IoT Based Public Water Complaint Management System

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ABSTRACT

India has an extensive network of pipelines and associated components forming the water distribution system. The condition of these pipelines is poor in terms of maintenance. Pipeline failure in water distribution systems disrupts the water supply to consumers and reduces the reliability of the system. It is found that a majority of the supplied volume is wasted due to pipe leakages. Thus, proper maintenance, inspection and control activities are required. Complaints regarding pipeline damages do not reach the water authority officers or may reach them but the actions may or may not be taken. By this app people can register their complaints and it will be submitted to the water authority. Then the authority can update their status through this app. People can get complaint resolved message when the authority have taken care of the issue. Users can attach the water control flow system to their water system and monitor the water usage. This device can calculate the water flow rate and store the data on a server, which they can later use for generating waterbills.

Key words: Android   application,   Node   MCU, Arduino,GPS.

1.   INTRODUCTION

In India there is a large-scale network of inland water resources. They are in the form of rivers, canals, backwaters etc. The load transportation by waterways is highly underutilized in India compared to other large countries. The cargo transportation in India is organized through these backwaters. There is an issue related to the continuous water supply to different parts of the country. It is because the water distribution is done through pipelines and these pipelines are not maintained properly. Nowadays peoples does not get required amount of water for their daily usage. Climate changes are the one of the reason for the scarcity of water. It will also affect our water distribution system. Peoples are not aware when the water willbe available and when there will be scarcity. There is no such efficient of effective means to take care of these pipelines. It is a common scenario in India to see roads filled with water, which occurs due to many pipeline

leakages. The authorities that have undertaken its maintenance are not aware of these leaks almost every time. There is no proper mechanism for the authority to be alerted on the situation. Currently the situation is that complaint is registered via phone calls which are not a proper mechanism. People even have a feeling in them that the authority will not perform action on behalf of registering complaints. If at all any action is taken, the status of work completed is not known. Again the user needs to make a call and then enquire about the status. The people are not interested in making phone calls every time to know the status. This is the same scenario for knowing the availability of water. Water complaint management is therefore a serious concern. Providing the people with an android application enables every individual to register complaints to the water authority about the pipeline leakages or water shortage at homes. The application also allows the user to know that the complaint has reached higher authorities and the status of work completion will be visible to the user. Through this application the user can also pay their water usage bills. The device can calculate the water flow rate and store the data on a server, which they can later use for generating water bills. The system uses an Arduino board connected to a Wi-Fi network that estimates the approximate water flowing through the pipeconnection.

2.   LITERATURESURVEY

For easier handling of the complaints in each city, the city is divided into wards. There are 3 options of handling the complaints, one is to visit each office and convey the problem. The second option is to make telephone calls to the contact center and third option is to create a web portal for registering complaints [1]. Complaints can also be registered by creating an android application. The Exact location where the problem is occurring can be shared to the authority officials smartly with the use of GPS. The app also allow the user to see the status of complaint lodged [3] [10]. It is more effective and convenient to implement complaint registration in android, as it becomes easier for access to large groupof citizens. Nowadays everyone owns a smartphone which further gives an advantage. Even though the complaints are conveyed, theofficials may not resolve the problem [2]. Furthermore, the clarity of the problem can be enhanced by implementing a feature to add photo of the incident which

enables the authority officials to have a clear idea of the situation [6] [4].For the mobile application a user will have to register himself with the app. Another alternative is to discard registration and let the user who has downloaded the app to register complaints and provided location tracking using GPS [5] [8]. Online complaint management system enables to eradicate corruption and provides every citizen the assurance that complaints are monitored, tracked, resolved and problem areas are targeted [7]. Mobile application creates an interface for the authority officials and people to have a proper communication and also reduces time and distance barrier [9].

3. PROPOSAL

In India, the water supply network consists of numerous pipeline networks and its associated components. Pipeline failure in water distribution systems disrupts the water supply to consumers and reduces the reliability of the system. Therefore, inspection, control and planned maintenance and rehabilitation programs are necessary to properly operate existing water distribution systems. By this application people can register their complaints and it will be submitted to the water authority. Then they can repair the pipeline and solve the complaint. The authority can then update their status through this application. People who register their complaint will receive a complaint resolved message. Users can also attach their water control flow system in their water system and monitor the water usage. This device can calculate the water flow rate and store the data on a server, which they can later use for generating water bills. The device uses Arduino board connected to a Wi-Fi network that estimate the approximate water flowing through the pipe connection. The Arduino controller board is programed specifically to calculate the rate of water flowing through the pipe. Data stored to the server is accessed by the android application and users can thus get a visual idea about the statistics. User's application also can be used to generate and pay monthly water bill through the application itself. They can also register if there is any complaint regarding the water connection. Users get response from the water authority based on the complaints registered. All the functions of the system are mentioned in the Fig. 1, the UML diagram. The User can have the following features in theapplication:

- Registration- User can register to the app and keep a personal profile to access services of theapp.
- Login- After registration, the user logs into his/heraccount.
- Pair device with app-Users can pair their water control flow system to theapp.
- Get water flow statistics- The water usage graph of each user can begenerated.
- Check water flow rate- The device paired with app notifies the availability ofwater.
- Get auto generated monthly water bills- Water usage bills of the user will be generated and payment can also bedone.
- Get customized emergency notifications- Notification regarding availability of water will beprovided.
- Alerts from authority- Any message that the authority wants to convey to the user will besent.
- Register complaints and get response- User can register any complaint related to the water authority and will get the officials alerted.

The Authority have been provided with the followingfeatures:

- Approve user's registration and grant them access credentials- User's registration is approved and they are grantedaccess.
- Monitor water usages of users- Allows to alert the user if he/she is consuming more water.
- Broadcast zone-based messages and alerts- Message from authority can be broadcast to manyusers.
- View user complaints- Authority can views every usercomplaints.
- Respond to user complaints- Response message to user can besent.
- Generate user water bill- Water bill of each user can begenerated.
- Approve bill payment- Payment of water usage bill can bedone.

Use case diagram

The purpose of a use case diagram in UML is to demonstrate the different ways that a user might interact with a system. Create a professional diagram for nearly any use case using our UML diagram tool. In the Unified Modeling Language (UML), this use case diagram can summarize the details of the system. Fig.2 represents the followingdata:

- The admin can give notification to theuser.

- The status of registered complaints can be updated by theadmin.

- The admin can also login/logoff account and add/deleteadmin.

- The user can register if not registered, then login to his/heraccount.

- The user can then register complaint, view its status and also make water billpayment.
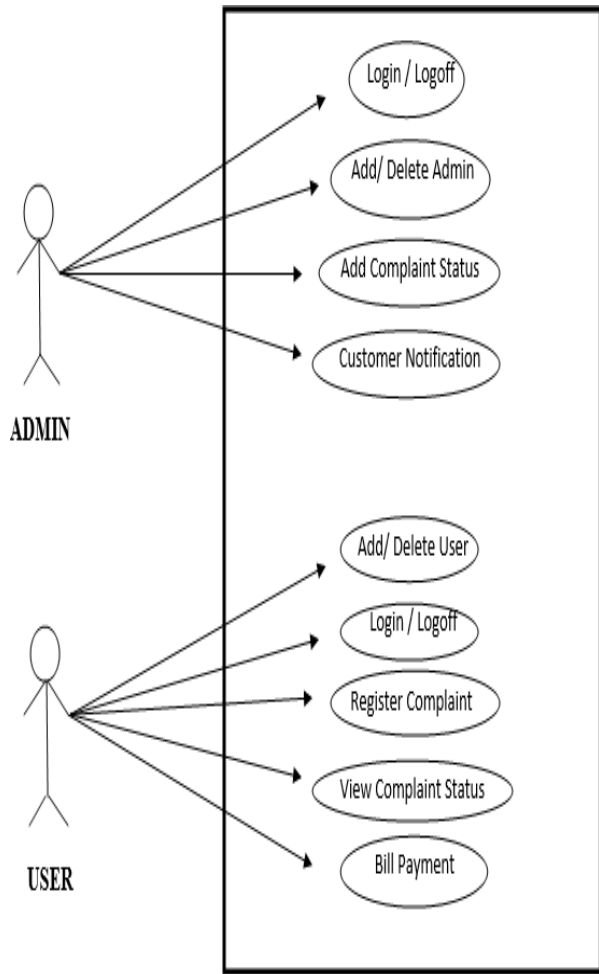
Figure 1: UML Diagram of proposed system
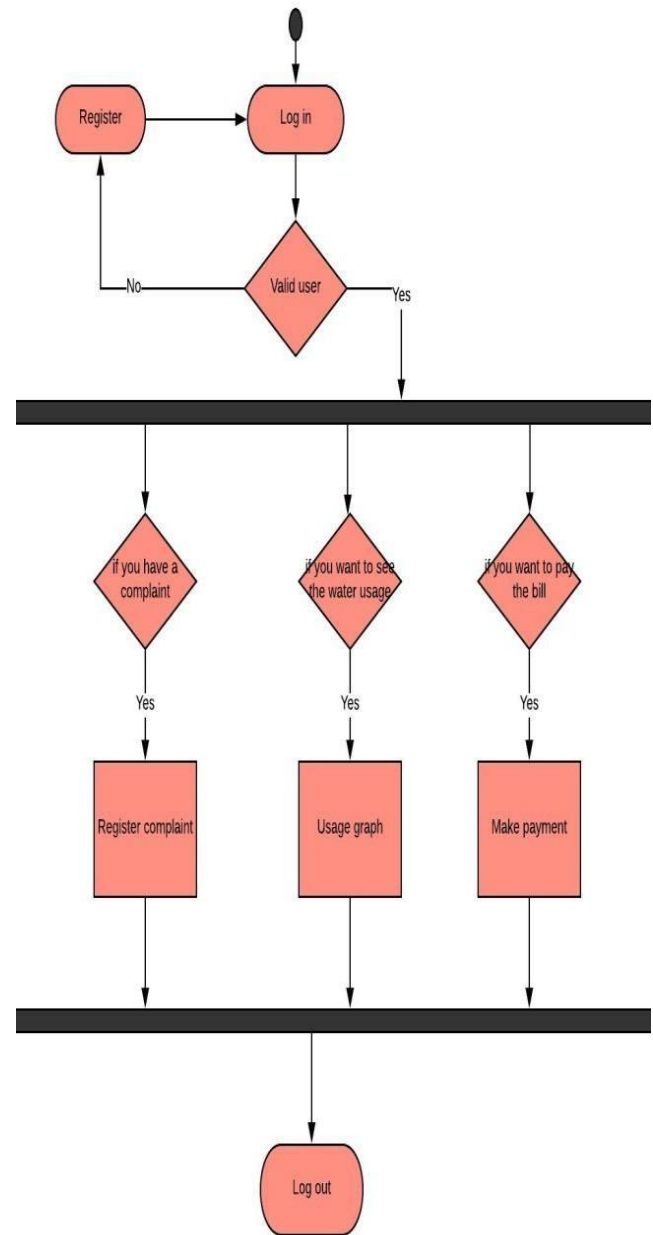
TECHNOLOGY USED

Hardware Specification
   ➢ NodeMCU
   ➢ Arduinocontroller
   ➢ HallSensor

Software Specification
   ➢ Programming language
     :Java

Figure 2: Use case diagram of proposed system

   ➢ Web technology : Html,JavaScript
   ➢ Database :MySQL

1) NodeMCU:

NodeMCU is an open sourceIoT platform. It includes firmware which runs on the ESP8266 Wi- Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson andSPIFFS.

2) Arduino controller:

Arduino controller is an open source hardware and software company, project and user community that designs and manufactures single board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution byanyone

3) HallSensor:

A Hall Effect sensor is a device that is used to measure the magnitude of a magnetic field. Its output voltage is directly proportional to the magnetic field strength through it. Hall Effect sensors are used for proximity sensing, positioning, speed detection, and current sensing applications.

4) Java:

Java is one of the general purpose computer programming languages. It is an object oriented programming language. Java is used in this proposed system for designing the user interface of the android application.

5) HTML & JavaScript:

HTML is used for creating web pages and web applications. It is the standard markup language. JavaScript is one of the core technologies of the World Wide Web, it enables interactive web pages. HTML and JavaScript are used in this proposal for login/logoff of user/admin and to handle bill payment page.

4. RESULTANALYSIS

In the current scenario complaints are registered by making phone calls to the authority officials or by registering to the "Kerala water authority" web portal. After registering complaint to the website users are not able to know when the action will be taken by the authority. By using this application, after the complaint is registered, the authority updates the status of work done on the issue. This app also enables the user to be alerted of the water that he/she uses in a week. Through the app the authority officials can alert the users if water is not available or let the user know when water will be available. Bill payment can be done through the app by specifying the user's consumer id. Alerts to the user on water availability can also be provided to the user through theapp.
The Fig.3 shows the user's water usage for a particular month. The Y axis shows the liters of water

and the X axis shows weeks of a particular month. From this graph the user can get a clear picture of the water used in a month.
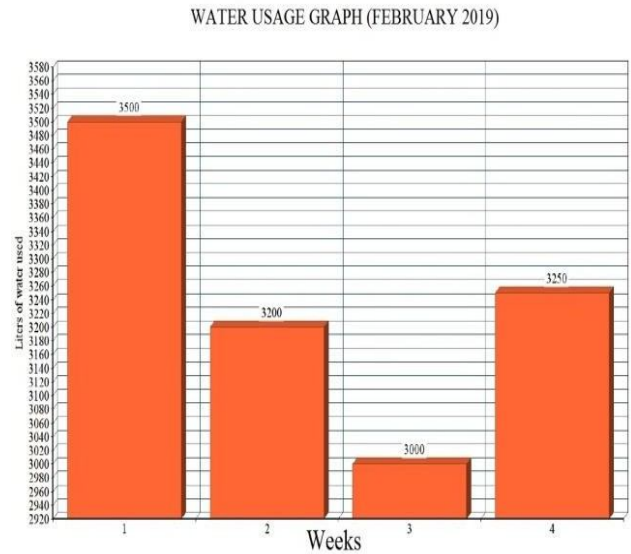
Figure 3: Water usage graph

5. CONCLUSION

India has a very complicated water distribution system inclusive of a large pipeline network. Due to bad maintenance of these pipelines, a large amount of water is wasted every day. It will affect the future generation leading to water scarcity. There is no proper complaint management system. By using an android application user can register their complaints. The authorities can update their status of user complaints after completion. Various other features such as water bill payment, water usage graphs are all included in the app. The user will also get to know the availability of water. This proposal provides a systematic approach towards managing the water relatedcomplaints.

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