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Autonomous Water tank Filling System using IoT

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***Abstract*—** Water is the most precious and valuable resource. With the increase in population, availability of clean water has become a problem. Today, water-supply department as well as common man is facing problems in real-time operations like water distribution and conservation efficiency. Therefore it is important to find a solution to address water wastage through efficient water monitoring and control system. In this paper, the problem is solved through autonomous water tank filling system using IoT where in embedded sensors are used to monitor the tank status along with some other key attributes like power supply, incoming water supply in real-time. Our intention of this research work was to establish a flexible, economical, easy configurable and most importantly, a portable system which can solve our water wastage problem along with saving the electrical energy. This enhances the efficiency of water distribution and reduces wastage.

***Keywords*—**Water conservation, Realtime monitoring, Proper utilization of Water, IoT, Sensors, Cloud.

I. INTRODUCTION

Water is a basic need of every human being. According to a recent survey, water has become a big issue because of less rainfall, increase in population. People in many cities don't have sufficient amount of water for their daily needs. Some areas in the city get water while other some areas are not getting adequate water supply. With improper monitoring of water distribution system, lots of water get wasted. It is our responsibility to save the water. Few of the problems that arise due to the improper monitoring of water distribution system are excessive consumption, overflow in the pipelines with more pressure would possibly cause pipeline damage, overflow of the overhead tank. Among all problems overflow of overhead tanks can be one such problem where we need to pay attention. So, there is a need for continuous monitoring, water supply schedules, and proper distribution. In this paper we are focusing on one of the problems, overflow of a water tank where a lot of water gets wasted, we propose and develop a low-cost device for real-time monitoring of water distribution system using the Internet of things (IoT) platform for minimizing the overflow of tanks.

The Internet of Things (IoT) is generally entails connecting anything anywhere to the Internet (or a shared network) and using that connection to provide some kind of remote monitoring or control of those things.[1] The inter-networking of physical devices such as vehicles, buildings, items embedded with electronics, software and many more with network connectivity which enable these objects to collect and exchange data. The IoT allows us to control the objects remotely across existing network infrastructure, which gives us opportunities for more direct integration of the real world objects into computer-based-automated systems, and resulting in improved accuracy, efficiency and financial benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart homes, intelligent transportation and smart cities. In the world of IoT every object is uniquely identifiable through its embedded computing system but still they are able to interoperate with each other using the existing networking infrastructure.

Rest of the paper is organized as follows, Section II contain the related work of automation systems available as on today, Section III contain the some points of interest to be observed, Section IV contain the architecture and essential steps of proposed system, Section V describes results and discussion and Section VI concludes research work with future directions.

II. RELATED WORK

This work focuses on a solution for 'Water management' in urban areas with the help of IoT. Water is precious and the supply needs to be regulated. Water demand is exponentially growing high with the increase in population of the urban

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areas. To maintain the supply demand ration proper, it is important to have systems to prevent any water loss & hence we have designed an IoT system with we can plan usage of water according to the availability.

M. Saraswathi et al. (2012) [2] Water level measurement data is very important in some water-related fields. An automatic water level measurement system is needed to prevent the difficulties when one does the measurement manually. This system uses AT89S51 micro controller to control the system, ultrasonic sensor to measure the water level, and SIM300C GSM modem to receive and send SMS. The system can measure the water level and give measurement report upon requested SMS. This system can be placed in many places because it only needs the initial setting via SMS, based on its installation condition at those places.

Prachet Verma et al. (2015) [3] discuss the design and preliminary results of an IoT based system for management of the water distribution system in a large campus. In particular, we focus on two specific components of the system: a low cost ultrasonic based water level sensor and a sub-GHz based campus scale wireless network to connect the sensors. We describe techniques to achieve a large sensing distance that makes them suitable for installation across overhead tanks (OHT) and ground level reservoirs (GLR). The wireless network, which uses sub-GHz radios, connects to a gateway that can upload the data online for visualisation and analytics.

Sayali Wadekar et al. (2016) [4] the 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. According to the level of water in the tank the motor functioning will be automatically controlled, at low level of water motor will automatically turn on and when tank is about to fill up it will cut off.

Priyen P. Shah et al. (2017) [5] Water is one of the most important basic needs for all living beings. A huge amount of water is being wasted because of uncontrolled use and exploitation of water resource. Some other automated water level monitoring systems are also present, but so far most of the methods have some shortcomings in practice. We tried to overcome these problems and implemented an efficient automated water level monitoring and controlling system. Our intension of this research work was to establish a flexible, economical, easy configurable and most importantly, a portable system which can solve our water wastage problem. We have used ESP and Ultrasonic sensor which reduces cost effectively and makes this project economical. Also, this project doesn't require special different tank for it, existing water tanks can be used. We have successfully implemented this project.

III. PROBLEM STATEMENT

Some of the automated water level monitoring systems are already present, but most of the methods have so far some shortcomings in practice. We tried to overcome these problems and implemented an efficient automated water level monitoring and controlling system with energy efficiency. We are focusing mainly on the following problems of existing system.

- According to [1] what happens if there is no network coverage in the installation area?
- According to [2] we can calculate only the level of water in the tank. No signs of discussion about the incoming source of water.
- According to [3] what happens if the water level in the tank is low and there is no power to turn on motor.
- According to [4] user have to take the decision and have to control the motor using android app manually. Which is inconvenient to the user because one have to check the power and then act accordingly.

And none of the above references have addressed what happens about,

- During the water filling, what happens if the incoming water line have no water supply?
- What happens if Power Failure occurs before (or) during the time of water tank filling?

IV. PROPOSED SYSTEM

In this paper, we proposed a novel model which address all the issues discussed in section III. The major components used in this project are all the components of the system is connected Arduino Uno Board. The block diagram of the system and work flow is as follows.

Table 1 List of Components used

Arduino Uno	Potentiometer	5v DC Motor
Water Flow Sensor	I^2C Driver Board	16x2 LCD
Ultrasonic Sensor	Solenoid Valve	GSM Shield
Cloud Account	Power Bank	9v Battery

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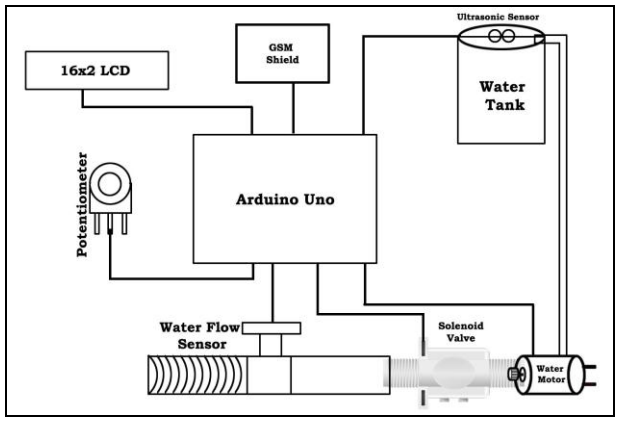

Figure 1 Block Diagram of the Proposed System

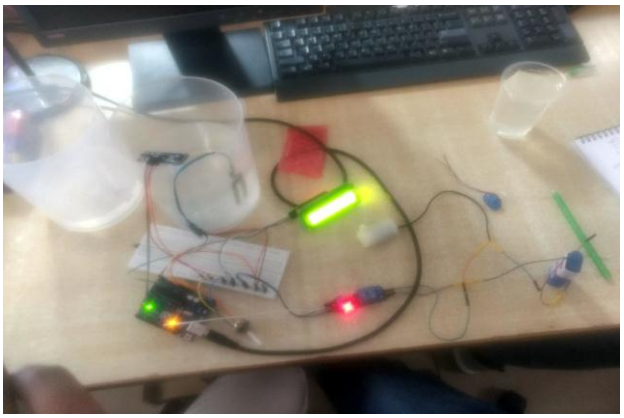

Figure 2 Implementation Phase

Our system work flow is as follows.

Step 1: The water flow in the main pipe line is identified using water flow sensor. If water flow detected, it will intimate the same to Arduino.

Step 2: Then the system will check if the power is there are not. To simulate this, we have used potentiometer, to measure a voltage of Arduino. In real-time we can check the AC mains.

Step 3: Then if power available, system will check for the water level in the tank through an Ultrasonic sensor.

If the power is not available, the same is intimated to the user using SMS, so that he can make necessary arrangement for the water.

Step 4: If the water level in that is up to MAX, then no action will be taken by the system, and the same message is conveyed to the user.

If water level is not up to the MAX, then system will automatically triggers the motor, so that the water level reaches to its required mark. Once the required level is reached, the motor will be turned off automatically.

Meanwhile the water is filled up into the tank, the incoming water line and the power supply is continuously monitored with the help of water flow sensor. If the incoming water supply is stopped, that will be intimated to the system by the help of Water Flow Sensor which in-turn triggers a signal to turn off the motor, with which we can avoid the problem of DRY-Run of motor.

V. RESULTS AND DISCUSSION

Proposed system giving the best result in saving water and energy. At present this was implemented and tested at various overhead tank filling points in apartments of urban areas in and around Rajahmundry. This reduced the need to waking up early in the morning and fill water tank. If the power not there, one have to wait till power comes, wasting of time. It made life easy and comfort.

With the data collected in cloud we are also able to analyze the water consumption in various areas and can take necessary actions for preserving the water for future use. The following are some of the graphs that are generated by thinkspeak cloud during the prototype testing. The collected data was plotted as graphs.

Figure 3 Electric Power Availability

In Fig.3 we show the status of power availability where zero indicates non availability of power and one indicates available.

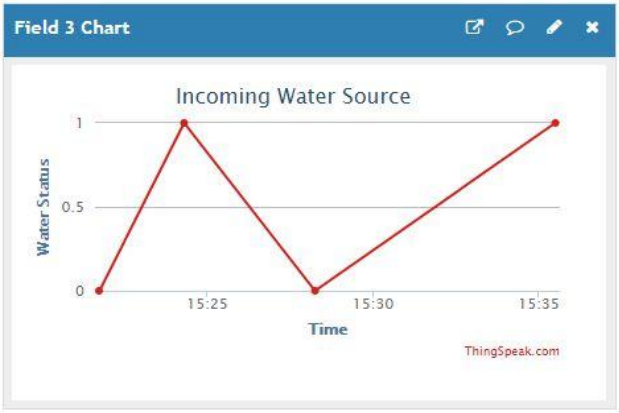

Figure 4 Water Source Availability Status

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In Fig.4 we show the status of Incoming water source status where zero indicates non availability and one indicates available.

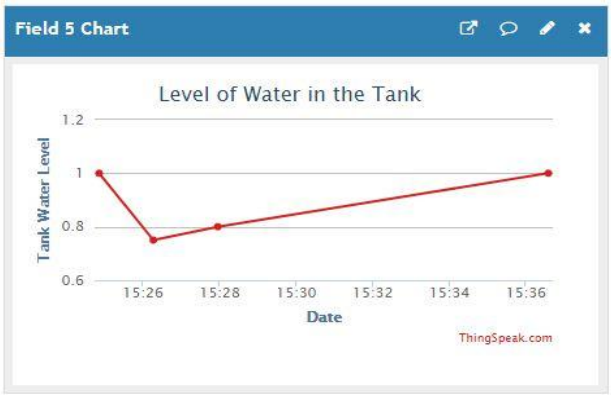

Figure 5 Indication of Water levels in the Tank

In Fig.5 we show the status of water level in the tank where zero indicates non availability and one indicates available.

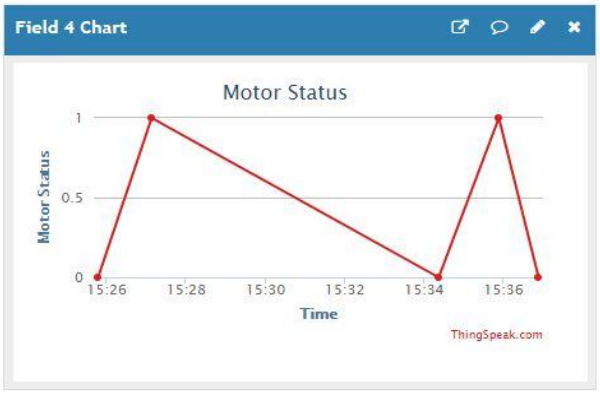

Figure 6 Indication of Motor Running

In Fig.6 we show the status Motor running where zero indicates motor OFF and one indicates motor ON.

VI. CONCLUSION and Future Scope

In our proposed system, water level will be monitored continuously from anywhere using cloud. Motor can be controlled automatically full smart automation is achieved. It is a robust system & small in size.

This device can be implemented at personal level. It can be implemented in a bungalow or at industrial level. In a bungalow it can be used as similarly described as above and at industry it can be used to check water levels of different tanks consisting of different types of liquids. The same can be extended to agriculture where farmers need to go to fields early in the morning, and gives water to their fields if the power is there. This system can also be used in dams in similar fashion.

REFERENCES

[1] Oluigbo Ikenna V., Nwokonkwo Obi C., Ezeh Gloria N., Ndukwe Ngoziobasi G., "Revolutionizing the Healthcare Industry in Nigeria: The Role of Internet of Things and Big Data Analytics", International Journal of Scientific Research in Computer Science and Engineering, Vol.5, Issue.6, pp.1-12, 2017

[2] M. Saraswati, "Design and Construction of Water Level Measurement System Accessible through SMS", in the Proceedings of the 2012 IEEE Computer Modeling and Simulation (EMS), 2012 Sixth UKSim/AMSS European Symposium, Valetta, Malta.

[3] Prachet Verma, "Towards an IoT based water management system for a campus", in the Proceedings of Smart Cities Conference (ISC2), 2015 IEEE First International, Guadalajara, Mexico.

[4] Sayali Wadeker, "Smart Water Management using IOT", in the Proceedings of the 2016 IEEE Wireless Networks and Embedded Systems (WECON), 2016 5th International Conference, Rajpura, India.

[5] Priyen P. Shah, "IoT based Smart Water Tank with Android application", in the Proceedings of I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2017 International Conference.

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