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An IOT based Water Supply Monitoring and Controlling System

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Abstract - *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 so that, we can have a record of available amount of water in tanks, flow rate, abnormality in distribution line. Internet of things is nothing but the network of physical objects embedded with electronics, sensors, software, and network connectivity. Monitoring can be done from anywhere as central office. Using thingspeak as free server data continuously pushed on cloud so we can see data in real time operation. Using different sensors with controller and raspberry pi as Minicomputer can monitor data and also control operation from cloud with efficient client server communication.*

Key Words: raspberry pi, Arduino Nano, water level sensor, flow sensor, GSM, relays, motors.

1. INTRODUCTION

According to recent survey, water has become a big issue because of less rain fall, increase in population many cities are facing this problem people have to suffer from this problem they don't have sufficient amount for their daily needs. Due to lack of monitoring water can't be supplied properly, some areas in city get water while other some areas can't so, there is a need of continuous monitoring, water supply scheduling and proper distribution another problems are excessive consumption, overflow of tanks, leakage in pipeline, interrupted water supply. Water is a basic need of every human being everyone has to save the water many times with lack of monitoring, overflow of these overhead tanks can occur because of this lots of water get wasted, another thing because of overflow in the pipelines with more pressure there is possibility of pipeline damage, leakage detection is one more problem all these problems are because of lack of monitoring, manual work, less man power. Before implementing this project I have taken a survey of Bangalore city to understand water supply distribution and related problems with the system, after taking a survey I observe that all the work is manual and need a better technology to make proper distribution. By focusing on problems in traditional methods our system design and develop a low cost embedded system device for real time monitoring of water distribution system in Internet of things (IOT) platform.

IOT is a world where billions of objects can sense, communicate and share information , all interconnected over public or private Internet Protocol (IP) networks. These interconnected objects have data regularly collected, analysed and used to initiate action, providing a wealth of intelligence for planning, management and decision making. The Internet Of Things (IOT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, devices many more and network connectivity which enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IOT-GSI) defined the IOT as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" and for these purposes a "thing" is "an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into communication networks". The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic 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 grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IOT will consist of about 30 billion objects by 2020. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens, or refrigerators/freezers that use Wi-Fi for remote monitoring.

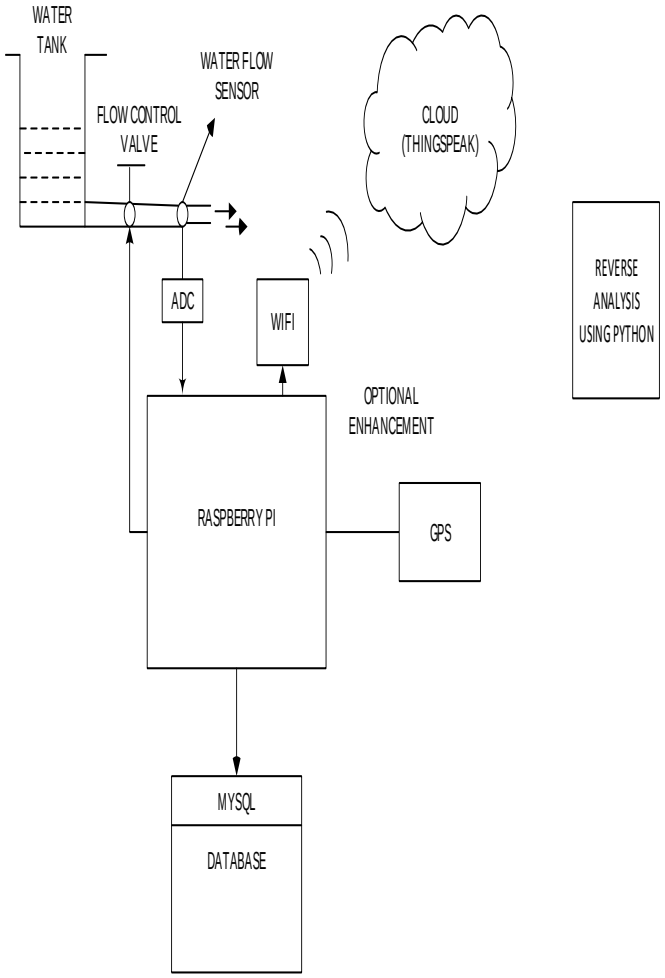
2. RELATED WORK

The setup has a water tank, which is filled with a help of a tap. The pipe is connection to solenoid valve or flow control valve and water flow sensor. The Raspberry PI controls the Solenoid value by turning it ON and OFF. If the solenoid valve is set ON (ON signal sent by RASBERRY PI).The water flow through the valve else if it is set OFF (OFF

signal sent by RESBERRY PI).the solenoid valve stops the water flow after this solenoid valve the water flows through the water flow sensor. This sensor is a turbine which will turn 3600 for every time of water passed through it. If 1litre is passed it rotate 3600. If 2liter passes through the water flow sensor the turbine rotate 6400.this rotation valve is read by ACD unit which will turn forward the digital value to "RASBERRY PI". The ADC unit converts the analog data into digital data and sends to the "RASBERRY PI".

The RASBERRY PI inturn to store this data in MYSQL database. These are 2 databases one is uses database and other is authority database. It can be used to generate bill for the amount of water used. the values of the amount of water passed is passed to the CLOUD(THINKSPEAK).since in any unexpected event of crash or destruction of the setup or software the values or data is stored on the CLOUD. Hence the cloud is used for security and safety purpose. There is a PH sensor attached after the water flow sensor which checks the PH value and decides if the water is portable(suitable for drinking).If the water is not portable, the sensor doesn't release the water further. A soil sensor is also attached after the PH sensor which will check for any soil in the water. Raspberry pi is a low cost small and portable size of computer board it has a high performance powerful processor its main core language is raspbian OS can also develop script or program using python language. Raspberry pi 3 has CPU 1.2 GHz BCM2836 quad-core ARM Cortex-A7 Memory, 1GB RAM, It has a 40 pin GPIO connector, micro SD. Purpose of using raspberry pi is an IOT. Raspberry is compatible with IOT. All the data is collected with a raspberry pi and it process continuously and push data on to the cloud. Using we are going to collect a data from sensors here, flow sensors are connected to analog to digital converter. Water flow sensor consists of a plastic valve body with a water rotor it uses a pinwheel sensor to measure how much liquid has moved through, water flows through the rotor rolls, speed changes which outputs the corresponding pulse Signal. Flow rate measured in Liters/sec/min/hour. By counting the pulses from the output of the sensor, can easily track fluid movement. The Global Positioning System (GPS) is the fully functional Global Navigational Satellite System which will help in determining the location, speed/direction and time with the assistance of 24 medium earth orbit satellites. Known as a useful tool for mapmaking, land surveying, commerce, and scientific uses, GPS is now a widely used navigation aid worldwide. Here in this project we use this for locating the position or place. Local database is installed in the SD card of the raspberry pi and data is collected and stored. From the cloud we can monitor and control the water flow. We also generate plots using data collected. The data collected there is also used in reverse analysis using python programming.

2.1 Block diagram



2.2 Software component used:

The programming language used in this project is PYTHON. It is a general purpose programming language we are using python for programming. There are different free servers for viewing data on to cloud think speak is one of them and MySQL server as local database. Raspbian is a Deben-based computer operating system for Raspberry Pi. It is now officially provided by the Raspberry Pi Foundation, as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian was created by Mike Thompson and Peter Green as an independent project.

The initial build was completed in June 2012. The operating system is still under active development. Raspbian is highly optimized for the Raspberry Pi line's low performance ARM CPUs. Raspbian uses PIXEL, Pi Improved X windows Environment, Lightweight as its main desktop environment as of the latest update. It is composed of a modified LXDE desktop environment and the Open box stacking window manager with a new theme and few other changes. Raspbian is a Debian-based computer operating system for Raspberry Pi.

PHP is the most popular scripting language for web development. It is free, open source and server-side (the code is executed on the server). MySQL is a Relational Database Management System (RDBMS) that uses Structured Query Language (SQL).MySQL works very well in combination of various programming languages like PERL, C, C++, JAVA and PHP.

Out of these languages, PHP is the most popular one because of its web application development capabilities. PHP provides various functions to access the MySQL database and to manipulate the data records inside the MySQL database. This requires to call the PHP functions, in the same way it call any other PHP function.

Python is Open Source and is a Biggest Open Source Community. It Supports well with Hardware and Software Development with Raspberry Pi. The Pi is the Word is Derived from Python Programming. Python Supports Well for Image processing, Machine Learning, Neural Networks and Deep Learning with Data Science and Artificial intelligence. Python is a widely used high-level programming language for general-purpose programming, created by Guido van Rossum and first released in 1991. An interpreted language, Python has a design philosophy which emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax which allows programmers to express concepts in fewer lines of code than possible in languages such as C++ or Java. The language provides constructs intended to enable writing clear programs on both a small and large scale .A Cloud from Math Works Company well Supportive for the Sensor Data which works well with IOT Works on HTTP Protocol . Basic Encryption of the Data has already been provided by the Vendors by Generating a API Keys for Logging Data. Since we're using a Free Account. The Data has a Cap of Logging with 15 Sec.

Once ThingSpeak is an open source Internet of Things (IOT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates ThingSpeak was originally launched by I/O Bridge in 2010 as a service in support of IOT applications.

ThingSpeak has integrated support from the numerical computing software MATLAB from Math Works. Allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Math works.

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3. RESULT

After all connections are done, through putty login as pi and execute the command sudo python filename. Once the command is executed continuous values are read and stored on cloud and local database those values are been displayed on the putty terminal. The output of the putty terminal is as shown in the above figure. As the water flows, the turbine starts to rotate. It divides the amount of water into 3 levels. 50%, 75% and 100%.

The above condition occurs when the water flow reaches 50%.Since we are uploading the values to both cloud and local database. we are uploading the values to the local database because we can't assure the internet all the time. The values are uploading to the cloud because large values can be stored with fewer prices. The cloud used here is thingspeak it's a free cloud available to some limits. here the values will be uploaded once in 15sec. just because to avoid the traffic in uploading the values. the values which are uploaded are represented in the form of graph this also called as reverse engineering.

4. CONCLUSION

There has been tremendous growth in the area of internet of things. In this paper we have proposed a system that monitors both the flow of water for daily usage for the residents and also that checks the soil moisture in the field of agriculture. The proposed system consists of Raspberry pi as core controller and several other sensors to monitor the water flow and soil moisture. The monitoring of water flow can be updated to the water board so that it helps them in turn to monitor the efficient supply of water for daily usage. Similarly, with soil sensors embedded within gardens or fields, gardeners or farmers can receive a notification whenever the soil requires water for their crops and they can even avoid wastage of water whenever the crops or garden has sufficient water due to rain. Further, our proposed system can be implemented in real time by installing water sensors in tanks and several soil sensors in farms.

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