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WATER MANAGEMENT SYSTEM BASED ON IoT

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Abstract
Water wastage management is a significant problem for the earth. Water monitoring systems come in a wide variety, but they all require human operation. The suggested system, which allows for regulated water discharge from the pipe automatically using mobile application, was designed using an Arduino board. Real-time monitoring and control of the motor and distributing valve from any location connected to the internet. The majority of individuals in metropolitan regions reside in flats and apartments where they must obtain water from the corporate and then purchase supplies for each. Normal water supply methods have a higher number of technical issues and are challenging to use often. To address these issues, we have created a functioning prototype for this project. One Main water tank is included in our model. We will get real-time information on a smart phone over Wi-Fi and each node (Solenoid Valve) can operate automatically based on the microcontroller operation or for other difficulties. In this project, the ESP8266 will serve as the microcontroller.

Key Words: Arduino, IoT, Wi-Fi, Esp8266, Solenoid Value, Tank Overflow, Blynk IoT, Realtime Status, Pump Control.

INTRODUCTION

Were our efforts to save water unsuccessful? We have focused on preserving water at the source ever since the water conservation discussion first started. In addition to encouraging locals to build irrigation systems and dams, we also tried to teach them other useful skills. The lowest ring of implementation, the end user, is where we fell short, though. No matter how much water is conserved at the source, if the end user decides to waste it or lacks control over his water usage, all of our efforts will be futile. So we brainstormed a solution to this issue as a group. Our project essentially increases awareness of the amount of water needed. Additionally, it runs automatically and without human input, powering the motors. As a result, just human monitoring could be necessary. This eliminates several thoughtless human mistakes. Water crises between Tamil Nadu and Karnataka can be resolved by implementing this project through hydro projects like dams. When such a system is put into place on a broader scale, it will effectively manage the water requirements between the states without wasting any water. A sufficient volume of water can be released into the secondary state before the dam automatically collapses. In many places, this may substantially settle a water conflict. The major subjects of this paper are the applications of IoT in water management systems. The motor will automatically switch on and off by mobile when the storage tank and motor are separated by distance. The status of the motor, water distribution valve, water level in the storage tank, and running condition are all displayed on the mobile device. IoT will be used to present real-time functioning status in the mobile application. Using the internet of things (IoT), all the systems will be controllable from anywhere in the world.

EXISTING SYSTEM

The greatest enduring issue in the modern world is water shortage. The majority of people in metropolitan regions reside in apartments and flats where they must obtain water from the company and then provide for each unit. Normal water supply methods have a higher number of technical issues and are challenging to use often. To address these issues, we have created a functioning prototype for this project. Two little mini-sub water tanks and one main water tank are included in our model. Each node (tank) can function independently depending on the tank and its ability to monitor groundwater levels or for other reasons. We will receive real-time information on our devices. In this project, the microcontroller will be an Arduino UNO.

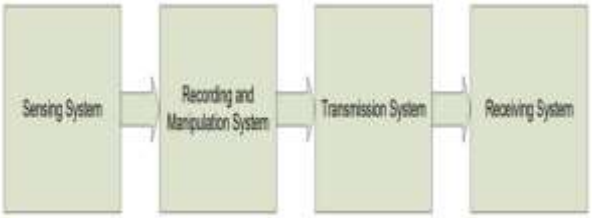

Fig-1: Block Diagram for Existing System

Problem Identification

- The tank's overflow control, the motor, and the tank may all be found close by.
- The water distribution value is only manual.
- When the tank and the motor are far apart, the timing function will automatically activate the motor.
- The amount of power used is enormous.

PROPOSED SYSTEM

The multiple controller and mobile application will show the current status of every operation. If the motor and tank are far apart, they are connected and interact over the internet. Because the IoT is used to operate this system, all of the components will be connected to one another over the internet.

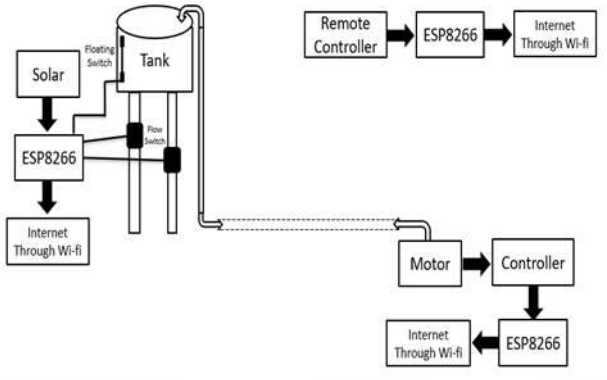

Fig-2: Block Diagram for Proposed System

ESP8266

The ESP8266 Wi-Fi Module, a self-contained SOC with an integrated TCP/IP protocol stack, enables any microcontroller to connect to your Wi-Fi network. The ESP8266 is capable of hosting an application or delegating all Wi-Fi networking duties to another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, enabling you to connect it to an Arduino device and achieve connectivity akin to a Wi-Fi Shield. The ESP8266 module is a board with a substantial price tag. The NodeMCU supports a variety of package kinds. All of the designs share the ESP8266 core as their fundamental component. The architecture-based designs have kept the 30-pin standard layout. It is important to understand that some designs have a wide (1.1") footprint while others use the more common narrow (0.9") footprint. The two most widely used NodeMCU devices are the Amice (based on the standard narrow pin-spacing) and LoLin (based on the wider pin-spacing and larger board). Due to the open-source architecture of the fundamental ESP8266, the NodeMCU market may constantly generate new varieties.

Fig:3 NodeMCU

SOLENOID VALVE

A solenoid valve is one that is controlled electromechanically. Solenoid valves differ from one another in terms of the characteristics of the electric current utilized, the strength of the magnetic field created, the way in which fluid flow is controlled, and the kind and quality of the fluid. The mechanism varies from linear action, plunger-type actuators, pivoted-armature actuators, and rocker actuators. The valve may be configured with two ports to control a flow or with three ports or more to switch flows between ports. Several solenoid valves may be grouped together on a manifold. Solenoid valves are the controls that are used the most frequently in fluid mechanics. They are responsible for mixing, dosing, distributing, and turning off fluids. They are used in a variety of industries. The benefits of solenoids are quick and secure switching, extended service life, high reliability, good medium compatibility of the materials used, low control power, and compact design.

The design of valves comes in a variety. In ordinary valves, numerous ports and fluid routes are possible. A 2-way valve, for instance, has two ports that are linked when it is open and allow fluid to move through them; when it is closed, the ports are separated. If the valve is open while the solenoid is not activated, it is referred to as typically open (N.O.). Similar to this, if a valve shuts even when the solenoid is not turned on, it is referred to as being normally closed (N.C.).Additionally, there are more complex patterns and 3-way patterns.

A three-way valve connects one port to one of the other two ports using its three ports.Another way to recognize them is by the way solenoid valves work. Only a little solenoid can deliver a small amount of force. For a direct acting solenoid valve, an approximation of the relationship between the orifice area A, fluid pressure P, and required solenoid force Fs is shown.where d is the orifice's diameter. A typical figure for solenoid force is 15 N (3.4 lbf). One application would call for a low pressure gas with a small orifice diameter, such as 3/8 in (9.5 mm) for an orifice area of 0.11 in2 (7.1105 m2) and an estimated force of 1.1 lbf (4.9 N).

Fig-4: SOLENOID VALVE

A solenoid might not be able to activate a valve on its own if fluid pressures are high and the orifice diameter is big. A pilot-operated solenoid valve design can be utilised to address this. In such a system, the solenoid acts as a "pilot" to guide the fluid, while the pressurised fluid itself applies the forces necessary to trigger the valve (see the paragraph below). Dishwashers, irrigation systems, and other devices that require high pressures or volumes all use these valves. Although pilot-operated solenoids tend to use less energy than direct-action solenoids, they are more prone to clogging if the fluid contains solid contaminants and will not function at all without appropriate fluid pressure.

Ultrasonic SENSOR

Fig-5: ULTRASONIC SENSOR

Devices that produce or sense ultrasound energy include ultrasonic transducers and ultrasonic sensors. Transceivers, receivers, and transmitters are the three broad categories into which they can be separated. Transceivers can transmit and receive ultrasound, whereas transmitters transform electrical signals into ultrasound and receivers into electrical signals. In many automated manufacturing and processing facilities, ultrasonic sensors can identify targets in motion and determine their distance from the sensor. Sensors can produce an analog output proportional to distance or an on-or-off digital output for sensing the movement of objects. As a component of a web guiding system, they are able to detect the material's edge.

To help drivers reverse into parking spaces, ultrasonic sensors are frequently employed in automobiles as parking sensors. They are also being tested for a number of other automotive applications, including as helping UAVs navigate and using ultrasonic persons detection.

Ultrasonic sensors can be used in situations where photoelectric sensors may not be since they sense sound rather than light. For applications where photoelectrics fail due to target translucence, such as clear object recognition and liquid level measurement, ultrasound is a fantastic alternative. Additionally, ultrasonic sensors are unaffected by target color or reflectivity and can function dependably in conditions with high levels of glare.

To find dangerous situations that produce ultrasonic sound, such as high-pressure gas or liquid leaks, passive ultrasonic sensors may be utilized. These technologies reduce sounds from the transducer (microphone) to a range that is audible to humans.

Commercially available ultrasonic cleaning equipment uses high-power ultrasonic emitters. A stainless steel pan with an ultrasonic transducer attached to it is filled with a solvent, usually water or isopropanol. The transducer receives an electrical square wave, which generates sound in the solvent that is powerful enough to create cavitation.

HARDWARE IMPLEMENATION

Fig-8: Experimental Setup

The major subjects of this paper are the applications of IoT in water management systems. The motor will automatically switch on and off by mobile when the storage tank and motor are separated by distance.is seen in Fig. 9). The status of the motor, water distribution valve, water level in the storage tank, and running condition are all displayed on the mobile device. IoT will be used to present real-time functioning status in the mobile application.(Is seen in Fig. 10). Using the internet of things (IoT), all the systems will be controllable from anywhere in the globe.

MOBILE APPLICATION INTERFRENCE:

Fig-9: Application Home Page

Fig-10: Graph of Water Monitoring

CONCLUSION

This paper may be utilised to create a civilization that uses less water. Saving water, electricity, and most significantly, human labour, is made possible by this. By placing main tanks in a region with a high groundwater level, which may be used to deliver water to these sub-tanks, it is possible to establish sub-tanks for a smaller area.

Due to its adaptability, this method can be utilized both manually and automatically. Although the system is designed to run automatically because mistakes do happen periodically, the water levels in the tanks may still be checked and regulated from any location as needed. This automated water grid is safe, useful, and energy-efficient in addition to being practical and convenient. The system, which was successfully built using Arduino, enables a controlled discharge of water from the pipe using a mobile application.

REFERENCES

1. REVANTH C.B," e-Water supply system using Python, Raspberry Pi and IOT", International Research Journal of Engineering and Technology (IRJET).
2. Kusuma S S1, Anil G N2 "An IOT based Water Supply Monitoring and Controlling System", International Research Journal of Engineering and Technology (IRJET).
3. Michel R. Machado, Tiago Ribas Júnior, Michele R. Silva and João B. Martins-Smart water management system using the microcontroller ZR16s08 as IoT solution.
4. Abes - associaçãobrasileira de engenhariasanitária e ambiental. PerdasemSistemas de Abastecimento de Água: Diagnóstico, Potencial de Ganhos com suaRedução e Propostas de Medidas para o EfetivoCombate.
5. Mr. Prashant palkar1 , Prof. (Dr.) Shrinivas Patil2 Prof. Mrs. Pooja Belagali3, Mr. Ashish Chougule4, "Automation in drinking water supply distributed system and testing of water", IOSR Journal of Electronics & Communication Engineering (IOSR-ECE)
6. Internet of things enabled real time water quality monitoring system, S. Geetha and S. Gouthami.
7. Smart water grid: the future water management platform, Seung Won Lee, SarperSarp, Dong Jin Jeon, Joon Ha Kim.
8. Researches on Smart Water Grid Author(s): CHOI, GyeWoon.
9. Smart Water Grids for Smart Cities: a Sustainable Prototype Demonstrator. Authors: Roberto Gavazzi, Leonardo Gabrielli, MircoPizzichini, Susanna Spinsante, Stefano Squartini
10. Need of Smart Water Systems In India, Aditya Gupta, Sudhir Mishra, NeerajBokde, Kishore Kulat