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Design And Implementation Of IoT Based Smart Water Heating System

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Abstract

Water is an essential resource for life and it is now a matter of important day. This problem affects various processes such as water management, water consumption, distribution, system detection and equipment maintenance. Based on this measurement, we offer a smart water heating system by connecting the Internet of Things technology with the combination of business process and decision support systems. We provide architecture to detail physical scene where we will examine our implementation. It is uncomfortable and often effective for periodic human intervention to maintain for the any traditional water system. This paper presentation will present the system's complete working process. In the introductory, there describe the details of the system, the purpose of the system, scope and justification of the system. There have some literature reviews about the relevant projects in relevant fields, which are reviewed and described soon. There are detailed descriptions of the work flow of the procedure section which are strictly followed during the project completion. Need Analysis, design and development hardware needs, software requirements, block drawing, description of the material used in the project, circuit diagrams and flotation discussions.

Keywords: Wireless Sensor Network (WSN), water parameters, Internet of things (IoT), WI-FI.

I. Introduction

Water is an essential resource for all life on earth. Accommodation in general water heating system inconvenience. System requires human intervention. Water heating with solar system is now a major problem in housing in rainy season. This issue affects various processes such as water heating, water consumption and maintenance of system detection and equipment. Sometimes the water is not heated as per requirement and it is inconvenient. In the previous method, the employee will go to check temperature of water tank and open the valve for a fixed period for further use, then the employee will go to the same place and stop the valve and the time will be lost. The proposed system is fully automatic. Here people are saved in the work and time. So we provide an automatic water heating system which acts as an automated system.

It replace the conventional geyser thermostat with an intelligent digital system that allows one to program switching on/off in a geyser, as well as a geyser temperature. As per our research Hot water cylinders (geyser) contribute to between 40 and 60 percent of your energy bill when in good sound condition. This system can save the electricity bill by intelligent scheduling of on/off the geyser. This intelligent controller is designed to control our geyser more smartly such that it manages to fulfill its purpose from both an energy and economical point of view[4]. The scheduling of geyser on/off is done by using a mobile application. In this paper we have tried to show how easily Internet of things IoT can be implemented for give the comfort to user by make it remotely accessible to user from anywhere in the world. Any device can be made remotely accessible using proper communication medium. We are using the online sever or web page to store information accessible to both our user and device itself. We have integrated this web based controlling mechanism with intelligent hot water controller.

II. Literature Review

Wireless sensor networks are also known as “wireless sensor and actuator network (WSAN)” that is a network containing" distributed sensors" to observe the environmental or physical situations like pressure, sound, temperature, etc. This system contains a gateway, which offers connectivity to the used world and distributed nodes, which can transfer the information through the network to main position [1].

The existing networks are bidirectional in nature and enable the sensor activity. This system consists of different water parameters. The microcontroller processes the data. At last data from the sensors is viewed on the web server. Water heating for domestic purposes is a simple and effective way of utilizing solar energy. It is a natural solar thermal technology. In rainy days it difficult to get the hot water from solar. Smart Water Heating system is an extension of intelligent hot water controller also it provides comfort to the user[2].

In the last decade, water demand has increased in India. The rising demand for water supply has become a big challenge for the world. The use of water, climate change and misuse of the city also reduced resources. Reservations and management of resources are of great importance. In this paper, we present an IOT design for water monitoring and control systems that support Internet-based data collection on a real-time basis[10].

III. Methodology

A) Implementation:

Microcontroller (Raspberry 3 B) communicates with NodeMCU via web communication. We configured NodeMCU as slave and microcontroller as a master. The sensor values received to the slave will send it to the master. NodeMCU has an ESP8266 Wi-Fi module which helps in connecting to a local router. This router then connects to internet and uploads these sensor values to the ubidots cloud platform. We can access this cloud platform from anywhere in this world simply by logging into our ubidots account. The WI-FI module used in this project that is ESP8266. It follows TCP/IP stack and is a microchip which is less in cost. This microchip allows the microcontroller to connect to a WI-FI network, by using Hayes style command connections are done or made through TCP/IP connection. ESP8266 has 1MB of built-in flash, single chip devices able to connect WI-FI. If systems are the manufacturers of this module, and it is a 32-bit microcontroller. There are 16 GPIO pins in this module. This module follows the RISC processor. It has 10 bit DAC. Later Espress if systems released a software development kit(SDK) which is used to programmed on the chip so that another microcontroller is not used.[5]

B) Block Diagram and Description :

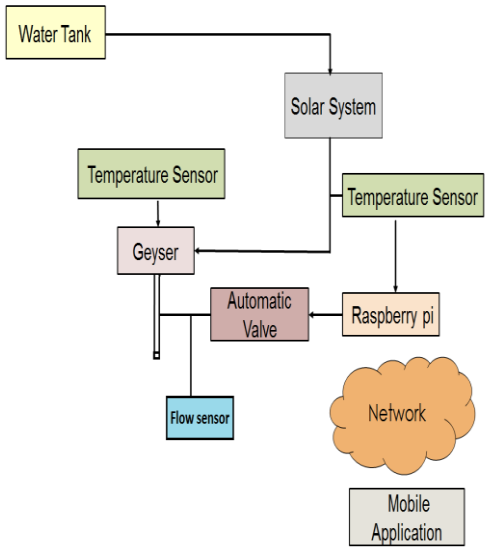


Fig 1: System layout/block diagram

Work Flow of the system:

In our project we design a system which intelligently handles the working of geyser that is on/off which provides comfort to user. Smart Water Heating System is system in which the outlet pipe of solar is connected to geyser because in rainy reason due to the lack of solar energy the solar water is not heated. To solve this problem we are designing this system. The sensor assembly is connected to the outlet of solar and geyser to monitoring the temperature of solar water and geyser for decision making. Automatic valve is used for avoid the wastage of water for automatic control. The system is controlled through mobile application and also online server or webpage is used for store information accessible to both our device and user its own. It can be further explained as system in manual mode and system in automatic mode.

i) Manual mode:

In this mode of operation the system will operate on commands of a user. A decision of turn ON/OFF of the system, giving signals to geyser by checking temperature on mobile/web server display is obtained by user only.

ii) Automatic mode:

In this mode of operation the system will operate on its own. The automatic mode is set through a program where the raspberry pi(main controller) will read data from an excel sheet. The excel sheet will contain the data of system turn on and turn off time, quantity and flow of water on users requirements. For example, the excel sheet is shown in following table. Where, column A consists of names of users, column B for turn ON the system, column C for water temperature corresponding to users and column D for quantity of the water.

Table 1: Excel Data Sheet

	A	B	C	D
1	Name	Time	Temp	Quan(Ltr)
2	A	6	30	5
3	B	7	35	5.5
4	C	7	30	6
5	D	8	33	4.5
6	E	9	32	5
7	F	10	25	6.5

c) Components:

1. Raspberry pi 3 b:

Specifications:

- SOC: Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SOC.
- RAM: 1GB LPDDR2 SDRAM

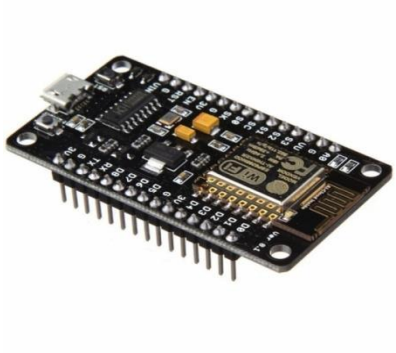
- WIFI: Dual-band 802.11ac wireless LAN (2.4GHz and 5GHz) and Bluetooth 4.2 .
- USB 2.0: 4 ports
- GPIO: 40-pin
- Operating system support: Linux and Unit.

2 .NodeMCU Wi-Fi Module (ESP8266):

Specifications:

- The WI-FI module used in this project is ESP8266. It follows TCP/IP stack and is

a microchip which is less in cost.



- It is a 32-bit microcontroller. There are 16 GPIO pins in this module.
- This module follows the RISC processor. It has 10 bit DAC.
- I2S, UART are used for communication

3. DS18B20 Sensor:

Specifications:

- Programmable Digital Temperature Sensor
- Communicates using 1-Wire method
- Operating voltage: 3V to 5V
- Temperature Range: -55°C to +125°C

- Available as To-92, SOP and even as a waterproof sensor

4. Solenoid Valve :

Specifications:

- Operating Pressure: 0-150
- Operating temperature: 14 to 176
- Body material: Stainless still
- Coil power: 20W

5. Flow Sensor:

Specifications:

- Working Voltage: 5 to 18V DC (min tested working voltage 4.5V)
- Maximum water pressure: 2.0 MPa
- Max current draw: 15mA @ 5V
- Output Type: 5V TTL
- Working Flow Rate: 1 to 30 Liters/Minute
- Output rise time: 0.04us
- Output fall time: 0.18us

- Working Flow Rate: 1 to 30 Liters/Minute
- Accuracy: ±10%
- Output duty cycle: 50% +-10%

D) Iot Implementation:

Microcontroller (Raspberry 3 B) communicates with NodeMCU via web communication. We configured NodeMCU as slave and microcontroller as a master. The sensor values received to the slave will send it to the master. NodeMCU has an ESP8266 Wi-Fi module which helps in connecting to a local router. This router then connects to internet and uploads these sensor values to the ubidots cloud platform. We can access this cloud platform from anywhere in this world simply by logging into our ubidots account.

IV. Results

We implemented our proposed system, where the water temperature is measured with temperature sensor. This information is analyzed and maintained automatically with the help of our project. The below figure is obtained in the ubidots cloud platform, where user can access this data for further use. Where there is a temperature value display of solar water, and two other switches for turn On/OFF of geyser and automatic valve. This switches are for the manual mode otherwise in automatic mode this switches are turned on and off by the program itself.

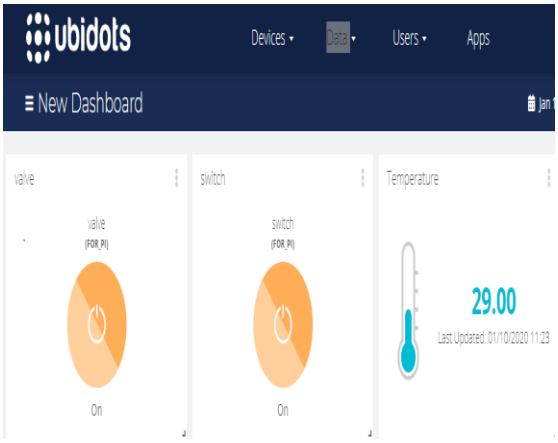


Fig 2: Ubidots Dashboard

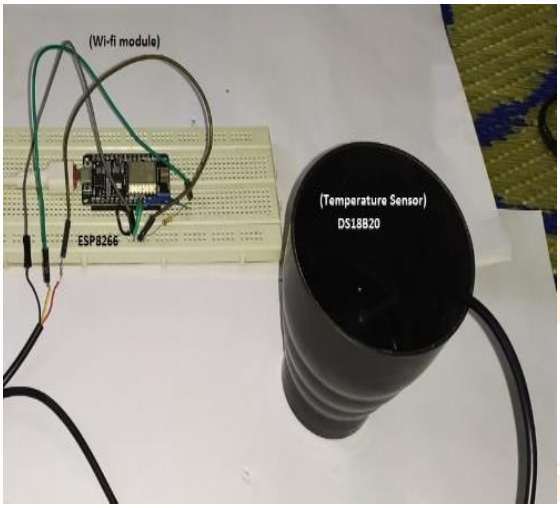


Fig 3:Interfacing the temperature sensor (DS18B20) with WiFi module (ESP8622)

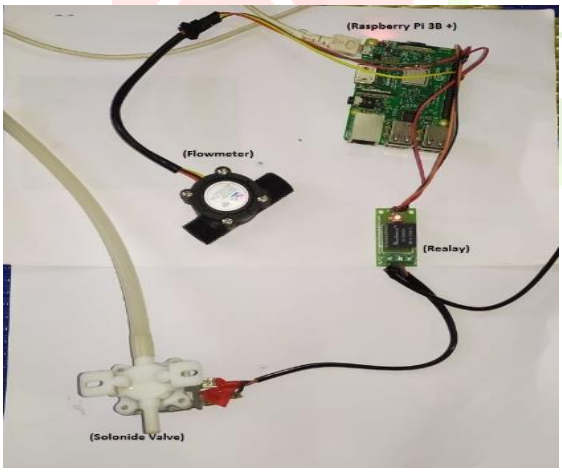


Fig 4:Interfacing raspberry pi with solenoid valve and flow-meter

V. Conclusion

Our intention of this research work was to establish a flexible, economical, easily configurable and most importantly, a portable system which can solve our water heating system problem. It is a robust system and small in size. Our proposed system comes under the field of Internet of Things (IoT). Our main objective was to design a smart system for approximating the water heating system and prevent wastage or analyze the water usage. This analyzing feature can also help us in finding whether water is sufficiently hot or not in the tank. Nowadays liquid this system is vtal in many industries too like oil, automotive etc. Using our smart system we can analyze the usage.

VI. Application

Areas as its title suggests, it can be very well used for the residential colonies, hostels, hospitals etc. This system can be used in chemical industries where fluids are filled in big tanks and their monitoring is required. It can also be used in nuclear plants where monitoring fluid filled tanks is mandatory as well as should be optimized.

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