IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.39 ⁜ Vol. 11, Issue 6, June 2022

DOI: 10.17148/IJARCCE.2022.11605

IoT Enabled System for Water Monitoring and Distribution

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Abstract: Our paper presents an IoT device which help to manage and plan the usage of water. This system can be easily installed in residential societies. Sensors placed in the tank which continuously informs the water level at the current time. This information will be updated on the cloud and using an android application, user can visualize the water level on a smartphone anywhere that is connected to Internet updated using the data collected using sensors. As we know water is so precious for human being as well as for the complete nature without which it will not be possible to survive. Even though lot many efforts have been taken by government though various schemes, it is becoming difficult day by day to save water for future and make efficient utilization of it. Hence the main focus is on water utilization in apartments and save water with proper distribution and monitoring system. The intensions of this work are water management, monitoring and system of proper distribution of water to save water and make efficient use of it, so that we can satisfy the trust of others. The system has been designed in such a way that it will monitor the available water level continuously. System has been implemented using embedded system and communication takes place through IoT.

Keywords: Water monitoring, IoT, Smartphone, Home Assisting Devices

I. INTRODUCTION

Internet of Things (IoT) is a leading technology integrates various devices and objects to make them smart and connected resulting in data exchange and enhancing the lifestyle of an individual. Things enabled with IoT can help in commanding the various devices connected through voice or action. So by using this technology devices are developed which can monitor water quality and help in easing the life of an individual.
IoT Enabled System for Water Monitoring and Distribution is an Internet of Things based project which aims at providing real time monitoring of water levels and quality of water which is being used. The system can be used to calculate bills based on the quantity of water being consumed.

II. BACKGROUND AND SIGNIFICANCE

The intension of our work is water management, monitoring and proper distribution of water and henceforth to save water and make efficient use of it. The system will be designed in such a way that will monitor the available water level continuously and detects tank level. We aim to balance the PH and check the water quality. Our goal is to determine water quantity consumed by each house to generate bills.
The IoT enabled water monitoring and distribution system – is an Internet of Things based project which aims at generating distributed bills for each house in an apartment. The system keeps check of the amount of water to be supplied based on the user requirement. It ensures the water quality checks are done frequently and thereby notifies on the application. The system would be helpful in apartments where water bill has to be generated based on the consumption of each house for monthly distribution of bill and therefore reduce the unnecessary quarrels between the residents. The quality of the supplied water is monitored using sensor technology and the system checks for water availability and incase found to be not available it lets user to activate the motor to fill tank through use of IoT technology.

III. LITRATURE REVIEW

Socio-economic processes have led to an exponential rise in the need for water resulting in scarcity due to over exploitation. One of the major drawbacks faced in India is water availability which is fit for consumption, i.e the quality of the supplied water and its right usage. There requires a well-managed system for monitoring and distribution of the water. It requires the usage electric pulses generated by the flow sensors which assist in calculating the water usage.

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Automated turn on/off of the motor is enabled to ensure the main tanks store a good amount of water for supply and is controlled through the use of control valve [1].

Water acts as the most important entity for human and the other living things in the nature without which its existence isn't possible. Enormous efforts with respect to proper utilization of water are being executed by the government bodies and NGOs by creating various schemes for ending up in efficiently using it. Focus is on larger area such as apartments and gated-communities to save water and efficiently using it. The water levels are monitored continuously and are communicated through use of IoT and embedded system [2].

Water being one of the most significant and important resource for the human existence, due to the enormous increase in population and urbanization the necessity of water has raised. It also requires a constant vigil on the quality of water being supplied or consumed. Sensors for quality monitoring such as pH sensor are used. The distribution of water uses flow sensor, control valve using which amount of water supplied can be known. Through the integration of this, the system would be able to distribute the water for consumption and have a check on the quality of water which is being consumed [3].

Automation is a main attribute in the growing era of IoT technology. Automating things helps in increasing the living status by providing comfort and thereby people can live conveniently. This automation can be provide with regards to water supply and the motive being usage of water judiciously and so that water management systems developed using IoT (Internet of Things) are equipped in the residences and their knowledge are transferred. This kind of automation is unduly required in the future use in managing water sustainably the same way as government has made mandatory for solar and rain water harvesting in houses [4].

The increase in population and urbanization in order to find jobs and to lead a better lifestyle people have had a role in destructing the aquatic ecosystems by construction of apartments in poached lands, water pollution due to dumping of garbage and releasing toxic effluents into the water bodies, air pollution by release of toxic gases from vehicles and engines using fossil fuels, global warming due to release of effluents such as CFC from refrigerators and air conditioners. The water cycle had also had an impact to these effects due to land coverage area changes during urbanization which resulted in increase of layers of concrete and natural factors which have been altered such as rainfall due to often change in climate hence creating shortage of water supply, low ground water level. To overcome this issue, it is required to work on solutions to develop technologies for systematic use of water in urban areas and balance the water cycle with use of information technology infrastructure and sensor technologies. Quantitative analysis of usage of water and the impact on water cycles and thereby having a track on the impact on the ecosystem is concentrated upon by gathering data from the sensor technology and studying them over a period of time and therefore to have a proper system to use water judiciously in urban areas [5].

Planning and managing the usage of water is much required to be installed in residential societies. This can be achieved by using IoT technology which are integrated with devices, these devices use the sensors placed in the tank which continuously gathers the current levels of water present in the tank. This data is then communicated to the rest of the devices connected by updating on to the cloud and then rendered on the android application. The updating of the values on to the cloud makes it possible to be accessed by a smartphone from anywhere over the use of internet and creating visuals of the water level. Monitoring the water level in the tank the automatic functioning of motor is controlled, when the water level is low the motor gets turned on automatically and it cuts off when the water level is full [6].

Management of water and its distribution in large campuses is required in order to save water and this can be achieved with the use of IoT technology. Ultrasonic sensor and water level sensors can be used in order to achieve a low cost based wireless network to connect the sensors and water monitored campus using these two components in the system, These sensor networks are able to achieve a large distance which are suitable for installation into overhead tanks and the ground sumps. The network which gathers the data wirelessly gets updated over the gateway by uploading the data online which can be communicated over to the application later to display visualization of the water levels [7].

The topic of management of water is a major cause and debatable topic since the existence of mankind on earth. The management of water supply is extremely challenging when residential communities such as apartments and gated infrastructure are considered. To have a sight on this, systems can measure the water flow and monitor the levels of water and later update on the mobile application, later this can be used to control the motor and fill the tank based on the water level and check water status continuously. The smartphones can create an established communication in managing and distribution of water [8].

Water is precious and has to be conserved. Since the available fresh water on earth is just 3% of the total reserves of water on the whole planet, it is important to use it very carefully and ensure it's not wasted and be judicious. Since wasting water in the current world scenario is due to overflow of tanks and results in water bills getting higher since conventional tanks neither can monitor nor can control the water level leading to a larger amount of wasting of usable water which flows into drainage. Water level monitoring can be controlled by using IoT technology with android applications. Hence by the usage of these methods an efficient and economical solution can be provided which is the main focus [9].

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Water being an important aspect in living beings existence, it is a crucial part of everyday life. As an effect of global environmental factors there has an outbreak on the water management and conservation which is vital source for human survival. There are huge needs of products having humanitarian needs for consumers which are developed using technologies such as IoT (Internet of Things). This proposes an Internet of Things based system for water monitoring that could measure the level of water on real-time basis. Water level monitoring is of more concern when used in disaster prone areas where floods occur and when these kinds of devices are used, it is possible to detect the desired parameter and if that parameter called threshold is reached then signals are generated in real time to the social networks. These measurements of water level can be displayed on remote dashboards. This can also be updated on cloud server and communicated long distances as required.

IV. RESEARCH DESIGN AND METHODS

IV.I Architecture Diagram

Fig. 1 General Architecture Diagram

IoT Enabled System for Water Monitoring and Distribution architecture has a Micro Controller (Arduino) which is connected with Ultrasonic sensor to collect the distance, pH Sensor to measure the water pH, Relay to turn on the water valve, float switch to get water level status in the tanks with connection to the Blynk app. The entire system is also supplied with power supply externally connected to the switch board socket. Blynk App is used to provide User Interface for the users to view the Distance, Units and Charges readings with the Motor and Tank Status.

IV.II Flow Diagram

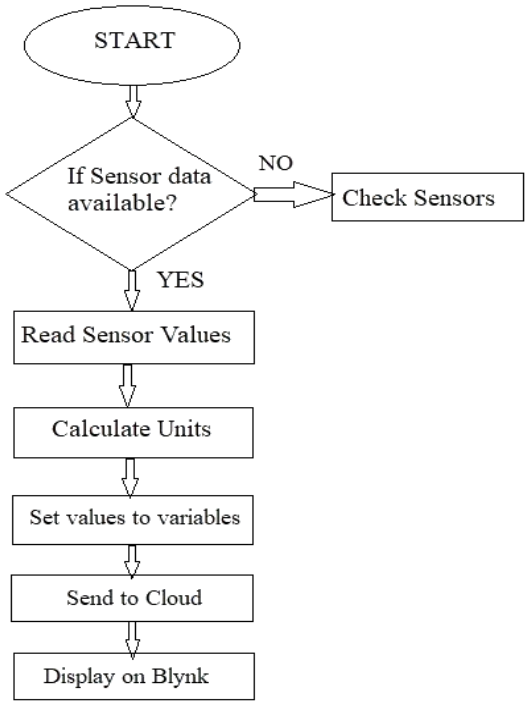

Fig. 2 Flow Chart of IoT Enabled System for Water Monitoring and Distribution

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The flowchart depicts the data and display part of the system. First the system checks for the data from the sensors. If data from the sensor is available, read the key parameters like distance, pH, IR values. Based on the details, the system is actuated. In case the sensor data is unavailable, the display shows improper or no value. The data read is available in the micro controller. Next is the user part, i.e., the motor and tank status with units and charge for the connection is sent. This iteratively works in the proposed system.

IV.III Sequence Diagram

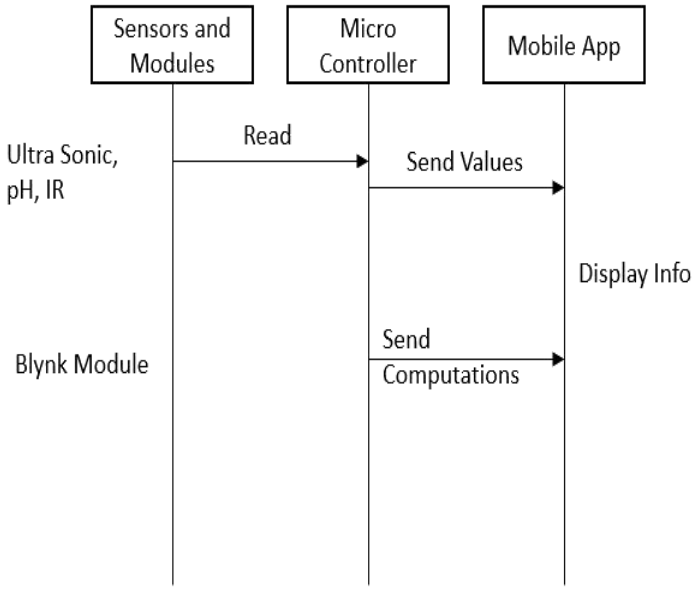

Fig. 3 Sequence Diagram of IoT Enabled System for Water Monitoring and Distribution

Above figure shows the sequence of operations performed in proposed system IoT Enabled System for Water Monitoring and Distribution to represent the events of the various components. The system contains a Ultra Sonic, pH and IR sensors to monitor the distance, pH value and Infrared rays that is interfaced with the controller using I2C protocol. The sensor provides the data obtained in the controller, following which the controller sends the data to the Blynk cloud for displaying. All these components are interfaced with the controller using serial communication protocol I2C. Further, there is a mobile application to view the parameters read by the sensors and to show the charges as per calculations on the backend.

IV.IV Module Decomposition

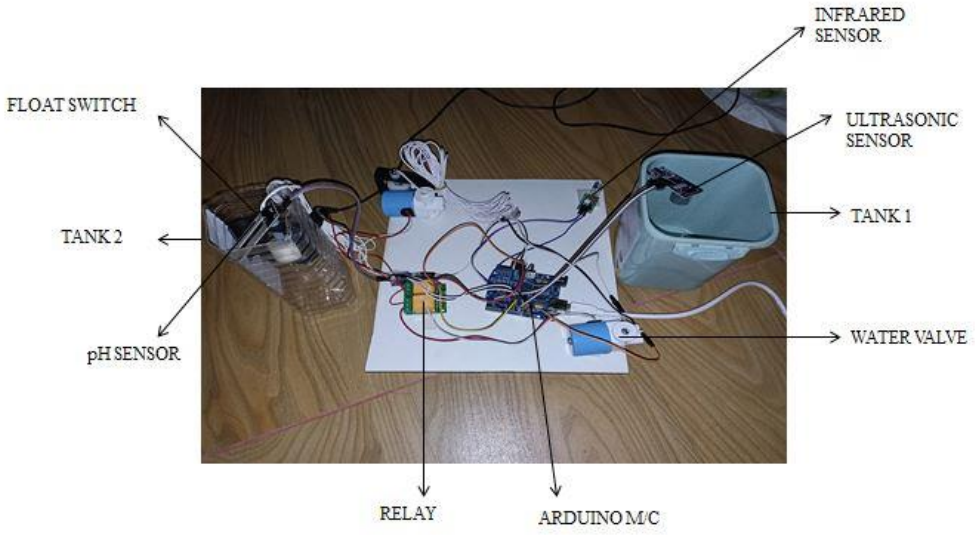

Fig. 4 General Module Representation

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The Proposed System i.e. IoT Enabled System for Water Monitoring and Distribution is mainly divided into three modules – Circuitry, Calculation and View System and Power System along with usage of Blynk App for user interface.

Module 1: Circuitry

The circuitry incorporates multiple sensors incorporated with the required hardware modules. The circuitry includes designing the connections of all the sensors with the micro controller using the digital input pins. The integration of these sensors with the overall circuit of controller, sensors and the Blynk app is included in the circuitry module. The data from sensors is served over cloud using COM3/5/7 connection.

Module 2: Calculation and View System

The calculation system takes in values of IR sensor and using the reading it calculates the charges of billing and it is sent to Blynk app for viewing. The Calculation system gathers the values obtained from the circuitry interface from various sensors integrated and supplies to the calculation system. The system then sends the data to the Blynk cloud to display on the application interface after necessary calculations of collecting units and calculating the charges to present to the users.

Module 3: Power Supply

The power supply is intended to supply the essential power needed for each and every component used in the design. The Power supply module is from a power socket source with the help of an adapter 5V 1A which is used to supply the required power for the operation of used hardware components. If power supply is on, the sensors read the data and send to the Blynk application.

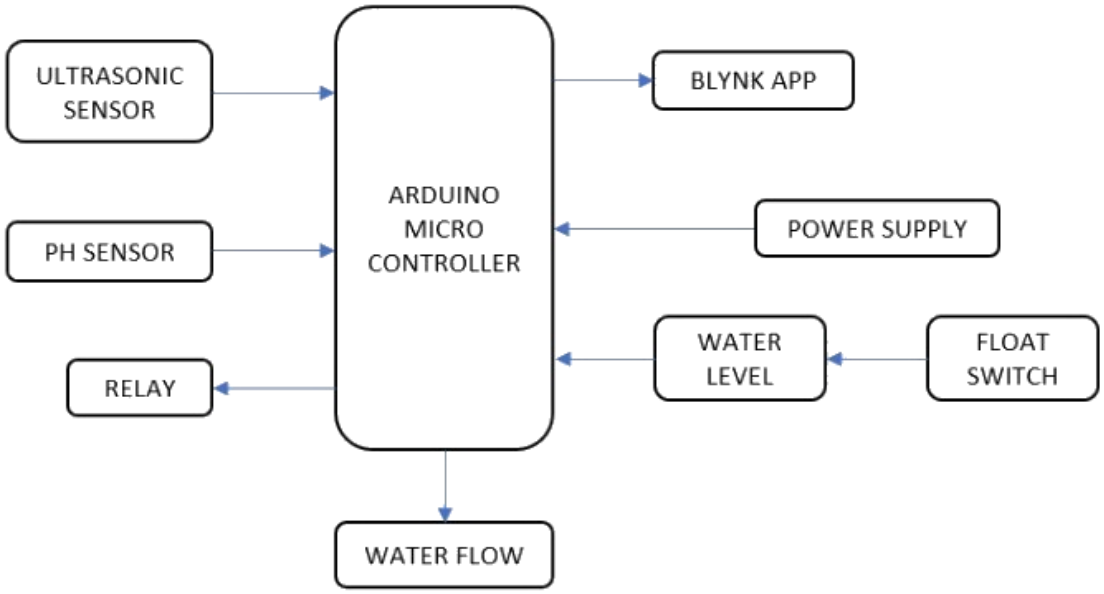

Fig. 5 Architecture Diagram of IoT Embedded System for Water Monitoring and Distribution

The IoT Enabled System for Water Monitoring and Distribution consists of circuitry with various components such as Arduino Microcontroller, Ultrasonic Sensor, pH Sensor, Relay, float switch and water valve. All these modules are interfaced with the microcontroller using I2C communication. Arduino is used as a controller due to its compactness with usage of the digital pins present. Serial pins are required to interface with other modules in the design. pH Sensor is used to get the pH value of the water and monitor water quality. Ultrasonic sensor collects data of distance and renders the rings of water empty in the tank. Float switch gives data of whether tank is empty or full and using the water flow valve the inlet water flow is controlled with the help of relay. The values of the sensors are sent to be updated on the cloud. The calculation of charges using the units of water consumed is then displayed on the created User Interface. The Blynk app also displays the other sensor data collected by using the data frame created using the portal as per requirement.

V. CONCLUSION

We would like to conclude that the project IoT Enabled System for Water Monitoring and Distribution has been developed by the use of different modules like the Circuitry consisting of Arduino as the micro controller, pH sensor for sensing pH value, ultrasonic sensor for sensing distance, IR sensor for collecting the number of units of water

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consumed. Power Supply for the components used is from a socket source over a 5V 1A Adapter. The collected data had been rendered to the users along with the motor and tank status. We have also used the Blynk Application for providing User interface for enabling the user to view the values sensed by the sensors. The values sensed by the sensors are sent to the blynk app with the help of Blynk Cloud. This system thereby helps in calculation of monthly water bills for individual houses and thereby providing distributed share of price in monthly water bill based on the consumption. It also helps in having a check on the water levels and the quality of water present in the tank.

RESULTS

Screenshot of Blynk App displaying sensor values: Units, distance, pH

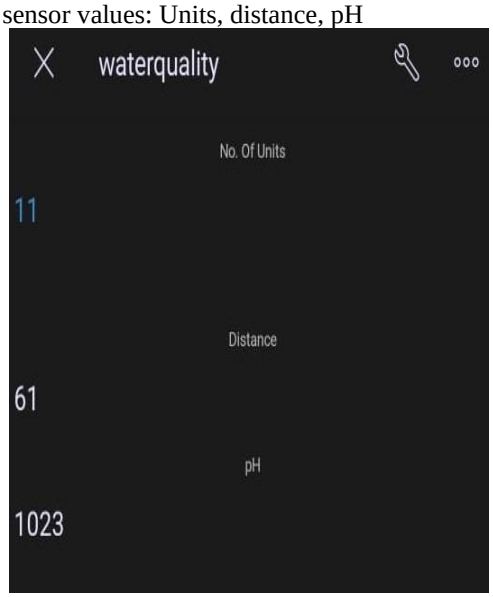

Figure A.1 – Screen Shot of Blynk App Displaying units, distance and pH values

Screenshot of Blynk app displaying the status of the motors and the tanks

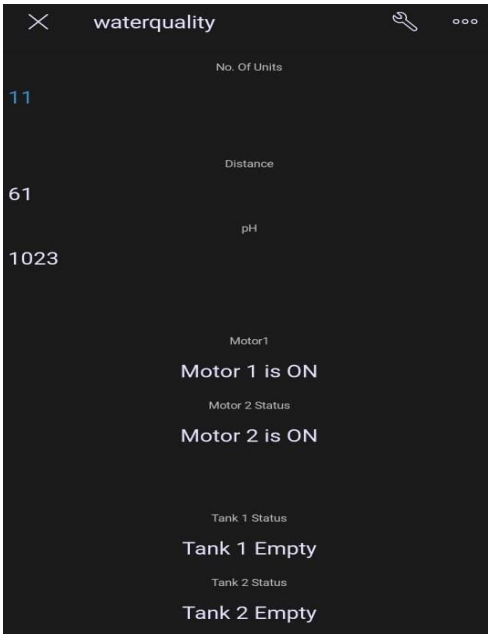

Figure A.2 – Screen Shot of Blynk App Displaying status of motors and tanks

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Screenshot of Blynk app displaying the calculated charges

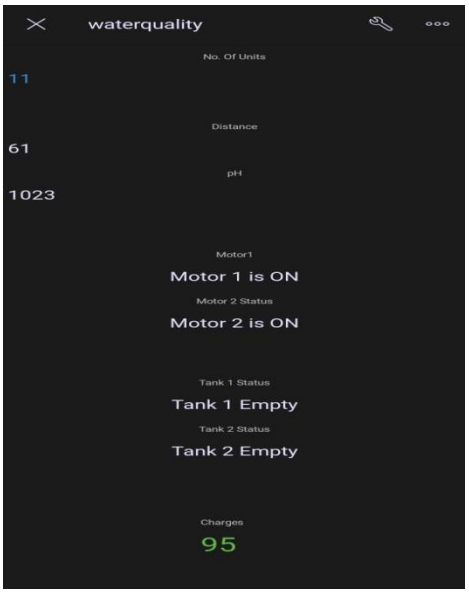

Figure A.3 – Screen Shot of Blynk App Displaying charges

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