Smart Water Measurement System

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***Abstract**- Water has been a major crisis in today's world. The flow sensor is connected across the water pipeline. According to the flow sensor specification, 450 pulses make one litre in the flow sensor and the data is uploaded to Thingspeak IoT Analysis Database. The uploaded data can be subsequently viewed in an android app. Automation that will be implemented here can do justice to each and every citizen in India. The flow of water can be monitored continuously and the information can be sent periodically to the user and the Corporation. So, reliability can be obtained by automation in this field. This could be the small step in the implementation of the concept of 'Smart Home'.*

Keywords- Android App, Esp8266-12E, Flow Sensor, IoT, Liquid Crystal Display, Thingspeak, Thunkable.

I. INTRODUCTION

Water and electricity are the most basic resources for human survival in this world. In India, the design of water supply systems has been done using certain standards. It is estimated that for communities with a population of between 20,000 to 1,00,000 — 100 to 150 litres of water per head per day is used and for communities with a population over 1,00,000 — 150 to 200 litres of water per head per day is used [1]. A tax paying system is followed in India wherein the tax is paid depending upon the number of members in each individual house and not depending upon the usage of water. In the proposed system, the user can pay the water tax based on the usage of water[2].

II. LITERATURE SURVEY

Design of Smart Sensors for Real-Time Water Monitoring System proposed by Niel Andre Cloete, Reza Malekian, and Lakshmi Nair uses Zigbee module which can transmit data only for a limited distance. Hence Internet of Things is not used and is not accessible over long distances.

IoT Based Water Management System for Smart City by Patawala Amatulla.H, Bansode Navnath. P, Bhong Yogesh, Prof. Zadbuke Ashwini. S proposes to use Arduino microcontroller and WiFi module which increases the cost of the overall product. Hence using a single microcontroller with WiFi module will reduce the cost effectively

A Low Cost Water Meter System based on the Global System for Mobile Communications by Peter Mwangi, Elijah Mwangi, Patrick M. Karimi proposes to use Global System for Mobile Communication. It is not effective for updating real time data. It is also not cost effective as a separate cost is charged for each message.

III. METHODS AND MATERIALS

The water flow is measured using the flow sensor and the pulses are converted into litres. It is displayed in the Liquid Crystal Display for every 0.10 litres. An LCD with I2C Controller is used to minimize the data lines to the controller. The Hardware is connected to the Internet using the ESP 8266-12E WiFi module. The data is uploaded to the Thingspeak Server for every 1 litre. A mobile app created using Thunkable tool is used to view the real time usage of water.

A. MEASUREMENT OF WATER

The Flow Sensor YF-S201B works based on Hall Effect. According to Hall Effect, when a magnetic field is applied in a direction perpendicular to the flow of current, a potential difference is produced[3]. Hence, when water flows through the sensor it induces a potential difference in a direction perpendicular to the flow of current producing pulses[4]. The quantity of water is measured by counting the pulses with the help of a controller. According to the specifications, production of 450 pulses accounts to 1 litre of water[5].

The quantity can be measured as,

$$\text{Litres} = \frac{\textit{Pulse Count}}{450}$$

The

The data hence calculated are displayed in the LCD for every 0.10 litres. Everytime the quantity reaches 1 litre, it is uploaded to the Thingspeak servers.

B. BLOCK DIAGRAM

The block diagram for smart water measurement system is shown in figure 1. The system is designed to measure the usage of water in day to day life. Water flow is measured using the obtained pulse from the flow sensor. The values are also periodically updated to the database.

The pulses can be converted into litres using a microcontroller. The intended model uses the microcontroller based on ESP8266-12E. The flow sensor is YF-S201B and an I2C attached Liquid Crystal Display is used. The complete system is powered by a battery that can be replaced. The Figure 3.1 shows the block diagram of the system. When the water enters the flow sensor, the rotor rotates at a speed equal to the speed of the flow of water. According to Hall Effect the rotation of rotor induces an electric current in a direction perpendicular to the flow of water. This creates a pulse which is given as an input to the ESP8266-12E through a 10K resistor. The resistor is added to reduce the voltage from the flow sensor output and to protect The WiFi module is controlled in the ESP8266-12E. The SSID and the password of the network to be connected is given in the code. The ESP8266-12E WiFi module must be connected to a private network. It is not mandatory that both the WiFi module and the mobile must be connected to the same network. The Thingspeak IoT analysis tool also provides a graphical analysis of the water usage.

C. FLOWCHART

The ESP8266-12E microcontroller is programmed based on Arduino IDE. Arduino IDE is an open-source software that is used to program many development boards.

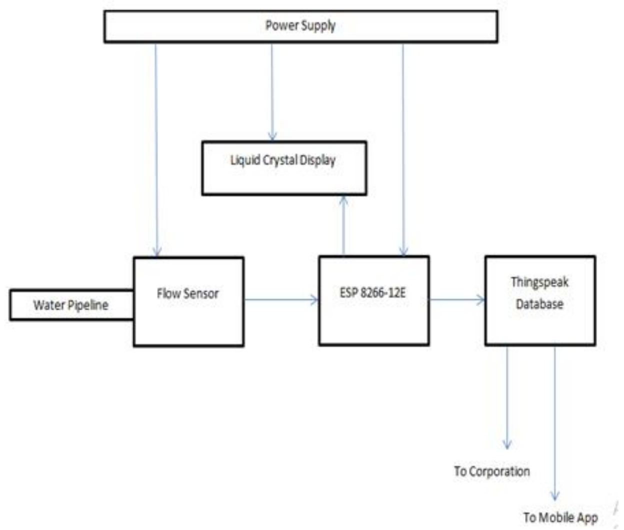

Fig. 1 – Block Diagram of Smart Water Measurement System

the microcontroller from getting damaged. To reduce the data lines I2C bus is used. The I2C controller has two data pins viz., SDA and SCL connected to the ESP9266 – 12E. The LCD displays the water usage per 0.10 litres and it is uploaded to the Thingspeak database per litre. This provides enough time for the database to get updated and for the user to view the real time data in the mobile app. This process runs on a loop and when the counter reaches a value of 450, the value 1 is uploaded to the database. In the next 450th count, the value 2 is uploaded to the database. Using WiFi function, the WiFi is enabled in the ESP8266-12E.

The pulses are counted by enabling the interrupt function of the microcontroller. That is, when a pulse is detected the interrupt is enabled and the counter value is incremented by one. Hence the data is transmitted through the private network. The value is updated only when it is connected to the WiFi. If it is not connected, the module tries again and again to connect to the network. The integer value that is to be uploaded to the database is converted to string and then uploaded. The integer value cannot be directly uploaded. The client i.e., our module requests the server to print the data in its database.

Hence the URL of the database is attached in the program. The Thingspeak server has the write and read API keys to write to and read from the database respectively. The figure 2 shows the flowchart of the program.

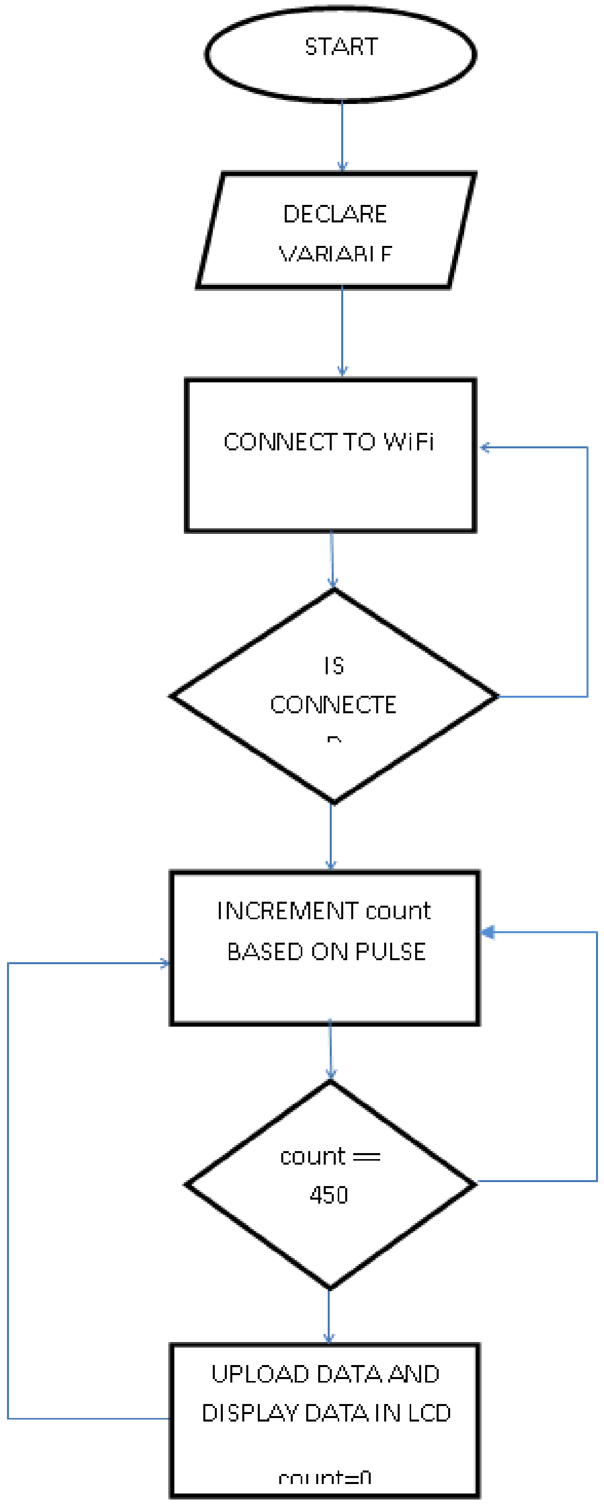

Fig. 2 Flowchart of Program

D. TOOLS ADOPTED

(i) THINGSPEAK IOT ANALYSIS TOOL

Thingspeak is an open source IoT analysis tool developed specifically for projects based on Internet of Things. It is basically a database that is used to upload and retrieve data. Specific 'Channels' are created for each module of the project. Each channel consists of 'Fields' which contains the data uploaded. It works on Application Program Interface which helps to write and read data from the servers. The write and read functions are done using the write and read API Keys. These API Keys are used in the embedded program. All the data are also encrypted and each user is provided with a secure account. The Thingspeak database also plots a graph for the data uploaded.

(ii) THUNKABLE APP DEVELOPMENT TOOL

Thunkable is also an open source app development tool similar to MIT Appinventor. The only difference is that Thunkable has a good user interface for the apps created. It has a designer tool and a block tool i.e., Front End and Back End respectively. The designer tool is used to design the UI for the app. It has buttons, textbox, and all the other design options. The Blocks tool is used to design the working of the app. The structure is similar to coding of an app but in blocks. The blocks tool define the behaviour of the app.

IV. RESULTS AND DISCUSSION

A. IMPLEMENTATION USING THINGSPEAK IOT ANALYSIS TOOL

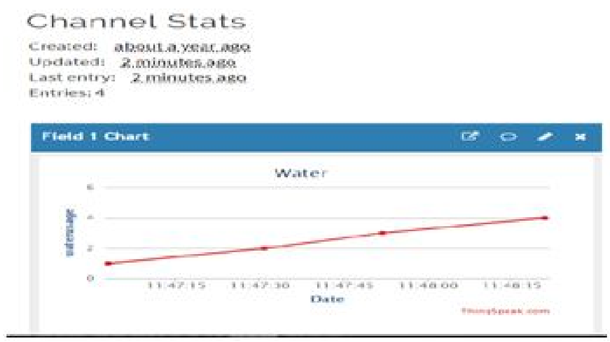

Fig. 3. Thingspeak Chart

The Figure 3 shows the Thingspeak Chart. The Thingspeak IoT Analysis tool displays a chart that shows the real time usage of water and the previous usage of water along with the date and time of usage. With the uploaded data, a chart as shown above is created.

B. MONITORING USING MOBILE APP

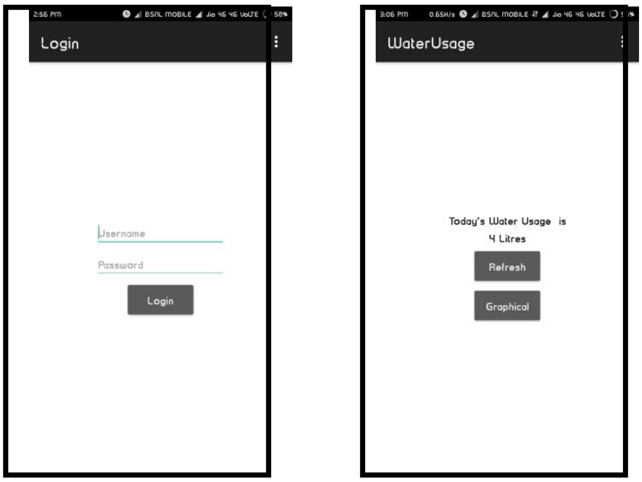

Fig. 4 Mobile App using Thunkable tool

The Figure 4 shows the mobile app. The mobile app has a login screen by which each user can login into his/her account. The next screen shows the real time water usage till date. The mobile need not be connected to the same network as that of the WiFi module.

V. CONCLUSION

The proposed method holds good for real time IoT projects. It uses all the necessary components required for the development of Smart Home. One of the primary advantages of this proposal is that it is cost effective. This could be further improved by the addition of leakage detector and water quality measurement system.

REFERENCES

[1] Peter Mwangi, Elijah Mwangi, Patrick M. Karimi, “A Low Cost Water Meter System based on the Global System for Mobile Communications” International Journal of Computer Applications (0975-8887) Volume 142 – N0. 12, May 2016

[2] Patawala Amatulla.H, Bansode Navnath. P, Bhong Yogesh, Prof. Zadbuke Ashwini. S, “IoT Based Water Management System for Smart City” International Journal Of Advance Research , Ideas And Innovations In Technology(ISSN: 2454-132X) Volume3, Issue 2, 2017

[3] Niel Andre Cloete, Reza Malekian, Lakshmi Nair, “Design of Smart Sensors for Real-Time Water Quality Monitoring” Department of Electrical, Electronic and Computer Engineering, University of Pretonia, Pretonia, 0002, South Africa, 2016

[4] M. Abinaya, R. Uthiradevi, “Intelligent Vehicle Control Using Wireless Embedded System in Transportation System Based On GSM and GPS Technology” International Journal of Computer Science and Mobile Computing, Vol. 3, Issue 9, pp. 244-258, September 2014

[5] C. Udhayakumar, M. Ishwarya Niranjana, R.Gowrimanohari, E. Arun kumar, “Design of various Logic gates and Multiplexer in QCA” in International Journal of Advanced Engineering Research and Technology, Vol. 2, Issue 7, pp. 265-269, October 2014