

Energy efficient Automatic solar water heater

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Abstract

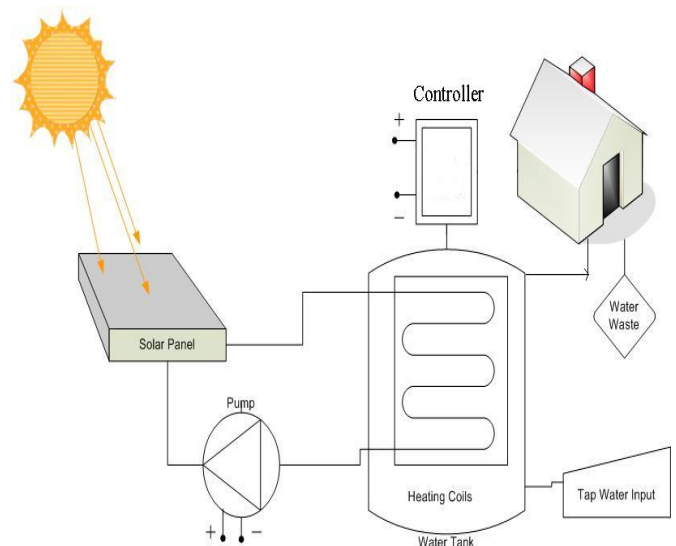
This project contains the control and design of automatic solar water heater with energy efficient technique. The project involves water level control in the water tank of heater also save the energy. Temperature sensor is placed to sense the temperature of water and control the status of pump. It would not allow the pump to operate in night as well as low intensity mode. The control circuit is based on electronics principal which provide the control signals. The total design, calculation and analysis of temperature control in water tank.

Keywords – solar water heater, Tank temperature sensor, collector temperature sensor, Heat exchanger, collector and tank pumps.

I. INTRODUCTION

Solar water heater is the widely used equipment for water heating purpose in household application.

It use nonconventional energy source for heating the water. In Conventional Solar Water heater, A Pump is continuously circulating the water in the solar heating panel in day light. But In Conventional Solar Water heater, some problems are occurred ,To avoid that problems We can make efficient solar water heater. Solar water heating systems comprise several innovations and many mature renewable energy technologies that have been well established for many years. This project contains the control and design of automatic solar water heater with energy efficient technique. The research involves water level control in the water tank of heater also save the energy. Temperature sensor is placed to sense the temperature of water and control the status of pump. It would not allow the pump to operate in night as well as low intensity mode. The control circuit is based on electronics principal which provide the control signals. The total design, calculation and analysis of temperature control in water tank. There are records of solar collectors in the United States dating back to before 1900, comprising a black-painted tank mounted on a roof. In 1896 Clarence Kemp of Baltimore, USA enclosed a tank in a wooden box, thus creating the first 'batch water heater' as they are known today. Although flat-plate collectors for solar water heating were used in Florida and Southern California in the 1920s there was a surge of interest in solar heating in North America after 1960, but especially after the 1973 oil crisis



“Figure 1. general solar water heating system”

Hot water heated by the sun is used in many ways.

While perhaps best known in a residential setting to provide domestic hot water, solar hot water also has industrial applications, e.g. to generate electricity. Designs suitable for hot climates can be much simpler and cheaper, and can be considered an appropriate technology for these places. The global solar thermal market is dominated by China, Europe, Japan and India.

In order to heat water using solar energy, a collector, often fastened to a roof or a wall facing the sun, heats working fluid that is either pumped (active system) or driven by natural convection (passive system) through it. The collector could be made of a simple glass-topped insulated box with a flat solar absorber made of sheet metal, attached to copper heat exchanger pipes and dark-colored, or a set of metal tubes surrounded by an evacuated (near vacuum) glass

cylinder. In industrial cases a parabolic mirror can concentrate sunlight on the tube. Heat is stored in a hot water storage tank. The volume of this tank needs to be larger with solar heating systems in order to allow for bad weather, and because the optimum final temperature for the solar collector is lower than a typical immersion or combustion heater. The heat transfer fluid (HTF) for the absorber may be the hot water from the tank, but more commonly (at least in active systems) is a separate loop of fluid containing anti-freeze and a corrosion inhibitor which delivers heat to the tank through a heat exchanger (commonly a coil of copper heat exchanger tubing within the tank). Copper is an important component in solar thermal heating and cooling systems because of its high heat conductivity, resistance to atmospheric and water corrosion, sealing and joining by soldering, and mechanical strength. Copper is used both in receivers and primary circuits (pipes and heat exchangers for water tanks).

Another lower-maintenance concept is the 'drain-back': no anti-freeze is required; instead, all the piping is sloped to cause water to drain back to the tank. The tank is not pressurized and is open to atmospheric pressure. As soon as the pump shuts off, flow reverses and the pipes are empty before freezing could occur.

Residential solar thermal installations fall into two groups: passive (sometimes called "compact") and active (sometimes called "pumped") systems. Both typically include an auxiliary energy source (electric heating element or connection to a gas or fuel oil central heating system) which is activated when the water in the tank falls below a minimum temperature setting such as 55 °C. Hence, hot water is always available. The combination of solar water heating and using the back-up heat from a wood stove chimney to heat water can enable a hot water system to work all year round in cooler climates, without the supplemental heat requirement of a solar water heating system being met with fossil fuels or electricity.

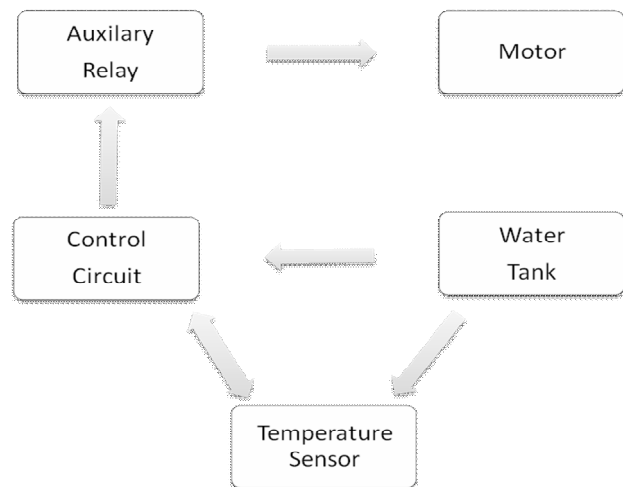
When a solar water heating and hot-water central heating system are used in conjunction, solar heat will either be concentrated in a pre-heating tank that feeds into the tank

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heated by the central heating, or the solar heat exchanger will replace the lower heating element and the upper element will remain in place to provide for any heating that solar cannot provide. However, the primary need for central heating is at night and in winter when solar gain is lower. Therefore, solar water heating for washing and bathing is often a better application than central heating because supply and demand are better matched. In many climates, a solar hot water system can provide up to 85% of domestic hot water energy. This can include domestic non-electric concentrating solar thermal systems. In many northern European countries, combined hot water and space heating systems (solar combisystems) are used to provide 15 to 25% of home heating energy.

II PROBLEMS IN GENERAL SOLAR WATER HEATER SYSTEM

If we forgot to switch ON the pump heater can not work so it is must to make On-Off automatically. But also problem accurate that pump can be work in cloudy or humid atmosphere. At that Condition energy is wasted in pumping the water in such sunlight which not capable to heat enough. So isn't a good idea to do automatic monitoring and control the heater according to its temperature difference...!!!!?



“Figure 2. BLOCK DIAGRAM”

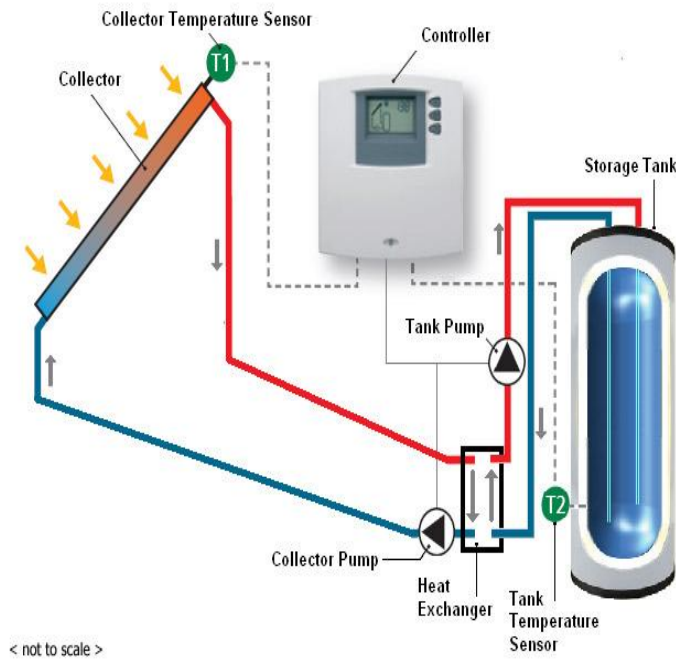


Figure3. "ACTUAL PLANT"

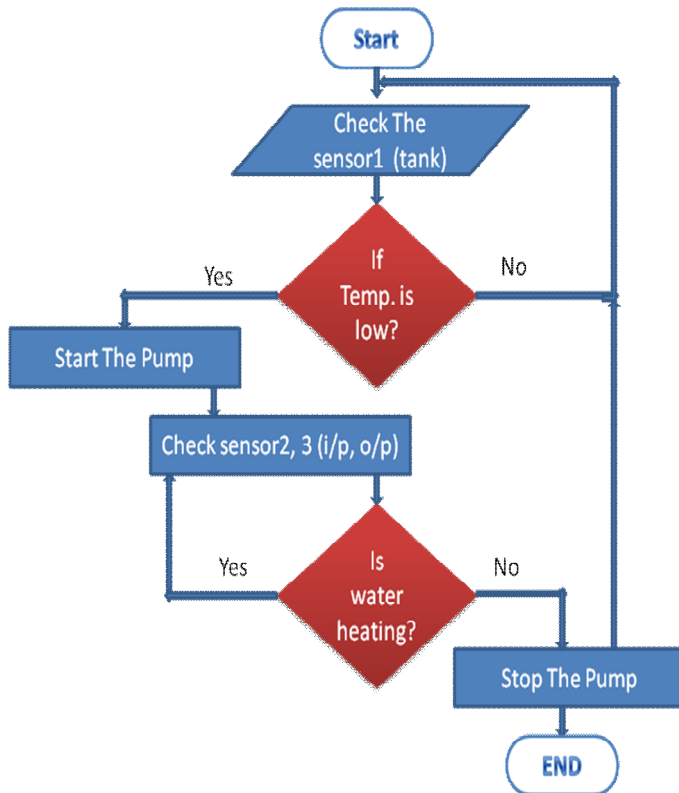


Figure 4. "flow chart of the system"

III Introduction Of New Technology

Solar water heaters are energy saving reliable system for water heater application but a pump required for circulates water into collector. If the tank at the lower lever than collector water pressure pump is required. This pump can operate with external power supply. This pump has to be operated manually by user. If user forgot to turn on the pump the water cannot circulate and heated up.

To avoid this problem automation of pump can take place to auto turn on and off the pump according to temperature of the water in to tank. Here we had introduced of smart control and monitoring of solar light to efficient optimization of solar light.

IV Thermistors

Each sensor type has advantages and disadvantages. For thermistors, the major advantages are:

Sensitivity: This allows thermistors to sense very small changes in temperature.

Accuracy: Thermistors offer both high absolute accuracy and interchangeability.

Cost: For the high performance they offer, thermistors are very cost-effective.

Ruggedness: Because of their construction, thermistors are very rugged.

Flexibility: Thermistors can be configured into a wide variety of physical forms, including very small packages.

Hermetic Seal: Glass encapsulation provides a hermetic package, eliminating moisture induced sensor failure.

Surface Mount: A wide range of sizes and resistance tolerances are available.

Of the thermistor disadvantages, typically only self-heating is a design consideration. Proper care must be taken to limit the sensing current to a low enough value that self-heat error is minimized to an acceptable value.

Non-linearity can be addressed by software or by circuitry, and moisture induced failure by glass encapsulation.

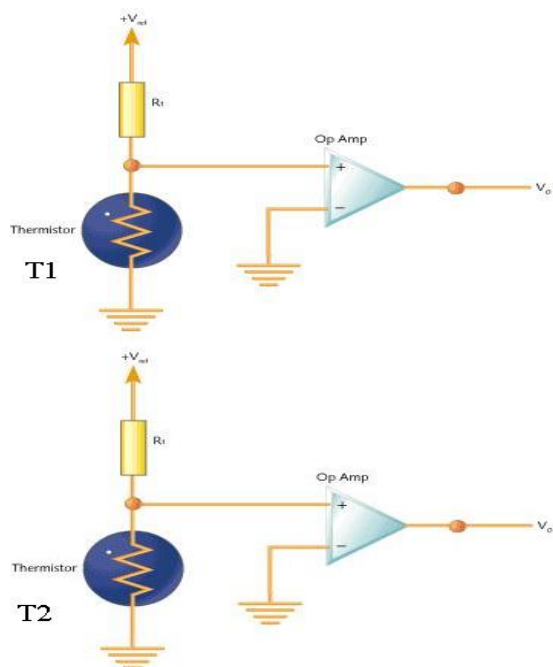
All sensors have specific advantages and

disadvantages. For a successful project, the key is to match the sensor capabilities with the application. If you would like assistance in deciding if a thermistor is the best design option, please contact MEAS application engineers.

A. Control Circuit

Control circuit generates the signal for controlling the motor to turn On/OFF the pump. The signal of control circuit will be boosted up or converted into high power signals by relay. Simple timer IC or microcontroller is used in this circuit according to precision.

Instead of using any controller we had used the logic of comparator for analogous control of water pump. The sensor thermistor is used to sense the temperature of water. The current of the thermistor is compared with fix voltage level.



V Benefits

Solve the problem of turn ON-OFF the pump at the time. It can be automatic turn on while temperature of water reduces to certain level. Automatic turn of when water temperature increases up on desired temperature. No operation at no sunlight and weak light for water heating. No malfunctioning at night. Over heat protection. Energy saving of pump with accurate control. Easy, cheap and beneficial technology.

VI CONCLUSIONS

If we use smart control of heater with temperature control as well as monitoring of heat than purpose of automation is fulfill. We have to place continuous monitoring on the input and output water temperature and compared each other. Comparisons are based on the current because of temperature change place according to resistance. Solve the problem of turn ON-OFF the pump at the time. It can be automatic turn on while temperature of water reduces to certain level.

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