Multipurpose Cleaning Robot using IoT and Image Processing

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Abstract - We present a smart multipurpose cleaning unit in this paper. Now a day's world moves toward automation. Starting from the gesture, line follower and Path follower several Path estimation algorithms are developed for automatic movement. Line follower user IR sensor to travel along the line. If the line is detected means it taken as 1 otherwise it becomes zero. Cleaning windows, especially of office buildings has always induced a time consuming process for the cleaners. This project aims yo reduce the time consumption by cleaning the window automatically. The System is programmed to clean the windows at a fixed intervals. A wipe is pulled by strings attached to a DC motor and pump is also attached to the system for spraying water during the downward stroke of the wipe. As well as, this project aims at increasing the efficiency of solar panel by solving the problem of settled dust on the surface of solar panel. Thus, by removing the dust on surface of panel it will lead improvement in panel output power and overall efficiency. The Mechanism is used to clean the surface of panel. The process takes place when the instructions are been given by the processor.

Key Words: Camera, Raspberry Pi, DC motor, Wiper

1. INTRODUCTION

The large scale solar array of panels build by a variety of solar panels, were all having different area different chip design and size. The solar panels are placed on the open surface over years at different environment conditions. During arid climates it rains very rarely so the ground is dry .When the wind blows the loose ground is carried by the wind and dust storms are very common. As the dust settles on the glass of the various panels, the energy output falls. As the dust prevents part of the light incident to the glass to enter and reach the chips generating the energy. Thus part of the light is refracted and less light goes through the glass and into chip structure which is designed to convert the solar energy to electricity. The loss of light energy depends on the amount of dust, size of particulates, and the chemical composition of dust. And many other atmospheric changes and other interrupting factors also taking into consideration. Also the cleaning of the glasses of window or wall is also the related factor. As the transparency of the glass is its objective due to dust settling down on it makes difference into its objective. Even cleaning the outer surface of the glass sometimes makes it difficult. The main objective of the project is to provide an automatic dust cleaning mechanism system using image sensing techniques. The efficiency of the solar panel is limited due to natural conditions, so it is very important to take care of parameters such as dust, humidity and temperature. In this sense, the work was resumed to study the efficiency of the solar panel with and without dust collected in it.

2. LITERATURE SURVEY

Today there already exist the class cleaning processes many of which include Mechanical models or the huge size structure with very high cost. None of the available projects in the available state have the method of detection which we have added in it. The automatic solar panel dust cleaning system has been to overcome the difficulties that arise in traditional cleaning and also produces an effective, non-abrasive and avoid cleaning Irregularities in productivity due to dust deposition. Studies carried out to evaluate the efficiency of the solar panel for powder collected in it for a day, a week and a month. The efficiency of the solar panel has been calculated even after cleaning the surface One day, one week and one month. And finally, comparing both efficiencies, it is shown that the efficiency of the solar panel increases important. Therefore, the developed model improves the performance of the solar panel.

Ritesh G. Mahajan and Prof. S. M. Patil explained, the Wall Climbing Robot (WCR) having capability that it can stick on a vertical as well as inclined surface and can easily move over the surface. The targeted capability to stick with surface can be achieved by suction cups. Suction cups create a vacuum pressure used to stick with vertical or inclined surface. For movement (climbing) of robot it is necessary that some of suction cup should release & that arrangement is obtained by developing the structure such that in which one frame is used to hold the robot to wall & other for climbing (vertical movement of robot).The motion of the other frame is carried out by providing rack & pinion type mechanism . The whole action is controlled by an arduino and the commands sending on the Zig-bee through the mobile [1].

Avvaru Subramanyam, Y. Malikarjuna and S. Suneel explained that, a suction cup, also sometimes known as a sucker is an object that uses negative fluid pressure of air or water to adhere to nonporous surfaces. And the climbing robot should be sucked to the surface on which it is climbing safely and overcome its gravity. That is the first difference between a climbing robot and an ordinary walking robot on the ground. The robot should have a function to move in both the up-down direction as well as the right-left direction to get to every point on the glass. Once the task signals are sent by the user, the robot should keep itself attached to and move on the surface, to meet the requirements of all kinds of functions, precise motion control is needed. The precise position control of the movement will begin automatically as soon as the signals are received. [2].

Soichiro Kawasaki, Koki Kikuchi explained that, the weight is proportional to the mass, i.e., the length cubed, the smaller the body size, the more advantageous it is for vertical wall climbing. From this viewpoint, the passive adhesive mechanism is suited to a small wall climbing robot moving with a few degrees of freedom (DOF). In particular, a passive suction cup has unique characteristics such as the edge of the suction cup is detached easily and the suction cup exerts far larger adhesion force than pushing force to attach it [3].

In this paper we studied about that, there are two units in the robot. One is for motion of the robot and other is meant for cleansing purpose. The motion of robot is achieved through motion unit. The motion unit comprises of 2 rotating discs, suction-cups, DC motor. Every additional climbing strategy or principle that is explored, improved or tested can increase the probability that a suitable method could be found for a (future) climbing task [4].

Shripad Malavadikar, Swapnil Mungale, Toshika Johri, Harshad Lokhande, in that paper Automatic cleaner robot which is able to do both manual mode and automatic mode. The hitting into an object that avoided by using Ultrasonic sensor and IR sensor. The sweeping and mopping that done simultaneously. The robot that will remember its path by a mechanism Docking station that starts mapping its area [5].

Pooja D.Rathod, Puja V.Wandile, Kiran S. Mohitkar, Pallavi G. Jiwtode In this paper multipurpose smart floor cleaning system by using Android Device. The robot is a multipurpose, used for both industrial and domestic application. Here use a PIC microcontroller to control all devices. And using an Android app for controlling the automatic command, the android app that operated by Bluetooth module that interfaced with a microcontroller [6].

H. G. T. Milinda "Mud and dirt separation method for floor cleaning machine" in this paper image processing technology that used to identifying mud and dirt. The algorithm that contains plane segmentation, threshold defining for MSER function, mud detection, residual filter, and thresholding the filling morphology technical that used to enhancing background, RGB method is also used [7].
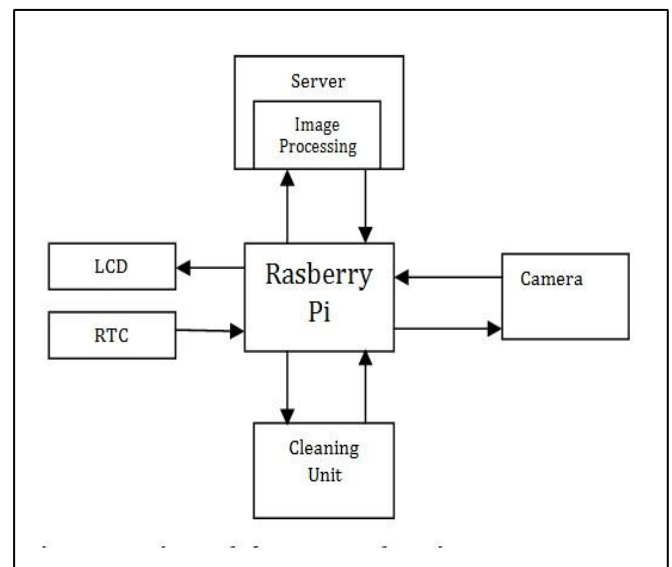
3. SYSTEM OVERVIEW

Fig 1: Overview of the system function

We present the system to clean the surface based on its cleaned status. The above Fig 1.shows the outline setup of the system proposed. The camera will be installed on the surface is to be cleaned. Camera unit is interfaced with the controlled (Raspberry Pi). The controller gives the signal to the camera tom capture the image. The captured image will be given to processing server to identify if the surface is clean or not. The LCD is attached to display the message. Real time clock (RTC) is interfaced with the control to keep the record of the time and date.
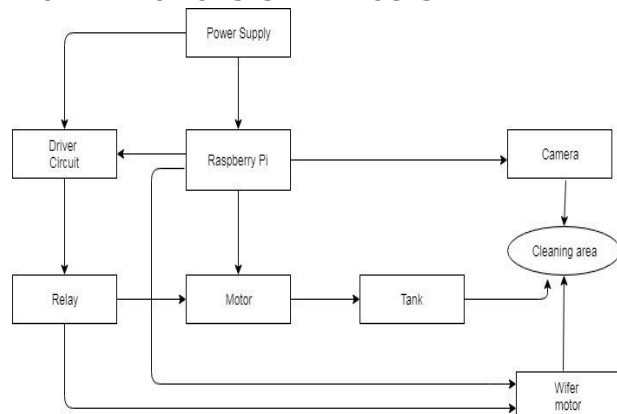
4. OPERATION OF SYSTEM BLOCKS

Fig 2: Operational block diagram

The entire system to operate needs power supply. The below Fig.2 shows the operational block diagram of the cleaning system. Camera is installed on the solar panel or on glass to capture the image after an instant of the specific area. If the area is found to be cleaned up-to the required amount them the process will be blocked else the motor will start the operation of cleaning. For the effective cleaning the water is spread on the surface and then the wipers will start the process.
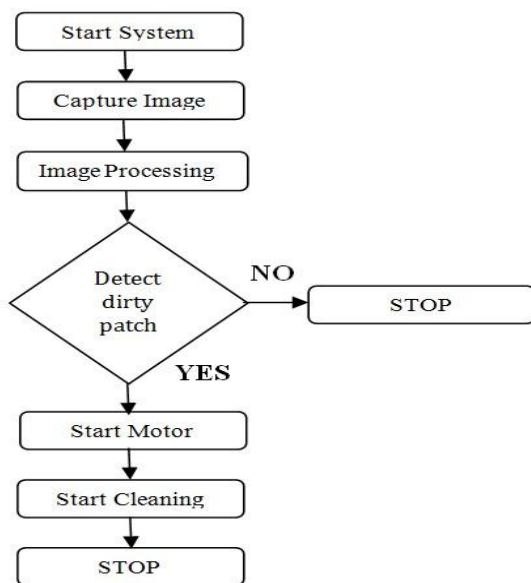
5. IMPLEMENTATION OF SOFTWARE

Fig 3: Flowchart of System

4. CONCLUSION

In this project we construct a reliable and effective automated solar panel and glass cleaning system which cleans the no of panels and the glass which reduces the human efforts. Proper detection of unclean surface and start the process after it with low power consumption. Also, maintenance is extremely important aspect of solar panel efficiency. The existing panel cleaning systems focus on the large arrays and mostly not suitable for small size array. Our system is suitable for PV arrays which can be easily installed on the top of roof. Complete cleaning is extremely advantageous since the hindering of a single panel with accumulated dust affects the efficiency for the entire solar panel. At output efficiency of solar panel is increases as surface get clean. Also the Image processing avoid the unnecessary cleaning.

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