

AUTOMATIC OVERHEATING PROTECTION SYSTEM FOR SOLAR HEATERS

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Abstract—This paper focuses mainly on the solution for the problem of overheating and stagnation. Buying and installing solar water heater is an emerging trend now-a-days as for energy saving purpose but it comes with lots of responsibility about which many people don't know. As in summer it is very hot outside, it results in overheating and stagnation of water. This may lead to the damage to water heater itself and inefficient performance of the water heater. So, proper care must be taken to prevent such situation and a possible solution has been proposed in this paper. The method we have used to solve the problem comprises of making the process of 'covering the collectors' automatic with the use of microcontroller(Arduino), motors and temperature sensors. The method has been discussed in the paper focusing on the design of the covering assembly which includes the motors, covering sheet (mat material), connecting rods. The next part it focuses on is the arduino interfacing with the temperature sensor and the covering assembly. The conclusions from this paper is the easy, automatic and cheap solution for the problem of overheating and stagnation of water heater. A solution which is easy to design, whose components are easily available and a long lasting, robust product.

Index Terms— Solar heater, solar overheating, solar cover and solar overheating solution, stagnation.

1) INTRODUCTION

In this energy saving environment all over the world, most of the people are seeking for solar powered solutions and save electricity. So, a huge number of population over the world are right now using solar powered water heaters which is one of the revolutionary solutions. Here, in India, weather is mostly sunny, which is very much suitable. In summer, the temperature rises by a big number nearly above 40°C, because of this the solar collectors (despite of careful designing and dimensioning) of solar water heater are susceptible to overheating and stagnation.[1] Other effects include the decrement of efficiency of the heater, decrement in the life of water collector.

So, as a solution for this problem we have designed a system which will prevent the overheating of the solar collectors. The gist of this solution is to cover the solar collectors when the temperature of the collectors reach a certain threshold value.

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2) MOTIVATION

In summer, as a result of hot weather there is overheating in the collectors of solar heater. The common people do not know when the overheating is done and when they see the effects of it then they start to prevent it by using some kind of cloth or cover. So, this results in the damage which is inevitable. As a solution to this, an idea of automatic overheating protection system for solar heater is proposed, which ensures the covering of collectors when the temperature reaches the threshold value. This reduces the hassle of people in indulging themselves into such activities which do not have guarantee of preventing the overheating.

3) OBJECTIVE

The whole and sole purpose and motivation for this project was to provide an easy, affordable, low-maintenance solution for the problem of overheating and stagnation in the solar collectors of solar heater.

4) COMPONENTS

Electrical :

1. Arduino UNO
2. Temperature sensor module (LM35 module)
3. Servo motors (Tower pro sg90)
4. Connecting Wires

Mechanical :

1. Sheets
2. Rollers
3. Outer structure

5) COMPONENTS SPECIFICATION

Arduino Uno is a microcontroller which is used to control the entire system according to the requirement of the user.

This allows us to manipulate the required temperature and degrees up to which the servo should rotate.

Servo Motor (Tower pro sg90) : This motor is controlled by arduino. Once we specify the value in degrees up to which we have to rotate the roller to cover the panel, it rotates up to that specified value only which is its advantages. So we chose this motor.

Temperature Sensor module : This is the most important component of the system because it is the one which senses the temperature of the water which is then send to the Arduino for further process.

Connecting Wires : We used single strand male to female and male to male wires. Because of its easy installation and use.

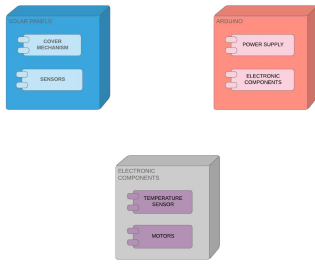


Fig -1: Block Diagram of components

6) SYSTEM ARCHITECTURE

For building this smart system, smart modern components like Arduino, temperature sensor, servo motors etc. In this architecture the main function of covering the collectors with the cover is carried out by Arduino. Temperature sensor is connected to the Arduino to the analog pin as it is a physical sensor and the servo motors are connected to the digital pin of the Arduino. Temperature sensor is connected to analog pin A0. Servo motors are connected to digital pin 9 and 10.

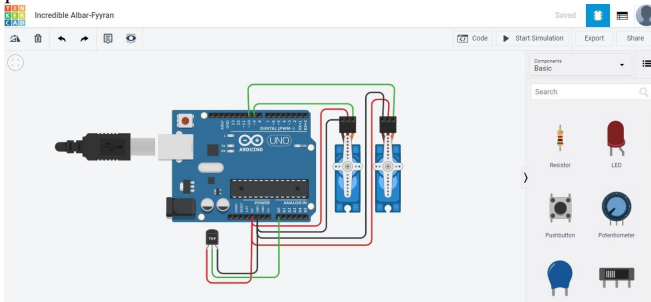


Fig -2: Circuit Diagram

7) EXPERIMENTAL SETUP

We decided such a geometry which allows easy installation of the component and hassle free maintenance. Every electrical component is placed in such a way that the connections don't entangle in one another and provide smooth operation of the product. So we decided to use rubber bush which holds the collector and also prevent the damage by clamps. We provided extension at the end to accompany the motors and rest of the electrical components. The rollers along with the sheet is placed in such a way that when it is in working it covers whole solar collector.

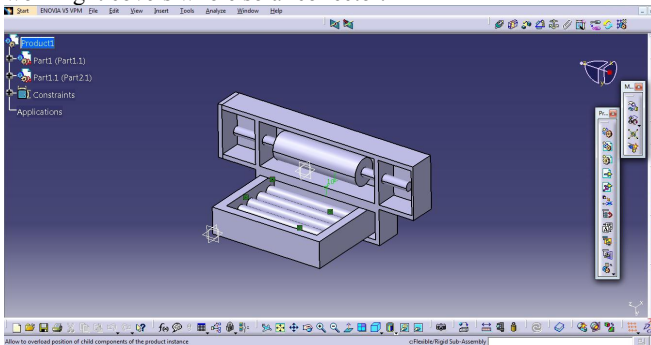


Fig -3: Geometry of solar cover

8) WORKING

Temperature transducer module is a physical sensor which measures the temperature around it and convert it into analog signals. This signals are then send to microcontroller that is Arduino which

then identifies this signals and works accordingly. Once the temperature reaches the specified value the temperature sensor sends the corresponding signal to the Arduino which it identifies and sends the digital signal to the servo motor to rotate anticlockwise which cuts off the heat reaching the solar collector. Over a period of time as the temperature drops beyond a certain specified value, the temperature sensor then sends the corresponding signal to the Arduino which then sends the digital signal to servo motors to rotate clockwise and expose the solar heater to the sun.

9) CONCLUSION

This system is really very useful in the places like India where the average temperature is huge and weather is mostly sunny. This product has the potential to become the eternal part of a well-defined and well-designed water heater system. This will increase the life of solar collectors and will make it easier for the user to take care of the system. This product is going to save a lot of work of user and thus help in serving the society on a huge ground.

ACKNOWLEDGMENT

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