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Design and Implementation of IOT Based Smart Water Distribution System

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ABSTRACT

The aim of this project is to manage and plan the usage of water using IoT. This system can be easily installed in residential societies. Water level measurement is very important in some water related fields. This project permits both meter reader as well as individual domestic/ industrial consumers to use regular smart phones. Flow sensor is placed in pipes which continuously inform the water level at the current time to the web server. This information will be updated on the cloud and using an android application, user can visualize the water level on a smart phone anywhere that is connected to internet. So there is a need to monitor and protect the water with a real time water quality monitoring system in order to make active measurement to reduce contamination.

Keywords : Water Losses Control, Arduino 2560 microcontroller, Flow Sensor.

I. INTRODUCTION

Water is the available natural resources on the earth. Water use includes provision of important terrestrial environmental values and much "green water' is used in maintaining forests and wild lands, there is also direct environmental use (e.g. of surface water) that may be allocated by governments. Water is the basic needs of people so it has to be provided at correct time to fulfill the needs of people. Water has influence in many areas such as agriculture field, domestic purpose, industrial usage etc. Water covers 70% of earth surface out of this only 3% of water is portable. In agricultural sector, water is used for irrigation and for livestock. Earth consists of 97% of salt water and 3% fresh water, so the water has to be used without wasting it.

Water use is measured in water volume consumed (evaporated) and/or polluted per unit of time. The water is also used in business for producing/manufacturing or for supporting activities and the indirect water use in the producer's supply chain.

Drinking water, also known as potable water or improved drinking water is water that is safe to drink or to use for food preparation, without risk of health problems. Water is essential for life. The amount of drinking water required is variable. It depends on physical activity, age, health issues, and environmental conditions. It is estimated that the average American drinks about one liter of water a day with 95% drinking less than three liters per day. For those working in a hot climate, up to 16 liters a day may be required. Water makes up about 60% of weight in men and 55% of weight in women. Infants are about 70% to 80% water while the elderly are around45%.

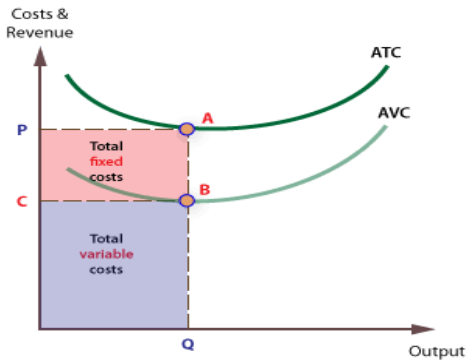

Fig1. Total cost due to water losses

II. METHODS AND MATERIAL

1. IOT Application

IoT Smart water management system exists to help us optimize the water use. The challenges that we face in water management are knowing how much water we are using or knowing if there was a problem within your irrigation system. With internet of things, these challenges are eliminated through remote monitoring and the use of various sensing technologies and quick response time. IoT smart water management system uses a lot of connected devices in the field, that's how it communication remotely with landscape irrigation system and weather station. It allows us to pull data back and commands out very quickly.

The IoT smart water management implement is an overall optimization of resource consumption. Detecting leakages, quality assurance, and matching demand with supply of water is where statistical method witch are unlocked through IoT smart water management solution shine best. IoT implementation in the water infrastructure makes sure no drop goes to waste because every drop counts.

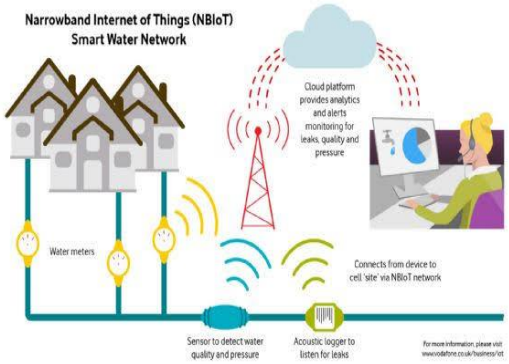

Fig 2. Structure of IoT system under development

2. System Description

A. Arduino mega 2560

The Mega 2560 is a microcontroller board based on the ATmega 2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila. The Mega 2560 is an update to the Arduino mega which it replaces.

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

B. Flow sensor

Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor

outputs the corresponding pulse Signal. Flow meter have proven excellent devices for measuring water flow and now it is very easy to build a water management system using renowned water flow sensor. There are many water flow measurement techniques as well as different type of water flow sensor used to measure the volume of water flow in pipeline.

C. Valve

Valve is used to control or regulate the flow of liquid by opening or closing it. To supply water efficiently the pipes need a way of switching and regulating how much water can pass through them, they also need a way of switching the floe off completely. Valves are mechanical switches that can turn pipe on and off or raise and lower the amount of fluid flowing through it. In an open valve fluid flow in closed they never allow liquid or gas to pass through it. It is also used in military and transport sectors.

D. Flow Switch

Flow switch is made up of metal body, magnet and reed switch. It sends an electric signal at specific flow rate. The magnet has a hole that allows the water to flow through it. It is a mechanical gadget used to control the flow of liquid, air or stream.

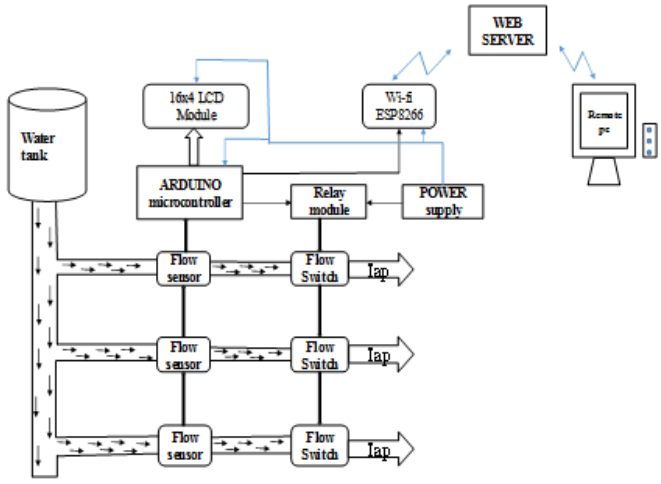

Fig. 3 Block diagram of Smart water distribution system

E. Solenoid valve

Solenoid valve is an electromechanically operated valve. Solenoid valves differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid , and the type and characteristics of fluid they control. The mechanism varies from linear action, plunger-type, actuators to pivoted-armature actuators and rocker actuators. The valve can use a two-port design to regulate a flow or use a three or more port design to switch flows between ports. Multiple solenoid valves can be placed together on a manifold.

F. Poer supply

A power supply is an electronic device that supply electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters.

G. IoT ESP826

The ESP8266 is a small WiFi module built around the ESP8266 chip that can connect your microcontroller to the internet wirelessly for a very small cost. It can be a great option for Internet of Things (IoT) projects, but can be difficult to work with for beginner hobbyists who do not have prior experience with the module. In this tutorial, we hope to show you how to interface the ESP8266 with an Arduino and perform some basic functions like connecting it to a WiFi network.

3. Software Description

A. Arduino IDE

The Arduino Integrated Development Environment – or Arduino Software (IDE) – contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

B. Writing sketches

Programs written using Arduino Software (IDE) are called **sketches.** These sketches are written in the text editor and are saved with the file extension.ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port.

C. Tools

Auto Format this formats your code nicely: i.e. indents it so that opening and closing curly braces line up, and that the statements inside curly braces are indented more. Archive Sketch is archives a copy of the current sketch in .zip format. The archive is placed in the same directory as the sketch. Fix Encoding & Reload-Fixes possible discrepancies between the editor char map encoding and other operating systems char maps. Serial Monitor-Opens the serial monitor window and initiates the exchange of data with any connected board on the currently selected Port. This usually resets the board, if the board supports Reset over serial port opening.

D. HTML

Hypertext Markup Language (HTML) is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript. Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

E. PHP

PHP (recursive acronym for PHP: Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML.Instead of lots of commands to output HTML (as seen in C or Perl), PHP pages contain HTML with embedded code that does "something" (in this case, output "Hi, I'm a PHP script!"). The PHP code is enclosed in special start and end processing instructions <?php and ?> that allow you to jump into and out of "PHP mode

F. Mysql database

A database is a separate application that stores a collection of data. Each database has one or more distinct APIs for creating, accessing, managing, searching and replicating the data it holds. Other kinds of data stores can also be used, such as files on the file system or large hash tables in memory, but data fetching and writing would not be so fast and easy with those type of systems. MySQL is a fast, easy-to-use RDBMS being used for many small and big businesses. MySQL is developed, marketed and supported by MySQL AB, which is a Swedish company. MySQL is becoming so popular because of many good reasons.

G. Wampserver

A Windows Web development environment for Apache, MySQL, PHP databases. Wamp Server is a Web development platform on Windows that allows Wamp Server installs automatically all you need to start developing web applications and is very intuitive to use. You will be able to tune your server without even touching the setting files.Wamp Server's functionalities are very complete and easy to use so we won't explain here how to use them.

III. CONCLUSION

System for implementing an economic and reliable smart water distribution metering using IoT based

hardware .The features of prototype system and the benefits are discussed. The novel approach overcomes disadvantages in analog meter, meter smartcards using hacking software, etc. This system extended to cover a range of Distribution metering and Unaccounted for Water issues faced by utilities while giving direct and intangible gains to the consumers in the changing smart infrastructure scenario in urban areas.

IV. FUTURE WORK

The future of water distribution and management can be implemented in smart water grid incorporates the use of IoT devices such as a sensors connected on a network to efficiently monitor and manage the water supply system. These devices can help overcome the challenges faced by the current systems on a significant level. The management of smart water grids is also relatively easy, resulting in an efficient water distribution method. Thus, a smart grid system can be looked at as a possible not only for significantly improving on the age- old water distribution methods but also to solve the water crisis faced globally.

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