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Novel Fully Automated Microcontroller Controlled Cloth Drying System under Direct Sun

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Abstract

Objectives: This paper outlines a completely automated system for drying the clothes under direct sun by eliminating the manual supervision. **Methods:** Such an automated system is constructed using smart sensors for monitoring humidity in the environment, a set of photo voltaic sensors and a drive system. Based on the output from the sensor a microcontroller instructs the drive system to move the cloth towards the optimal section. **Findings:** The simple design exhibits a reliable, fast-response in a continuous manner without manual supervision. **Applications/Improvements:** System can be put into operation throughout the duration of drying especially during inconsistent weather condition.

Keywords: Cloth Drier, Microcontroller, Sensor, Sun Drying

1. Introduction

In this fast moving world automation has spread its roots through our day to day life. Advancement in technology makes automation to be a part in every complex system. Manual supervision of drying clothes under direct sun is being hectic in modern life style. To obtain completely dry clothes, continuous observation is necessary in terms of the climatic conditions. Rain or other changes in weather make it quit complex. So fully automated system for drying clothes under direct sun is indispensable, to overcome the difficulties and to provide a sustainable lifestyle.

Sun is being the primary energy source of the earth, whether in direct are indirect means. As its direct forms are seasonal and fluctuating nature mostly its energy is extracted in indirect fashion as their reliabilities are more. So mostly solar dryer which are designed for various purpose to dry vegetables, dry fruits, wood and even clothes had adapted only indirect methods, when there is conversion of energy, definitely there is a need for designing a closed chamber and conversation mechanism, which makes the system quiet complex.

In direct methods its necessary to vigilantly monitor the rain fall which will have drastic impact in drying process as it delay the drying time or it can change texture of the material thereby it affects the quality of the drying process. Due to the earth's rotation over its axis, direction of sun rays incident on earth changes, so tracking of sun rays for optimum location is vital. The system is confined for small scale dry fruit seasoning, system adapt indirect sun drying with designed chamber with sensor for monitoring various parameter and controlled micro controllers[1].

This paper deals with drying of emptied fruit bunches of oil extracting industries by designing closed chamber, again material to be dried is not exposed directly to sun and it requires skilled design for implementation[2]. In this work they designed a solar dryer for drying vegetables in a drying chamber with blower and two flat plat collectors this system also in need of closed chamber and little complex design[3]. This review paper analyses various indirect solar and forced solar dryer for various material such as food grains, fruits, wood, vegetables etc. Here again most of system proposed are with closed chamber adapts indirect solar drying[4].

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2. Proposed System

A humidity sensor is chosen such that it is capable of covering the entire area of consideration. The humidity sensor monitors the relative humidity which enables it to detect the rain fall. The area under consideration is divided into multiple sections, which are embedded with PV sensors for each section, Figure 1 displays block diagram of the system. Figure 1 consists of PV cells, humidity sensor, power supply, 4 low capacity ac motor, load (rope for drying clothes in different section), drivers for driving the motors and microcontroller to instruct the driver as per the feedback received, therefore the system exhibit a complete close loop system.

This PV sensor in each unit detects and measures the average direct sun rays incident in each section. A comparison among the data from PV sensors enables us to pin point the optimal section for drying, as the PV cell in section where the direct incident sun rays are more, produced output voltage of that particular PV cell will be also more compared to other three sections PV cells. A drive system is designed in such a way that the clothes can be moved to any desired section. For simplicity, the transaction between the sections is designed to be unidirectional. The optimal location is compared with the current location of the clothes and in case of discrepancy; the clothes are moved to the optimal location[5] with help of the microcontroller based drive system.

3. Approach Adapted

3.1 Algorithm

Algorithm of the methodology adapted for the programming microcontroller are displayed in detail as follows.

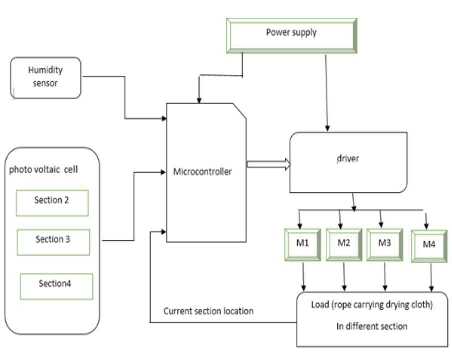

Figure 1. Block diagram of fully automated direct sun drying system.

Step 1: Start the program.
Step 2: Compare humidity value with preset value.
Step 3: If humidity > preset value, move the load to Section 1 and stop the motor.
Step 4: If humidity < preset, proceed to next step.
Step 5: Find optimal section location.
Step 6: Compare optimal location and current location.
Step 7: If miss match rotate the motor anti clock wise and repeat Step 6.
Step 8: If optimal location and current location are same, stop the motor.

3.2 Flow Chart

Figure 2 exhibit the flow of approach adapted in automation of drying clothes in direct sun rays in a simple manner. It consist of two repeat loop, one loop check whether drying cloths are in section1 if the humidity sensor output is high if not motors are operated till it reaches Section 1, once it reached section 1 motors are stopped.

Second repeat loop check the current location of drying clothes with the optimal location selected by the microcontroller after comparing output voltages of PV cell of all three section. In the whole process the primary priority is given the first repeat loop.

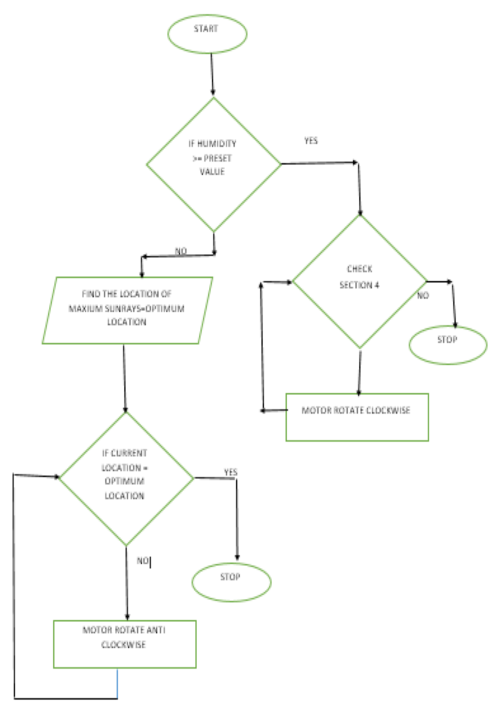

Figure 2. Flow chart of fully automated direct sun drying system.

4. Outcomes of the Implemented Design

Figure 3 display the design of fully automated direct sun drying system in detail about the location of smart sensors[7,8], mechanical arrangement such alignment of pulley and orientation of motors[6]. The design reveals the different area taken for consideration and direction of motion.

For different condition of weather, average sun ray incident on various section under consideration and it optimal placement by the automated system are discussed below.

Condition, if humidity sensor value is higher than preset value is taken for consideration in the Figure 4, under this situation system understand that it is raining outside sodrying clothes are to be maintained in Section 1 or it has to be brought back to Section 1. Microcontroller instructs the driver to rotate clockwise to bring the drying clothes to Section 1.

In Figure 5 condition, if voltage of Section 2 photo voltaic cell is high compared to Section 3 and 4 is taken for consideration it highlights that direction of direct sun rays incidents in Section 2 is more than other two section, so section to will be the optimum location for drying in this circumstances. Therefore micro controller instruct the driving system to operate the motor in anti-clock wise direction until drying clothes reaches Section 2.

In Figure 6 condition, if voltage of Section 3 photo voltaic cell is high compared to Section 2 and 4 is taken for consideration it highlights that direction of direct sun rays incidents in Section 3 is more than other two section, so section to will be the optimum location for drying in this circumstances. Therefore micro controller instructs the driving system to operate the motor in anti-clock wise direction until drying clothes reaches Section 3.

In Figure 7 condition, if voltage of section 4 photo voltaic cell is high compared to Section 2 and 3 is taken for consideration it highlights that direction of direct sun rays incidents in Section 3 is more than other two section, so section to will be the optimum location for drying in this circumstances. Therefore micro controller instructs the driving system to operate the motor in anti-clock wise direction until drying clothes reaches Section 3.

In Table 1, it expose the optimal location of drying clothes for various situation defined by the outputs of sensors. PV_{1-} output voltage of the photo voltaic cell in the

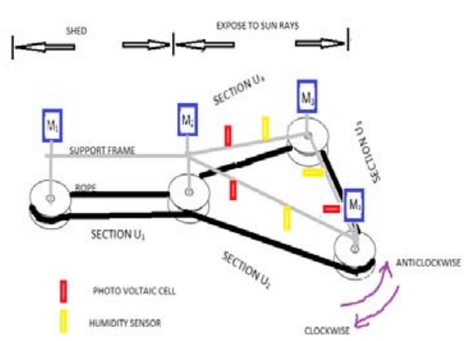

Figure 3. Design of fully automated direct sun drying system for clothes.

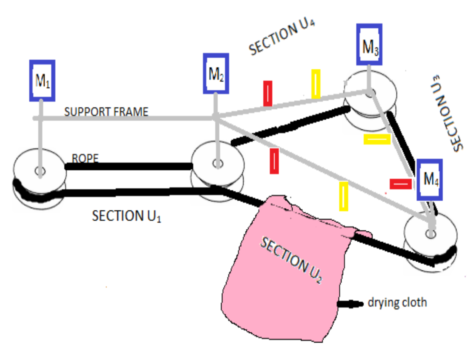

Figure 5. Block diagram if Voltage of section 2- photo voltaic cell is high compared to section 3 and 4.

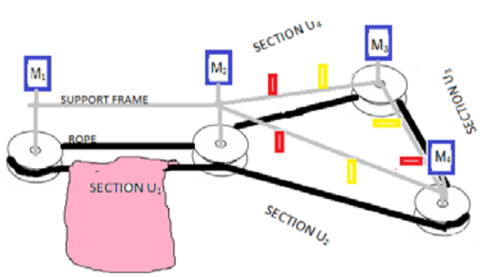

Figure 4. Block diagram if humidity sensor value is higher than preset value.

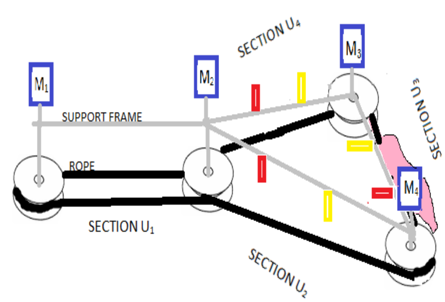

Figure 6. Block diagram if voltage of section 3 photo voltaic cell is high compared to section 2 and 4.

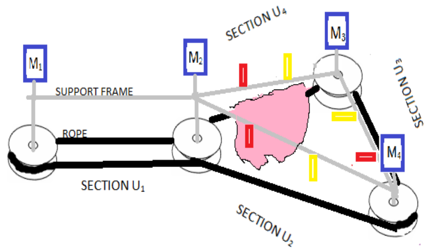

Figure 7. Block diagram if voltage of section 4 photo voltaic cell is high compared to section 2 and 3.

Table 1. Optimal location of drying clothes for various situation defined by the outputs of sensors

Humidity sensor	$PV_{1\,(VOLTS)}$	$PV_{2\,(VOLTS)}$	$PV_{3\,(VOLTS)}$	Drying section
>=preset value	0.33	0.42	0.39	Section 1
< preset value	0.5	0.32	0.34	Section 2
< preset value	0.31	0.48	0.29	Section 3
< preset value	0.35	0.27	0.49	Section 4

Section 2, PV_{2-} output voltage of the photo voltaic cell in the Section 3 and PV_{3-} output voltage of the photo voltaic cell in the Section 4.

It is obvious that system priorities humidity sensor repeat loop over optimal location repeat loop from the first condition of the Table 1. Other three condition of Table 1 signify that selection of section for drying clothes are priorities based on output voltage of PV cell in various sections. The section with the maximum output voltage is selected as optimal location for drying clothes.

5. Conclusion

The designed system proves to be fast, considering the lower response time.The system is a completely automated system and much reliable even in fluctuating climatic condition due to the smart sensors. Since these smart sensors are low power devices, the power consumed is less, which can also be designed as a stand-alone system by using PV system with energy storage. As the system is simple it is easily mountable anywhere.

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