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Solar Water Heater Using an IoT

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Abstract: Traditional water heaters use a lot of electricity to heat water. Traditional water heaters require a heating coil to heat water, which uses at least 2000 watts. It also requires human intervention. For this reason, we utilize solar energy. Solar energy is not only a clean and renewable alternative to fossil fuels, but it is also environmentally friendly, has a wide range of applications, and has low maintenance costs. Therefore, the aim of this project is to convert solar energy into electrical energy and utilize solar energy to heat water. The solar hot water system includes IoT, solar panels, various modules and various sensors. Based on this measurement, we provide a smart hot water system through a combination of Internet of Things technologies and business processes and decision support systems. Maintaining a traditional water system is inconvenient but often effective when regular human intervention is required. In this project work, the complete workflow of the system is presented.
Keywords: Internet of things (IoT), Flat Plate Collector, Blynk, DS18B20, Automatic system, Microcontroller, PV panel

I. INTRODUCTION

Conventional water heaters consume significant electricity for heating water. They typically use heating coils with a minimum power rating of 2000 watts and often require manual intervention for temperature control. This project addresses these limitations by introducing a smart solar water heating system powered by renewable solar energy. The proposed system eliminates the need for manual operation. It automatically regulates the water temperature using sensors and a microcontroller unit. Additionally, the system integrates with a mobile application, enabling users to monitor and control the heating process remotely. This translates to increased user convenience and potential energy bill savings through intelligent scheduling. The proposed system removes the necessity of manual intervention. It automatically regulates the water temperature using sensors and a microcontroller unit. Additionally, the system integrates with a mobile application, enabling users to monitor and control the heating process remotely. This translates to increased user convenience and potential energy bill savings through intelligent scheduling

II. II.RELATED WORKS

1) Monitoring and Controlling of Solar Watered Pumping using Arduino (B. Sujatha et al.) explores a similar system using Arduino for controlling water pumps in solar water heating applications.
2) Smart Water Heater System Monitoring and Controlling Using Arduino Board (Khalifa Dai Elnour) focuses on temperature monitoring and control for minimizing energy waste in water heaters with Arduino.
3) An Iot Based System for Improving the Solar Water Heater (Chanda Ellis et al.) investigates the impact of absorber plate design on solar collector efficiency in IoT-based solar water heaters.
4) Automating a solar water heating system (Wassima Ait Ahmed et al.) evaluates the effectiveness of adding controllers to manage key parameters in solar heating systems for improved efficiency.

These studies highlight the growing interest in developing smart and efficient solar water heating systems. They also identify areas for further research, such as optimizing sensor calibration, exploring alternative control algorithms, and integrating advanced features like predictive maintenance.

III. III.METHODOLOGY

A. System Components

The proposed system comprises several key components:

1) *Solar Collector:* Absorbs the solar energy and it converts into heat.
2) *Temperature Sensor (DS18B20):* Measures the water temperature in the storage tank.
3) *ESP8266 Microcontroller Unit (MCU):* Acts as the system's brain, processing sensor data and controlling the relay.
4) *Relay Module:* Switches the heating element on or off based on MCU instructions.
5) *Mobile Application:* Provides a user interface for remote monitoring and control.

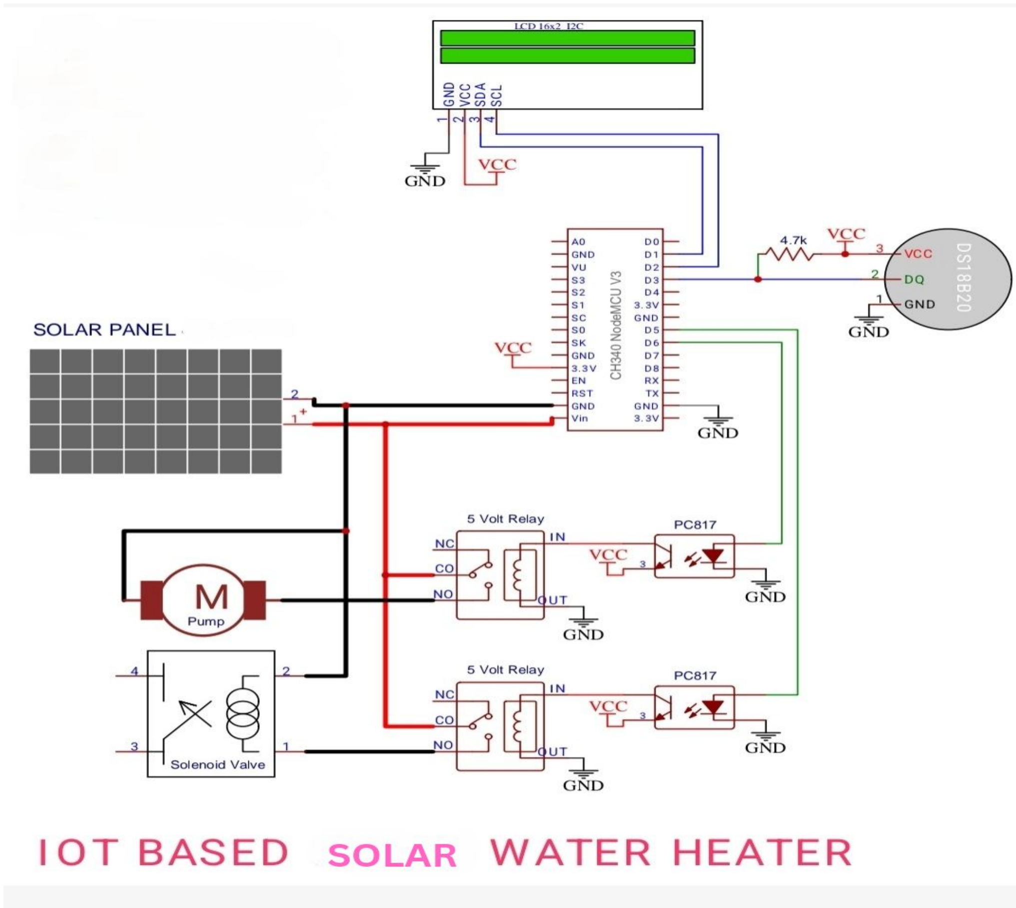

Fig.1. Schematic diagram of controlling and monitoring of Solar Water heater using an IoT

B. Block Diagram (System Operation)

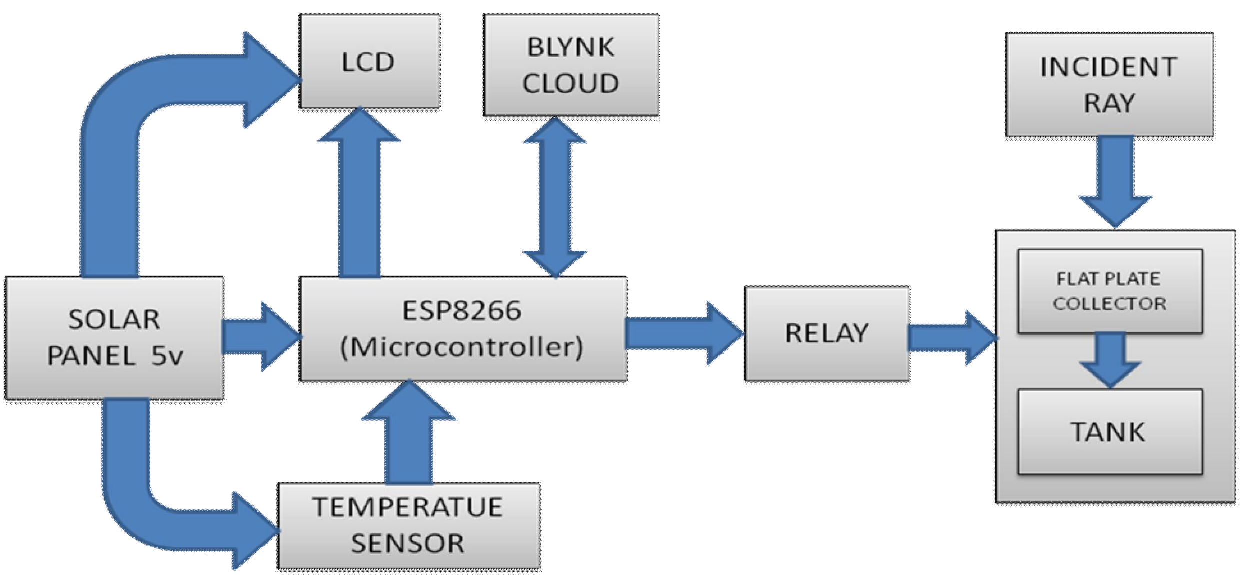

Fig.2. Block Diagram

The system operates as follows:

1) The temperature sensor continuously monitors the water temperature in the tank.
2) The sensor data is transmitted to the ESP8266 microcontroller unit.
3) The MCU compares the measured temperature to a user-defined set point.
4) If the temperature falls below the set point, the MCU (Microcontroller Unit) activates the relay, turning on the heating element.
5) Once the desired temperature is reached, the MCU (Microcontroller Unit) deactivates the relay, turning off the heating element.
6) The mobile application allows users to remotely monitor the water temperature and adjust the set point as needed.

IV. EXPERIMENTAL CONDUCTION

Fig.3. Solar Water Heater using an IoT

V. RESULTS AND DISCUSSION

The implemented system successfully demonstrates automatic water temperature control using a solar water heater. The temperature sensor provides real-time data that is used by the MCU (Microcontroller Unit) to regulate the heating process. The mobile application offers a convenient platform for remote monitoring and user interaction

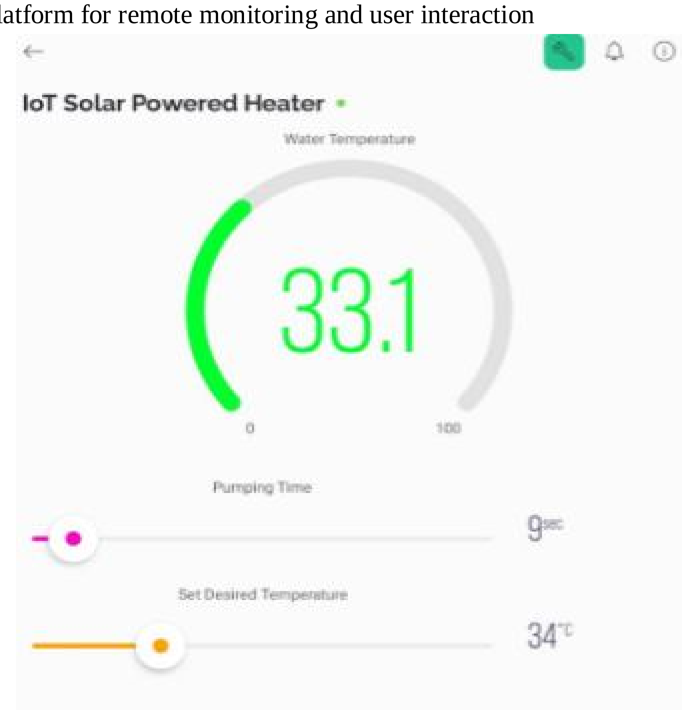

Fig.4. Controlling of the system (pumping time and set desired temperature) through Blynk app

Fig.5: Temperature is displayed on LCD

Fig.8 shows the monitored (current temperature and required temperature) of solar water heater using IoT. The required temperature has been set to 35 degree Celsius and the current temperature of heater is 29 degree Celsius. Initially, the pump is in idle condition and the pumping time is also monitored and displayed on the LCD.

VI. APPLICATIONS

This smart solar water heating system holds promise for various applications, including:

1) Residential buildings
2) Hostels
3) Hospitals
4) Chemical industries (for monitoring and maintaining fluid temperatures in large tanks)
5) Nuclear power plants (for critical temperature control in fluid-filled tanks)

VII. CONCLUSION AND FUTURE SCOPE

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4) Chemical industries (for monitoring and maintaining fluid temperatures in large tanks)
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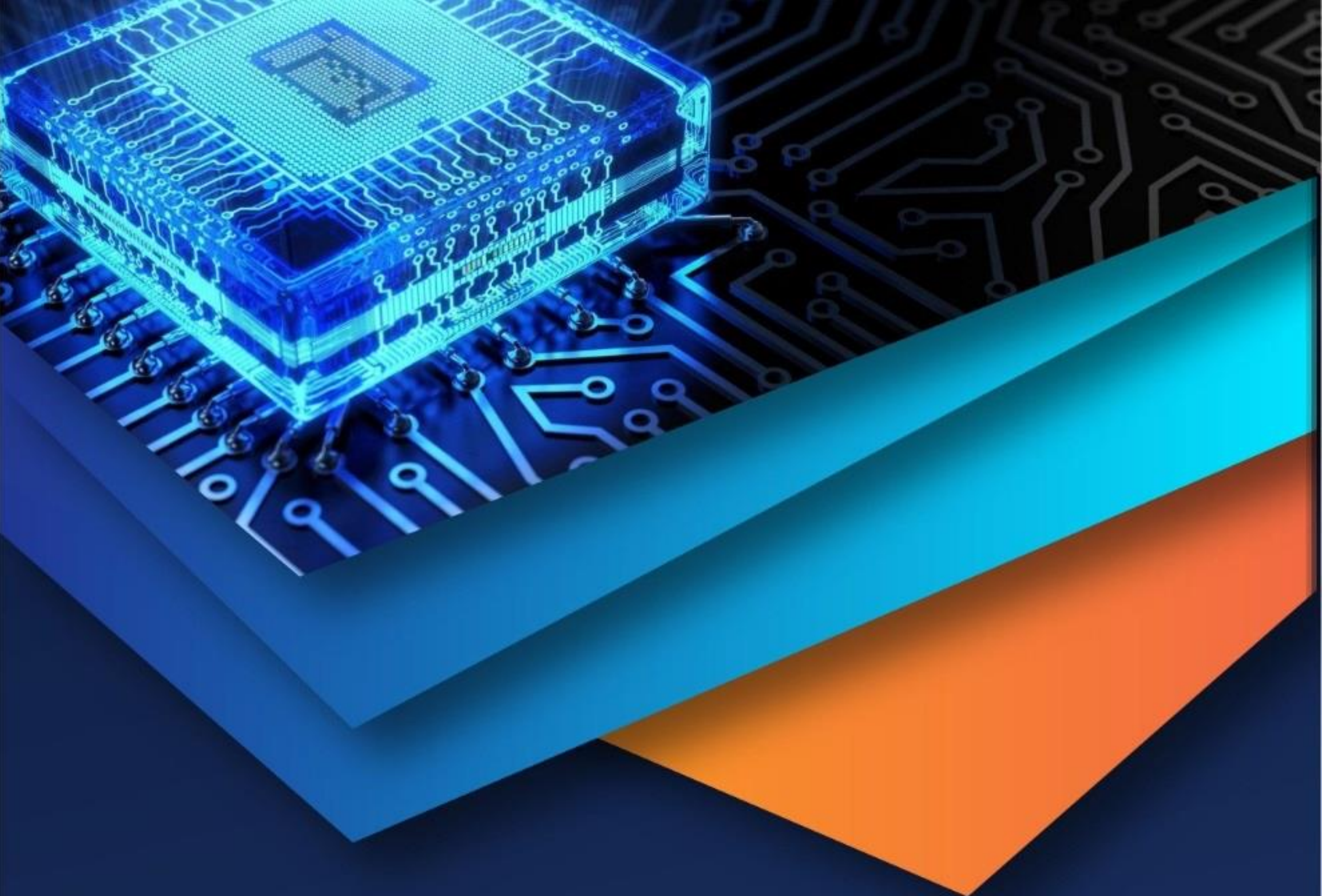

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