NexMETAP Automated Water Meter

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Abstract-*The necessity of water is high now. It is great time we took strong and effective methods to conserve water and water bodies. First step can be a proper water supply system with automated water meter, bill calculation and control. In this paper, we are introducing an automated water meter which can be a primary solution to the problems with water supply and water billing.*

Keywords-- nexMETAP, water conservation, water meter, flow sensor.

I. INTRODUCTION

Nowadays, the water meter billing process is done by a meter-reader who comes to the consumers' house from the respective water authority offices. For reading the meter, he has to find where the water meter is located, and then he writes down the consumed water units and compares it with the previous unit and at last he writes down the cost of current usage's cost. Chances of errors are high in this case.

To avoid this complexity, we are introducing a new app called nexMETAP. nexMETAP is the next generation water meter that is used for reading the water usage automatically. Detailed information about the water consumption will be there in this app. Other services like bill payment, ownership change etc. can be done. User can disconnect the water supply remotely. Water authority can also cut the connection automatically if the customer fails to pay the bill.

Coming to the hardware section, with the parallel development of both sensor and wireless communication technologies in recent years, wireless sensor networks (WSN) has become popular in study area of electronics & computer science and preferred to use on different areas and applications such as military, health, industrial controls, fire brigade, and greenhouse and so on. Water distribution systems are one of these. WSN based monitoring systems implemented on water distribution systems are used world-wide.

II. WATER RESOURSES IN INDIA

Water is one of the most precious resources the earth provides to mankind. Its use in modern age is manifold. We drink water to satisfy our thirst. We use it for domestic needs, irrigation, industrial use, transportation, power production and waste disposal. Water is universal solvent.

Thanks to our nature; it is very rich in water. About three-fourth of the earth's surface is covered with water. But only a small portion of total water resources is actually available for human use. Majority, about 97.3% is present in oceans and is salty in nature.

The fresh water constitutes only 2.7%. Out of this, inland" surface waters i.e. lakes, rivers, and ponds account for hardly 0.02%. This relatively negligible portion of the earth's water is crucially important to all form of terrestrial and freshwater aquatic life. We get water mainly from three sources;

(i) Rain water.
(ii)Surface water
Impounding reservoirs
Rivers and streams
Ponds, tanks and lakes
(iii) Ground water
Shallow wells.
Deep wells.
Springs.

Rain water is the primary source of all waters. It is the purest form of water.

The average annual rainfall in India as a whole is estimated at 117 cm in a year. It is less than 20 cm in the part of the Thar Desert, more than 200 cm in eastern India and western coastal tracts of the peninsular plateau and between 50 and 200 cm in the rest of India.

The total rainfall is estimated at 400 million hectare meters and this is distributed in three important ways; 70 million hectare meters evaporate immediately; 215 million hectare meters percolate into the soil and help soil moisture and recharge ground water; and finally 115 million hectare meters run-off into surface water bodies like rivers. Water utilized was 38 million hectare meters in 1974 which is expected to rise to 105 million hectare meters by the year 2025.

The figures for the average amount of rainfall that many parts of India receive are quite meaningless since there is a lot of variation in the actual amount of rainfall received from year to year. The amount of rainfall varies from very heavy and scanty in different parts.

One-tenth of the country receives very heavy rainfall of over 200 cm annually, sometimes leading to floods while about one- third of the land has scanty rainfall of less than 50 cm and sometimes causing extreme drought conditions. Moreover the distribution of rainfall over a year is very uneven. The bulk of the rainfall is concentrated in three or four months of the year, mainly in summers. Water is needed for the cultivation of winter crops (Rabi).house.

III. LITERATURE SURVEY

This project aims at overcoming the disadvantages of the existing analogue water meter.

The major disadvantages of the existing system are:

Creepy water meter Reading: This is by far the most popular meter problem. Whether it is you or your local water company that is reading the meter, not all persons are aware of the correct way of reading a water meter. Knowing the right way to read the water meter can tell you how to locate leaks, conserve your water and monitor your water usage.

Air Accumulation Problem: Air pressure in the piping system can lead to major water meter issues such as erroneous water metering and damage to the internal components of the water meter. An air valve prevents air from travelling through the piping system and passing through the water meter. When public or private water supply is irregular or inconsistent, water channels through from upper levels of the distribution system and gathers in the lower levels. Air replaces the water drained from the upper levels. As soon as the water supply is restored, water refills the pipeline, moves the air, forcing air through the water meter, rotating the impeller and gears very quickly. Air flowing through the meter causes damage to its internal components and escalates its readings.

Uneven distribution of water: The analog meters which cannot keep the track of the amount of water supplied results in uneven distribution of water.

Hence there is a requirement in replacing the water meter with a SMART METER which is capable of overcoming the disadvantages mentioned.

IV. BLOCK DIAGRAM

Here we are implementing this technology to analyze the water consumption, with this technology it is easier for taking the water readings and it will also help us to automate our water consumption. With this we can measure the usage of water using the water flow sensor, and the sensor will feed signal to the ADC unit/or we can use hall sensor and the micro controller will calculate the usage. The water usage will be displayed in the 16*2 LCD display as well as to the Bluetooth unit. The Bluetooth unit will provide these data to our android device and this android device will hold our all information regarding the user and it was also connected to internet, we can also connect this sensor module to our android phone with our android app, the android device can control the control valve but only the authorized admin can control the main pipe water flow. If there is any failure in the bill payment the authorized admin can cut the supply and then the user can't establish connection with the sensor module.

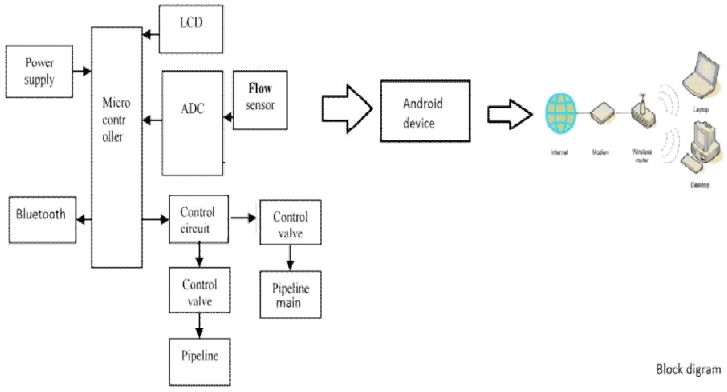

Fig No.1 Block Diagram

V. OBJECTIVES

In the present scenario, the per capita usage of water in a community with a population of between 20000 to 100000 is nearly 100 to 150 liters, per day. For communities with a population of over 100000 the per capita usage is nearly 150 to 200 liters, per day. This is according to the BIS standard 1172:1998. The ever increasing population of metropolitan cities have led to significant crisis of water.

Meanwhile a large amount of water is not evenly distributed due to the malfunction in the current water supply system. The current water supply system i.e. BWSSB for Bangalore supplies approximately 900 million liters of water per day, despite a municipal demand of 1.3 billion liters. The per capita water supply that BWSSB is able to provide averages 100 to 125 liters, per day. However, the actual availability of water to the poor areas of the city is limited by

infrastructure, and so for these areas, the per capita supply can be as low as 40 to 45 liters per day. Hence there is an excess of supply in water for many areas resulting in scarcity water in few areas.

This project aims at overcoming these disadvantages apart from the primary disadvantages mentioned.

VI. DESIGN AND COMPONENTS

There are many electronic components used in the hardware part to implement the system.

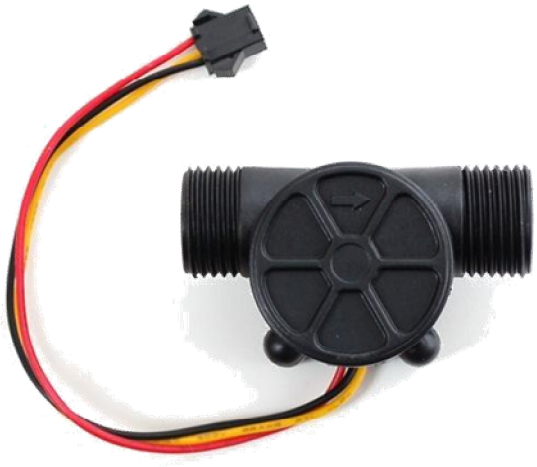

Fig No.2 Flow Sensor

Flow rate sensors quickly record even the smallest flows with a high degree of accuracy. Flow measurement is the quantification of bulk fluyid movement. Positive displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. Flow may be measured by measuring the velocity of fluid over a known area.

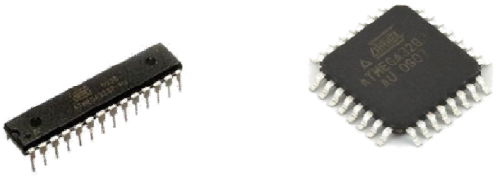

Fig No.3 Atmega 32

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 32KB of programmable flash memory, 2KB SRAM, 1KB EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts.

By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

Fig No. 4 Bluetooth Module

Bluetooth is a wireless technology standard for exchanging data over short distances from fixed and mobile devices and building personal area networks. Bluetoothis managed by Bluetooth Special Interest Group (SIG). It oversees development of the specification, manages the qualification program, and protects the trademarks.

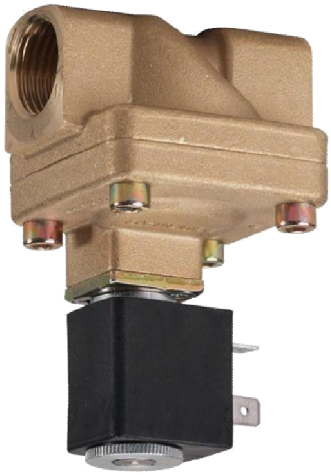

Fig No.5 Solenoid Valve

The solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through the solenoid: in the case of a twoport valve the flow is switched on or off; in the case of three port valve, the overflow is switched between the outlet ports. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids.

VII. nexMETAP

Here in this project we are linking electronics and android programming together to establish such an efficient

system in electronics. We are measuring the amount of water flow through flow sensor. There are mainly two types of sensors available; ADC and hall sensor, both are suitable but hall sensor is cheaper and easy to interface. We are processing the signal from the sensor in the microcontroller unit here we are using an ATMEGA32 controller to control the overall process in the sensing unit, Atmega32 is a high performance Atmel 8 bit AVR RISC based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

The microcontroller will sends the measured data via Bluetooth to the android device and the android device will display the sensor readings processed the controller as well as it will calculate the usage and the android device will store and upload to internet so admin can access it.

The control commands from android device will receive the controller via Bluetooth to the controller and if the user wants to cut the water supply the user can send command by clicking a single button in android device. This command will process in the controller and the valve control will control the solenoid valve. This solenoid valve is an electronically operated valve.

The user can access the water flow valve but only admin can access the main pipe water flow control. Our microcontroller will do this authentication based on the data from the android device. The measuring unit will also display the readings and important messages in the sensor unit with the help of an LCD display.

By all these hardware equipment, we design a device that takes the reading of water consumption. With the help of this device, using our app nexMETAP, users are allowed to know the real time consumption of water supply. This app automatically calculates the amount of the current usage and it will be displayed in this app. Bill payment can also be done through this app. Previous bills can also be evaluated. Water authority can also cut the connection remotely if there is any fail in bill payment. Users will not have any access to the meter after the disconnection of the supply by authority.

Water authority can share information, time of water supply and disconnection of supply to the users through this app. Notifications like due dates of the bill reminder, closing of water supply is provided in this app.

If one user have more than one connection he can have more than one account in the app. Username and password is used to access different accounts.

Fire Base server is used as the database here. This is more advanced than the SQL database. It is a secured server. We can update the data in real time.

Water meter automation system can be successfully implemented using all these methods. This system also helps the users to be aware of their water consumption. The information or meter reading is transmitted to the water authority using internet connectivity. The information is available to the authorized users of the system via website over the internet and also by using mobile-phones.

VIII. ADVANTAGES AND DISADVANTAGES

Whole data is brought into a nutshell with the app. Bill payment is made easy and secured. Human interference can be eliminated in meter readings and also in supply disconnection if the bill is not paid properly. Water authority can share information, time of water supply and disconnection of supply to the users through this app. Notifications like due dates of the bill reminder, closing of water supply is provided in this app.

If one user have more than one connection he can have more than one account in the app. Username and password is used to access different accounts.

The disadvantages include bugs and errors in the app. The app should be updated regularly. The feedback of the users should be taken and modifications should be made. Failure in the app can affect the whole supply system.

IX. CONCLUSION

Water meter automation system can be successfully implemented using all these methods. This system also helps the users to be aware of their water consumption. The information or meter reading is transmitted to the water authority using internet connectivity. The information is available to the authorized users of the system via website over the internet and also by using mobile phonesNexMETAP are major component in building efficient systems for water

management. Since smart meters are digitized and automated, high accuracy is maintained reducing human effort. Security of data is provided in real time both at hardware and software level.

REFERENCES

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