PREPAID AND POSTPAID WATER DISTRIBUTION CONTROLLER OVER IOT

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Abstract :**These days using computer and Iotit simplify deadly manual work in significance. Why so?Because technology gives benefits like speed, reduction, flexibility, and minimizing tedious manual work. The water billing, monitoring and controlling of water supply in municipal corporation is manual. To overcome this problem, we are proposing a new system like as Prepaid and Postpaid Water Distribution Controller which can control it'susage according to their payment which is buildup in Asp.net and MS-SQL server database. This system is capable of two payment modes ie. prepaid and post-paid which can block the supply after consumption amount limit or failure of bill payment**.

1.INTRODUCTION

Now a days water supply department are facing problem in real time operation this is because less amount of water in resources due to less rain fall. The "Prepaid and Post-paid Water Distribution Controller" has been developed to override the problems prevailing in the existing manual system. In this project, we are focusing on continuous and real time monitoring of water supply in IOT platform. Water supply with continuous monitoring makes a proper distribution. We can have a record of available amount of water in tanks, flow rate, abnormality in distribution line. Here, Internet of things is nothing but the network of physical objects embedded with electronics, sensors, software, and network connectivity. But, Using different sensors with controller raspberry Mini computer can monitor data and also control operation from cloud with efficient client server communication. Municipal Corporation Water Distribution System is manual system and have no system to monitor the consumption of water. As we know, Water is the most precious and valuable because it's a basic need of all the human beings With increase in Population, urban residential areas have increased because of this reasons water has become a crucial problem which affects the problem of water distribution, interrupted water supply, water conservation, water consumption and also the water quality so, to overcome water supply related problems and make system efficient there is need of proper monitoring and controlling system.Each individual have their own capacity for usage of water but everyone have to pay same amount for their consumption. And if any person fails to pay water bill then there is not any system which can restrict the water supply to their houses. According to study, Water is a basic need of every human being everyone has to save the water many a times with lack of monitoring and overflow Before implementing this project a survey of Aurangabad city and field survey have been taken to understand water supply distribution and related problems with the system. After taking a survey, a fact has been discovered that all the work is manual and need a better technology to make proper distribution. This system is designed for the municipal corporations to carry out drinking water operation in smooth and effective manner.

2.THEORITICAL FRAMEWORK:

This system is focused on, Internet of things which is new scenario to make city as a smart city with different application. Main objective to implement this project is to design and develop a low cost reliable and efficient technique to make proper water distribution by continuous monitoring and also controlling it from a central server so that we can solve water related problems. Proposed system consist of a Raspberry pi used as minicomputer, different sensors such as water level sensor, flow sensor, and turbidity sensors are used. Arduino collects the data from sensors and send it raspberry pi. This system solves problem of Overflow, over consumption, Quality of water and makes a proper distribution. Continuous monitoring and controlling from a central server is possible using this system.

3.EASE OF USE

Actual ease of the use of this project is to develop a system to keep track of water level of water source from location. The project is based on IoT. The proposed systemis presented in this project which will be helpful to achieve this task. It is about to prepaid and post-paid water distribution controller will monitor the flow and quality of water by each consumer.. We get real time data of consumption and can control the valve to restrict flow of water. User can see the usage any time through dash board or mobile application.The system will get planted on the water supply pipes at every consumer location.

4.OBJECTIVE(S) AND SCOPE

This system is based on Internet of things which is basically new scenario to make the city as smartas it can be the city with different application. Proposed system consist of a Raspberry pi used as minicomputer, different sensors such as water level sensor, flow sensor, and turbidity sensors are used. Arduino programming collects the data from sensors and send it raspberry pi. This system solves problem of Overflow, over consumption, Quality of water and makes a proper distribution. Continuous monitoring and controlling from a central server is possible using this system.Main objective to implement this project is to design and develop a low cost reliable and efficient technique to make proper water distribution by continuous monitoring and

also controlling it from a central server so that we can solve water related problems. Although proposed system is by no means the final word on this subject, it predicts that both water service providers and their customers are likely to welcome these systems as cost effective and user friendly.Currently most water service providers are experiencing problems with cost recovery from community water supply schemes. The report also explains how water payment and administrative support systems can be selected and introduced in a manner which promotes effective cost recovery.

5. SYSTEM DESIGN

System is designed as the Prepaid and Post-paid Water Distribution Controller which will monitor the flow of water by each system. The system will get planted on the water supply pipes of every house and then It will monitor the flow of water control. Here, User can see their usage anytime through dashboard or mobile application system. Proposed methodology is to develop a meter which calculate amount of consumption of water which is wirelessly directed to server which store records. Web portal or mobile application is to access information from server and display it to customer.

6.EXISTING SYSTEM

Water distribution and it's control over billing cycle is most challenging task for government.

- Municipal Corporation Water Distribution System is manual system and become difficult to monitor the consumption of water centrally.
- If any consumer fails to pay water bill then there is no system which can restrict the water supply to consumers house.
- Existing system fails to monitor the quantity and quality of water.
- Unpaid bill recovery costing are more than actual bill which waste man hours cost.

- Meter having analog and non-electric, physical flow sensor which may give inaccurate result in case of low pressure water supply.
- It gives overall consumption and no statistics of usage on time basis.

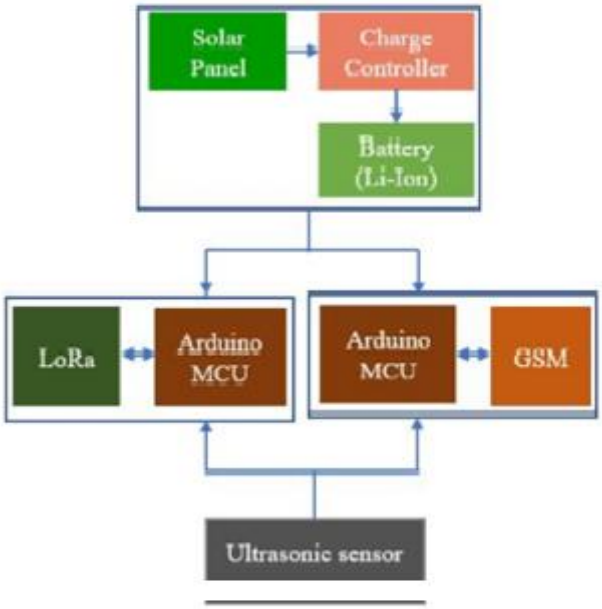
7.COMMUNICATION WITH GSM MODEM

- AT commands are instructions which are used to control a modem.
- AT is the abbreviation of Attention.
- Beside common AT command set, GSM/GPRS modems and mobile phones support an AT command set which is specific to the GSM technology
- It include SMS-related commands like AT+CMGS (send SMS message),AT+CMSS(send SMS from storage),AT+CMGR(Read SMS message),AT+CMGL(list SMS message).
- Many of the commands are used to control wired dial-up modems, such as ATD (dial),ATH (hook control) which are supported by GSM/GPRS modem .Every command line starts with “AT” or “at”.

8. HARDWARE DESIGN

8.1 REMOTE NODE

Water level in the reservoirs is usually measured by using float & board level gauge and dip sticks. The level gauge values are not accurate and require constant human effort. Improper readings can result in insufficient storage or reservoir overflow. Remote nodes are installed in the OHSR/UGSR to monitor water levels. It consists of Arduino MCU, LoRa module (AI Thinkers Ra-02 SX1278), Ultrasonic sensor, GSM Modem. Arduino collects the water level in the reservoir every minute from ultrasonic sensor and sends to gateway/relay node using LoRa. Arduino Nano MCU is used, due to its small form factor and low power consumption.



BLOCK DIAGRAM OF REMOTE NODE

PROTOTYPE OF REMOTE NODE

MaxBotix weather proof ultrasonic sensor (MB7060 XL-MaxSonar-WR) is used to measure water level in the reservoirs. The sensor and electronic devices are enclosed in IP65 box. GSM (Sim 900A module) is used as a redundant system. Figure 2 shows the block diagram of the developed module.Separate MCU is used for both LoRa and GSM. LoRa is connected to Arduino using serial peripheral interface (SPI). Power supply is designed to supply 5V to Arduino, ultrasonic sensor and GSM. Power for LoRa is taken from Arduino 3.3V output. Remote nodes take reading for every minute and send to gateway. Lithium ion batteries are used to power remote nodes which do not have access to electrical mains. considering three 2200 mah batteries with battery utilization of 75% and gsm in receive mode, the system can work approximately for 10 days. solar panels are used as a power source to charge lithium ion batteries. 20w/12v solar panel is used to charge the batteries in two stages, linear voltage regulator followed by charge controller. the system can work continuously without changing the batteries frequently. remote nodes are duty cycled to wake up every minute to save power.

8.2 ACTUATOR NODE

In intermittently operated water networks, supply to different parts of the network are regulated using valves according to heuristically determined schedules. currently, in many networks, sluice valves are operated manually by using long t pipes. it is a labor-intensive operation, e.g., more than 45 turns are required to open/close a valve on a 10” line. moreover, complex operation and schedules cannot be implemented using manual operation alone. hence, the existing sluice valve is retrofitted with an electrical actuator to ease the operation and to enable complex supply schedules. the block diagram of the actuator node is shown in figure 4. the actuator has local status indication (open/close) and button to operate the valve locally. it also has remote control option, i.e., it can be opened/closed externally using relay or plc. as shown in figure 5, the electric actuator is fixed on top of the valve using supports and a long stem is used to transfer the torque from actuator to valve. potential free contacts are provided to read actuator status. the remote node reads the actuator status including local/remote mode status, fully open, fully close. this is read every five seconds and transmitted to the gateway using lora. communication between actuator node and gateway is half duplex. after sending actuator status to gateway, it waits for short period of time to get control command from the gateway. based on the command received, arduino can energize or de-energize the relay to open/close the actuator. these nodes are powered from actuator power supply, so batteries are not used. power supply is designed to supply 5v to arduino and gsm. to avoid single point failure, separate mcus are used for both lora and gsm. actuator status and controls are connected to both mcus. both lora and gsm are initialized during starting.

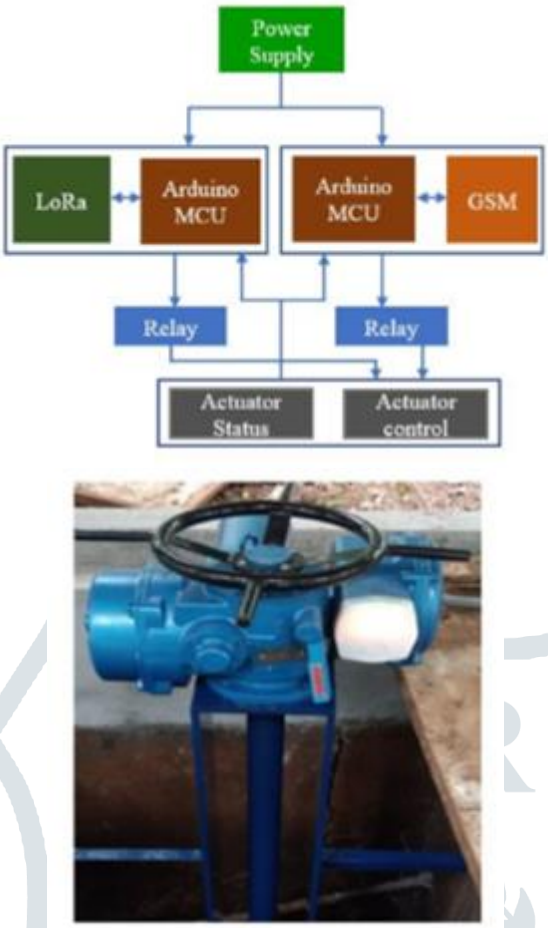


Fig:Electrical Actuator

8.3 GATEWAY NODE

The gateway node collects the data from remote nodes and actuator nodes, processes the data and sends to centralized server. commercial lorawan gateways can listen to many lora channels simultaneously. semtech sx1301 concentrator is typically used and is capable of scanning 8 channels simultaneously. the cost of such sx1301 based gateways is high (~1000 usd). we use a single channel gateway developed using sx1278 based chips. raspberry pi is used for data processing and internet connectivity. the cost of raspberry pi based gateway is low (~75 usd). sx1278 based lora modem is connected to raspberry pi using serial peripheral interface (spi). raspberry pi is connected to centralized server using local area network (lan). the gateway pushes the data to central server whenever it receives data from any of the remote/actuator node. it receives command from the centralized server and transmits to the actuator node to open/close the actuator. gateway lora is always in receive mode. python is used for programming raspberry pi.

9.COMPONENTS OF MODELS

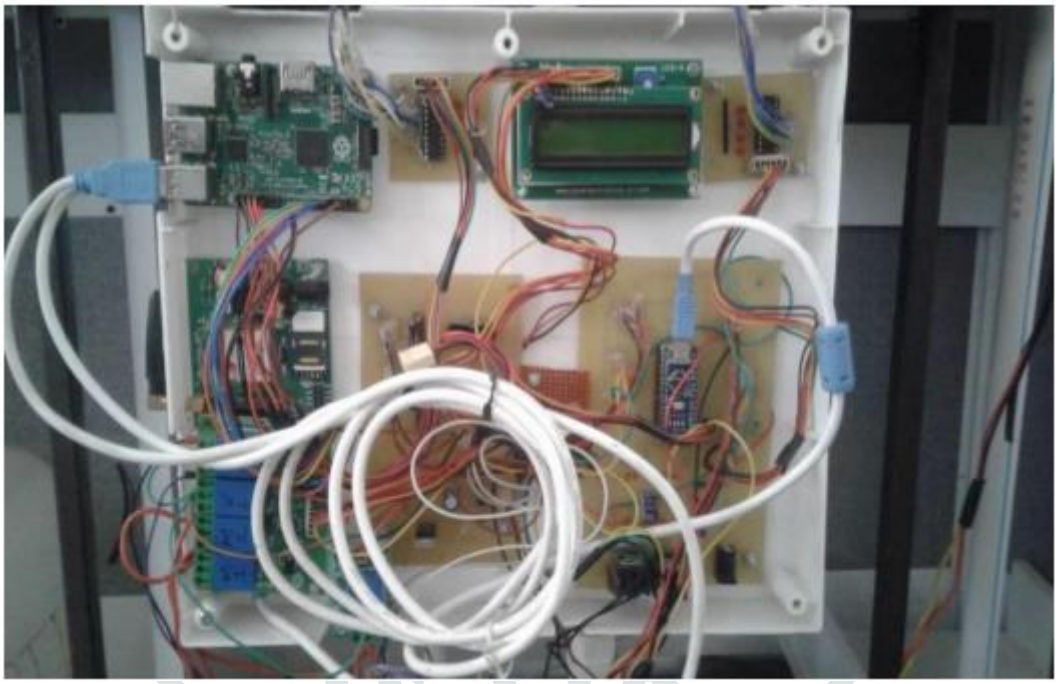


FIG:COMPONENTS OF MODELS

It shows detail hardware set up of the system. all the sensors are connected to arduino. it takes data from all the sensor. relays and lcd are connected to raspberry pi connector. solenoid valves and motors operated through relay. gsm module has usb through which it is connected to raspberry pi. arduino is connected raspberry pi through microusb. raspberry pi takes data and continuously push it on cloud.

PROJECT IS DIVIDED INTO THREE MODULES:

HARDWARE MODULE: It consists of hardware parts like Flow Sensor, Solenoid Valve, and Microcontroller for controlling the flow of water system.

a. **Flow Sensor:** It measures the water Consumption.
b. **Solenoid Valve:** It control water supply.
c. **ATMega382p:** Arduino supportable microcontroller.
d. **4-Digit 7-Segment Display:** display real time meter reading.
e. **SIM800 Module:** GSM+GPRS supportable module to use GSM and GPRS functionality in project.

WEB SERVER MODULE: It consists of server parts like web server, database, web app to fetch and store the reading of meter.

f. Server will fetch the real time ratings and then display the same ratings on website/application in form of records or charts.
g. Store the customers' information and billing status.

WEBSITE/APPLICATION: It consists of application part like website or mobile application to monitor usage of water.

h. User Interface to display the reading and consumption data to users and provide billing system.

10.Results and discussion

If there is no water in any line gsm will trigger a message also if there is excessive consumption in any line it will trigger a message that abnormality in line. the system processes within given time period at adafruit also can operate as continuous process it means proper scheduling is done for distribution. on adafruit server we can see previous record also data continuously pushed on cloud so that we can monitor and control it in real time. 16*2 lcd is used to observe data locally connected to raspberry pi.a feed for each parameter is created on adafruit. first it checks turbidity off water here mapping has been done for turbidity if turbidity of water is less than five motor in ground tank will start automatically otherwise motor will remain off. as motor get started it will fill water in both overhead tanks according to its level of water in tankwater is supplied this valves operate automatically flow sensors gives flow rate in ml/sec. if we want to cut supply of any line we can control it from adafruit by making relay on/off so, controlling is possible from a remote location.

FIG: ADAFRUIT SERVER

11.CONCLUSION

This paper presents a low cost iot based solution using lora for monitoring and control of campus water distribution network. our lora based nodes show good coverage, energy efficiency and reliability while reducing deployment and maintenance costs. it can be easily modified to add pressure and flow sensor readings. this system employs the use of different technologies in its design, development, and implementation. the secure and continuous monitoring is possible no need to go on field for monitoring so manual work has reduced it makes system more efficient, reliable, low cost and accurate we can data monitored from anywhere controlling is possible from a remote server it is economical in development. this research has successfully provided an improvement on existing water level controllers by its use of calibrated circuit to indicate the water level. gsm is used as a redundant system to ensure continuous monitoring and control. initial deployment results are encouraging, all remaining ohsr, ugsr and manual valves will be instrumented to create a smart water distribution network.

12.ACKNOWLEDGEMENTS

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