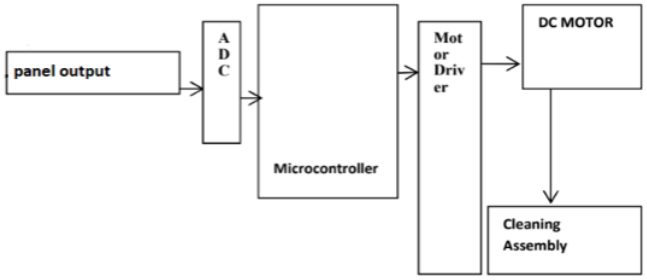
Abstract:
The Solar energy is the most abundant source of energy for all the forms of Life on the planet Earth. Solar is the basic source of renewable energy. One can generally assume a reduction of about 40% - 55%, if the panels are not clean properly for 1-2 months. It is the proposed to develop a Solar Panel Cleaning System which remove the dust on the surface on a regular basis and maintain the plant output. This is automatic system using ARM V micro controller which moves automatic on the surface of solar panels and use dry methods for cleaning as rotating cylindrical brush keeping in mind the limited availability of water in areas like deserts where such plants are mainly located. This project aims to reduce the human involvement in the process of solar panel cleaning. But using this Arm v microcontroller it reduces the cost of sensors and comparators.

Keywords: Arm V microcontroller.

I. INTRODUCTION

Sustainable energies become more and more important as part of global electrical energy consumption. The demand of electrical energy is rising globally. Usual sources like coal fired power plants or nuclear power stations cause environmental problems today and even more in the near future. Photovoltaics (PV) is the emerging technologies in the energy sector that converts the suns radiant energy, i.e., solar irradiance directly to the electricity. Here, the PV cells absorb the energy presents in the photons released from the sun into useful energy. PV technology has transformed the energy sector giving keen attention to generate clean power and scope for the world to move towards the sustainable practices in energy. Dust remains a significant challenge for the solar industry at the operation and maintenance level, as dust accumulation on panels can significantly reduce the power production of those panels. There is a strong alignment between regions of optimal solar insolation and the presence of climactic conditions that lead to dust deposition on solar panels. It has been observed that the loss in power generation due to dust accumulation can exceed 40%,Pv cells cleaning robot consists of rolling brushes connected to the body that moves horizontally over the panel.The brushes settled to the robot are made of microfiber which guarantee that pv cells will not be scratched

Block diagram



II. ANALYSIS OF DUST ON PANEL

The accumulation of dust on the surface of a photovoltaic module decreases the radiation reaching the solar cell and produces losses in the generated voltage and power. Dust not only reduces the radiation on the solar cell, but also changes the dependence on the angle of incidence of such radiation. According to the research, the daily energy loss along a year caused by dust deposited on the surface of the PV module is around 4.4%. In long periods without rain, daily energy losses can be higher than 20%. In addition, the irradiance losses are not constant throughout the day and are strongly dependent on the sunlight incident angle and the ratio between diffuse and direct radiations. When studied as a function of solar time, the irradiance losses are symmetric with respect noon, where they reach the minimum value. The PV module performance has been tested under the deposition of different pollutants (red soil, ash, sand, calcium carbonate, and silica). According to the obtained results, a drop of PV module's voltage and output power is observed when dust particles are deposited on the PV module depending on the mass accumulated, and the type of pollutant. Moreover, larger reduction occurs when the PV module's temperature is increased. In addition to that, keeping the PV modules clean and cool, results efficient system performance.

Components required:

ARM V microcontroller, Microfiber brushes, Dc motor.

III. ARM V MICROCONTROLLER

The Fire Bird V robot is the 5th in the Fire Bird series of robots. Theses platforms were made commercially available from the version 3 onwards. All the Fire Bird V series robots share the same main board and other accessories. Different family of microcontrollers can be added by simply changing top microcontroller adaptor board. Fire Bird V supports ATMEGA2560 (AVR), P89V51RD2 (8051) and LPC2148 (ARM7) microcontroller adaptor boards. This modularity in changing the microcontroller adaptor boards makes Fire Bird V robots very versatile. User can also add his own custom designed microcontroller adaptor board.

Fire Bird V ATMEGA2560 (AVR)

Microcontroller:
Atmel ATMEGA2560 as Master microcontroller (AVR architecture based Microcontroller) Atmel ATMEGA8 as Slave microcontroller (AVR architecture based Microcontroller)

Sensors:
•Three white line sensors (extendable to 7)
•Five Sharp GP2Y0A02YK IR range sensor (One in default configuration) Eight analog IR proximity sensors
•Two position encoders
•Current Sensing (Optional) Five MaxBotix Ultrasonic Range Sensors (Optiona

Indicators:
•2 x 16 characters
•LCD Buzzers
•Indicators LED

Control:
• Autonomous control
• Pc as master and robot as slave

Communication:
• USB Communication
• Bluetooth communication

Input / Output Operations on the Robot:
Fire Bird V has eight IR proximity Analog sensors out of which five are interfaced directlyo ATMEGA2560. Power to these eight IR proximity sensors can be turned on permanently by jumper 2 marked as J2 on the main board. In order to control illumination by

Function	Pins	Ip/op	Recommended Initial state
Robot Direction control	PA3 to PA0	Output	Logic 0
Lcd display	Pc4 to Pc7	Ip/Op	Logic 0
On board Interrupt switch	PE7	Input	Pu
Buzzer control	PC3	Output	Logic 0
Sharp& white line sensor control	PG2	Output	Logic 0
Side Sharp enable	PH2	Output	Logic 0
Irproximity Analog sensor enable	PH3	Output	Logic 0

microcontroller jumper J2 must be removed. By disabling these sensors we can reduce current consumption by about 300mA and also allow many robots work in the same field without interfering with each others sensors by turning them on and off in a predetermined schedule which can be synchronized via wireless communication between these robots using XBee wireless module.

IV. REFERENCES

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