IoT Based Smart Water Meters and Tap Leakage Detection

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Abstract: *In the Previous year in Pune and all over in Maharashtra, India. There was the problem of shortage of Water during the sunny days while some of the Societies will flooding with full of water because of they are situated nearby Corporation so those societies are wasting so much water even if someone doesn't getting a drop of water then also. But using the IoT Based smart water metering and tap leakage detection system it is easy to detect usage of water and force of water of each and every home from the Municipal Corporation Building Via the cloud. It is the modern Digital Metering system for measuring the force and total usage of Water consumption of each and every home with the tap leakage detection digitally and automatically triggering the main Water inlet if there is excess use or the leakage in the tap. We believe that using this technology user will use less water and they will avoid the wastage or misuse of water.*

Keywords: Thingspeks Cloud, ESP8266 WiFi, API Keys

1. Introduction

Water "Water is a Life" of the human being. When it comes to its proper usage then it will reach us up to the crest but its wastage is very Costly for economically as well as by Humanity point of view. Pune Municipal Corporation spends about 100 Million Rupees every year on Filtering and purification of water for the commercial and home use [4]. In addition, they spend about 10-15 million rupees on the maintenance and repairing of those traditional Analog Water meters .Then also the Department of Water supply section gets less revenue on its various Taxes of water from the public and or from the industry because they have set a fixed billing method for every user for unlimited usage of water. So that people thought that why I use less water even if i save the water but our colleague is wasting the water then also both we are giving the same bill so why i save the water.

But these IoT based Smart water meters are made to track the usage of water with force and total usage of water digitally for each and every Homes and societies by processing the real time usage of water data and billing to the respective user according to its usage. With this system user needs to pay for its usage only, not like a traditional fixed rate Tax. So that the user will use the water carefully and the situation like shortage or Wastage of water will not be there because of per/lit billing.

Also in traditional analog meters there is no facility of Tap Leakage detection but using the digital meters we can be able to track the Leakage and it is easy to find as well as this technology will also save the water because of leakage by closing the main inlet automatically if this situation occurs[5].

Because of the digital system we can get the real time notification updates on our android phone about over usage of water as well as about the Leakage. The Billing system is also the digital by using Online billing to save the paper and to make system green and paper friendly.

2. System Description

In this system we will install these Smart water meters to each and every home and in the Society. And these water meters are connected via the Internet enabled WiFi Router which will takes the data from those smart water meters and send it to the Cloud.

The water meter consists of Microcontroller, Smart Intelligent Nextion HMI Display for GUI, Water Solenoid Valve, ESP8266 WiFi Module, DFPlayer for Narrators Voice based notification. System will takes the data from Water Flow sensor and send it to the Microcontroller and microcontroller will process this incoming data and send it to the Display unit and to the WiFi Module, WiFi module then send this data to the Thingspeks cloud using the http protocol [1]. It will send the Total usage of the water as well as the current force [2] of water to the cloud in Thingspeks cloud they have built in Matlab Analytics tool so we can save this data there in cvc format or by using the Things HTTP tool we can send this live data values from thingspeks cloud to the our personal website or to the PMC Municipal Corporation website for Generating the Digital bill of water usage.

As this website is build using the PHP and Bootstrap it is the mobile resolution friendly website so the user can get to know there bills using this this website. Also by sharing the data base of this website to the Android app of this system user will get to know the real-time notification about the Tap leakage detection as well as the over usage of the water .
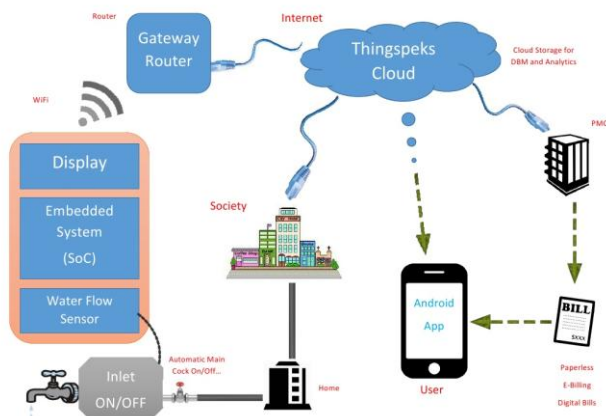
2.1 System Block Diagram

Figure 1: Block Diagram

2.2 System Hardware Design

2.2.1 Water Flow Sensor

The Grove water flow sensor is a hall-effect sensor which will gives the output Pulsating DC voltage values according to flow of water passes through it. By which we can able to measure the force of water and total liquid passed through it [6].

Figure 2: Water Flow sensor

2.2.2 Solenoid valve Main Inlet On/Off

The Solenoid valve is an electromechanical device which will controls the flow of water through it, like it may off the water flow across it when leakage and over usage condition occurs. It's nothing but our main inlet cock which will control the whole water supply to our home [8].

Figure 3: Solenoid Water Valve

2.2.3 ESP8266 WiFi Module

ESP8266 12E is a WiFi module which we have interfaced with our microcontroller using serial transmission line for data interface with Microcontroller and ESP module. In this module it has built in 32bit RISC Microcontroller with inbuilt TCP/IP Stack and inbuilt I2C, SPI, I2S, UART interface with any other external microcontroller and to sensors. We have user ESP module to communicate with internet over the http protocol using the gateways and routers to send the data to the Internet [7].

Figure 4: ESP8266 12E

2.2.3 DFPlayer Mini MP3 Module

The DFPlayer is a small MP3 voice and notification module which we will interface with the Atmega328 over a serial UART protocol Rx & Tx. It plays the MP3 extension files stored in its SD card. We store the Alert Voice message in SD card and play this mp3 when leakage and Over usage occurs to attract the attention of user towards alert message[9].
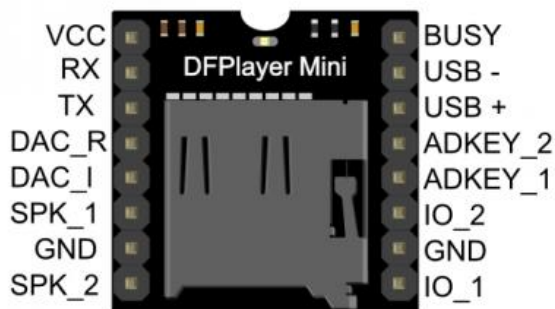

**Figure 5:** DFPlayer Mini MP3 Module

2.2.3 Nextion Smart HMI Displays

The Nextion smart Intelligent Resistive touch screen Displays we use in this system for the GUI to give total usage information and system setting through touch screen panel. This Display works on Serial line Rx and Tx Interface with Atmega 328

3. System Software

The system works on Internet of Things so it will gives the data to the Thingspeks server, the thingspeks server then send the Analytics and data further to the personal website and to the Android app using the Things HTTP tool.

3.1 Municipal Corporation Website

This website is Build using the PHP and Bootstrap techniques which takes the data values of Usage and Force of Water from the Thingspeks cloud and show it on to the logged in user's Dashboard with its Geographic location of water meter sensor where it has been installed. User can also view the Bill generates on this website
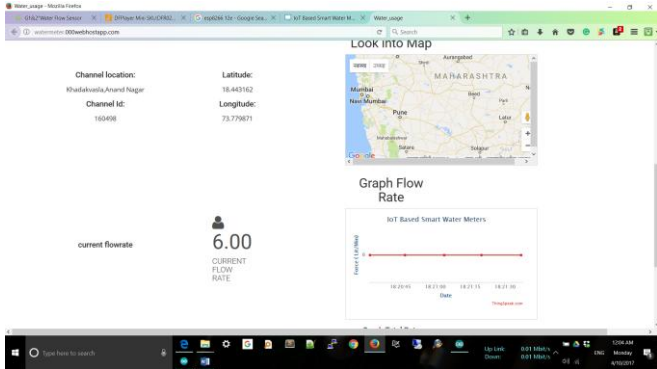
Figure 6: Website

3.2 Android Widget

With the available Android Widget of thingspeks we can use it for notification about the certain things happened in the system like Over usage, Leakage, Bill's Last date, New Billing Rates etc.


Figure 7: Android Widget

4. Result and Discussion of Result

The overall result shows the Data of Force of water and the Total usage of water on the Thingspeks cloud. With the graphical view. After the over usage it alerts the User via The Twillio SMS Service and by the sending Tweet. Well as locally it gives the Voice based notification alert to the user
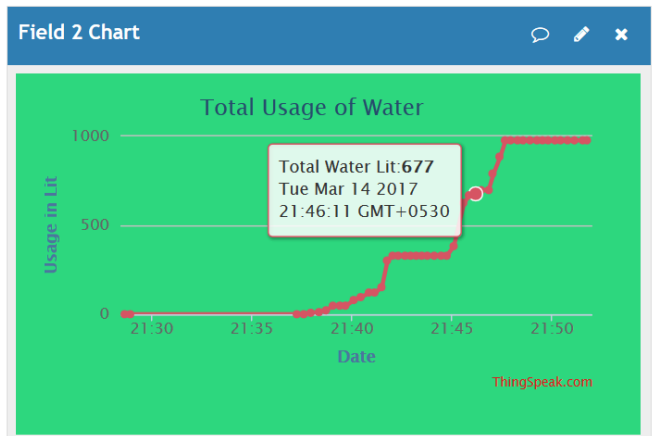
4.1 Force of Water

Result shows the data values of force of water on the Thingspeks Cloud
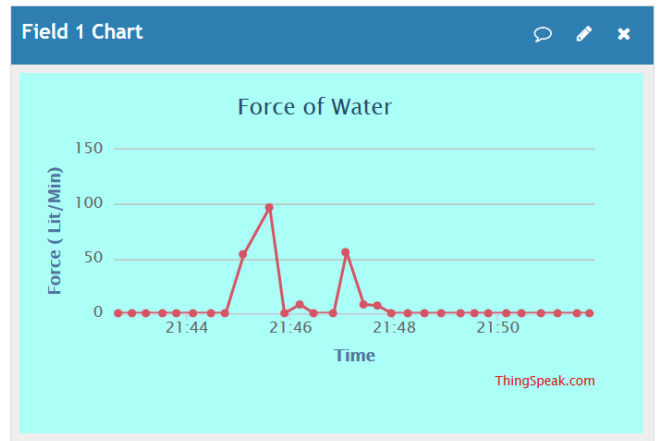
Figure 8: Force of Water data on Thingspeks

4.2 Force of Water

Result shows the data values of Total Usage of water on the Thingspeks Cloud .it shows the values are stay constant when there is no usage of water and it shows varying when someone is using the water

Figure 9: Total Usage of Water data on Thingspeks

4.3 GUI of the Nextion Display

On Nextion display we able to see the total usage of water consumption locally as well as we can able to control and set the associated peripherals of the system like Buzzer On/Off , Main Inlet On/Off . As well as we also get the Leakage detection of tap from the server [3]

Figure 10: Nextion Display

5. Conclusion

As this system is totally digital if there is any fault will happen in the system then it can be easily detected to the Main server as well as at the Municipal Corporation website so they can provide the onsite assistance immediately. As well as they can also be able to track the usage of each and individual costumer's Usage of water and generate the Bill according to their usage of water, so by that people can save the more water. As Well as if there is any leakage occurs then it can be easily detected to the main server from that they can be able to close the Main Inlet directly from the server to avoid unnecessary wastage of Water. This way this system very smart system over a traditional Analog Water meters.

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