Abstract

One of the most popular and simplest ways for utilizing solar thermal energy is the solar water heating system. These systems are favored primarily due to their low capital investment as well as low maintenance cost as compared to other conventional ones. The consumption or requirement of hot water is greatly varied depending on its use, e.g., domestic or industrial and also on seasonal variations, e.g. summer or winter. The required quantity or temperature of hot water is primarily governed by the type of application such as washing, bathing or an industrial process. It is difficult to operate a solar water heating system naturally to fulfill the hot water requirement at a particular required temperature continuously due to variation in incident solar radiation over a day or even in different seasons of the year. Hence, an auxillary heating system need to couple with the solar water heating systems to get a constant temperature output water. However, the share of water from both the systems for constant temperature output can not be done without using an automatic mechanism which can continuously monitor the temperature of hot water output. This mechansim can intelligently take measures for switching on or off a secondary source of water supply for getting the intended output. A smart controller is expected to serve this purpose effectively in terms of providing required quantity of water at desired temperature continuously as per users' need.

This work deals with the designing of a control mechanism in which water temperatures at the outlets of two systems, viz. primary (solar water heating system) and secondary systems, will be continuously monitored. DS18S20 temperature sensors are used which uses the exclusive 1-Wire bus protocol and implements bus communication using one control signal. Based on these sensed temperatures, along with the water flow rates from the two systems, a microcontroller estimates and displays the required mass flow rate for obtaining hot water at the desired temperature at the delivery outlet. The necessary programming for the microcontroller has been carried out in Mikro C environment. The actuating signal from the microcontroller drives a stepper motor depending on the mass flow rate. Thus, this mechanism is a fruitful solution to the problem of obtaining warm water at a desired temperature and fulfilling the temperature specific operations as it estimates the amount of cold water to be supplied from the secondary source. Further, the energy consumption can also be reduced by implementing the hybrid mode (that is the solar water heater and the electric heater), as the water will be already preheated by the solar water heater and so the expenses on electricity by using the electric heater are curtailed. Hence this is an energy efficient mechanism and helps in conserving the conventional energy sources.