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Water Management System Using IoT with WSN

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Abstract - This paper presents an IoT device which helps to manage/monitor and plan the usage of water by observing the level of water in the tank. By using The Internet of Things(IoT), we can regulate the usage of water in residential/offices. The device uses sensors to record the level of water in the tank at any instant and sends the data to the cloud using Wi-Fi. The information gathered can be read by users on the integrated website using their smartphone/laptop device connected to the internet. The device also controls the automatic functioning of water motor by turning it on when the water level lies between the low level and the high level (the specified range) and by turning it off when the water level falls below the low level or rises above the high level.

***Key Word*: IOT device, Water Level sensor, cloud, Water resources, Arduino Uno, Node ,MCU**

1. INTRODUCTION

Internet of Things (IoT) is currently a technology of great significance worldwide. IoT is a platform which provides the physical devices present in the network embedded with electronics, software, sensors, actuators, and connectivity to connect and exchange information to address specific needs. IoT is when the internet and networks expand themselves to domains such as manufacturing, transportation, healthcare and security. An Embedded system is a combination of software and hardware which carries out a specific function within a larger system. The implementation of IoT with the help of embedded systems can help vastly with the management of water. Water management is the complete management of water resources under set policies and regulations. It is the activity of planning, developing, distributing and managing the optimum use of water. Water management is important to satisfy demands for water by allocating water on an equitable basis. The foundation of this project is based on Internet of Things (IoT) and Embedded Systems.

2. OBJECTIVES

Water, once an abundant natural resource, is becoming a more valuable commodity due to droughts and overuse. Hence, it is important to use a Tank Water Level Monitoring system to avoid overflow by intimating the level of water in the tank. Water controlling system implementation makes for a potential significance in home applications. The existing automated method of level detection is described as something which can be used to turn the motor device on/off to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. This helps enhance the water management system.

3. LITERATURE SURVEY

[1] Design of a Water Environment Monitoring System Based on Wireless Sensor Networks:

This paper is devoted to the explanation and illustration of our new design of water environment monitoring system, based on a wireless sensor network. The system generally includes three parts: hardware and software of data monitoring nodes, hardware and software of the data base station, and software for the remote monitoring centre. The system's measurement capacity ranges from 0 to 80 C on water temperature, with an accuracy of 0.5C; and from 0 to 14 on pH value, with an accuracy of 0.05. Sensors, applicable to different water quality, could be installed at the node to meet the monitoring demands in different water environments and to obtain different parameters.

[2] Smart Water Monitoring System Using Wireless Sensor Network at Home/Office:

This paper is about developing an efficient wireless sensor network (WSN) based on water monitoring system. There are two different ways to monitor the water: water level monitoring and water pipeline leakage monitoring. Finally, this is water monitoring system of smart homes/office research concept will be completed by using wireless sensor technology. By using the monitoring system, we can find a more optimal way to preserve the water, hence saving it for the present and the future generations.

[3] Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network:

Here, the proposed implementation of high power Zigbee based WSN for water quality monitoring system offering low power consumption with high reliability is presented. An important fact of this system is the easy installation of the system, where the base station can be placed at the local residence, close to the target area. And the monitoring task can be done by any person with minimal training at the beginning of the system installation.

4. PROPOSED SYSTEM

In accordance with the literature survey, we are trying to make a smart system for controlling the wastage of water by using an ultrasonic sensor to sense the level of water in tank. If the water tank is full or up to the maximum level the sensor will sense it and stop the system automatically. If the water tank is at the minimum level set by user, the sensor will sense it, activate the motor pump and stop at the maximum level. We can control this whole process using IOT.

5. BLOCK DIAGRAM

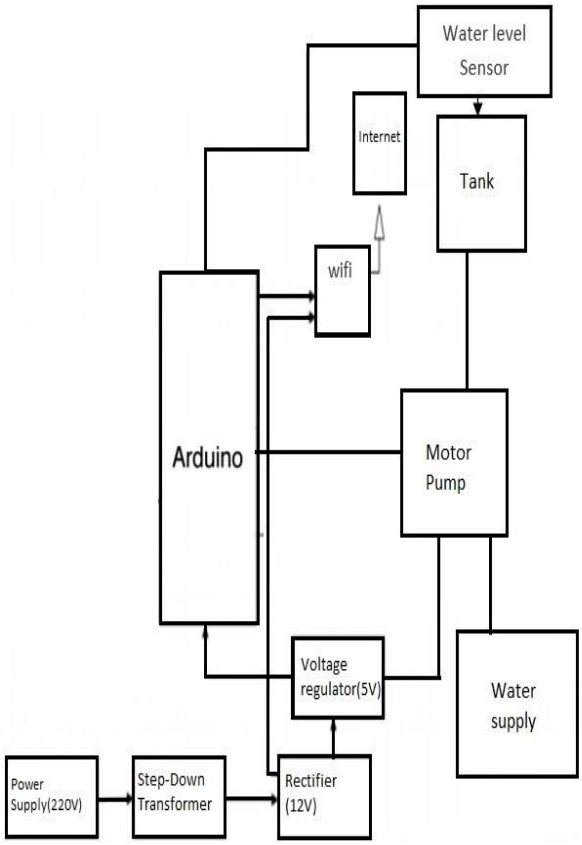


Fig.1 Block diagram

6. FUNCTIONS OF COMPONENTS

1. Arduino UNO Board

The hardware consists of an Arduino microcontroller development board, Ultrasonic Sensors and a Wi-Fi module to collect & transfer data to cloud. Data is collected from ultrasonic sensors using Arduino Uno microcontroller. Arduino is an open source hardware platform which is compatible with various sensors and communication technology. There are different types of Arduino microcontroller that are used for different purposes. It not only control devices but also can read data from all types of sensor. Arduino Uno is a microcontroller board based on the ATmega328P. It is simple, low cost, easy to use and easily available in the market. It takes 5V voltage as input at the speed of 16 MHz. Arduino Uno contains 14 digital input /output pins and 6 analog input pins to connect various sensors that gives analog inputs.

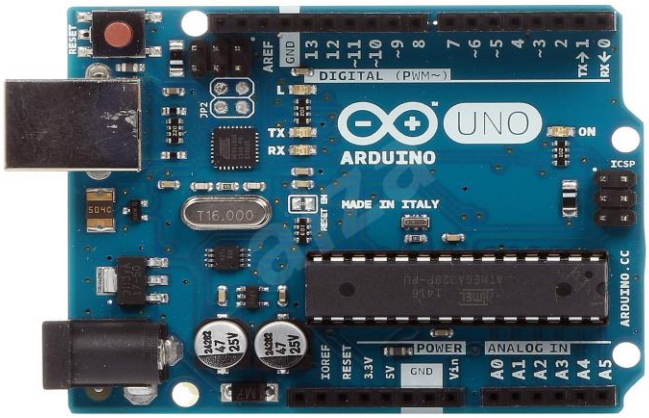


Fig.2 Arduino UNO Board

2. ESP8266-WiFi Module

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to the Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, which means, one can simply hook this up to Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers. The ESP8266 module is an extremely cost-effective board with a huge and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, and is designed to occupy minimal PCB area.

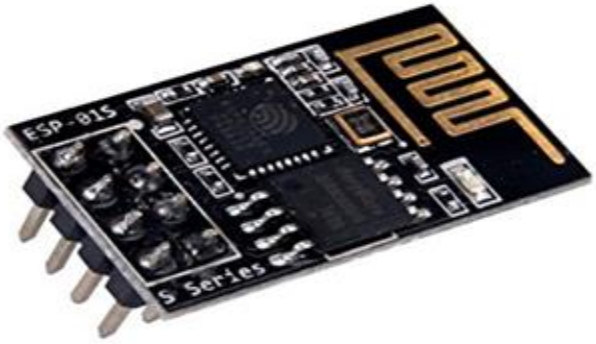


Fig.3 ESP8266-WiFi Module

3. Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to the target (water level) using sound waves. It measures the distance by sending the sound waves at a specific frequency and then listening for it to bounce back. This helps keep track of the current level of water between maximum water level and minimum water level as set by the user.

Fig.4 Ultrasonic sensor

4. Motor Pump

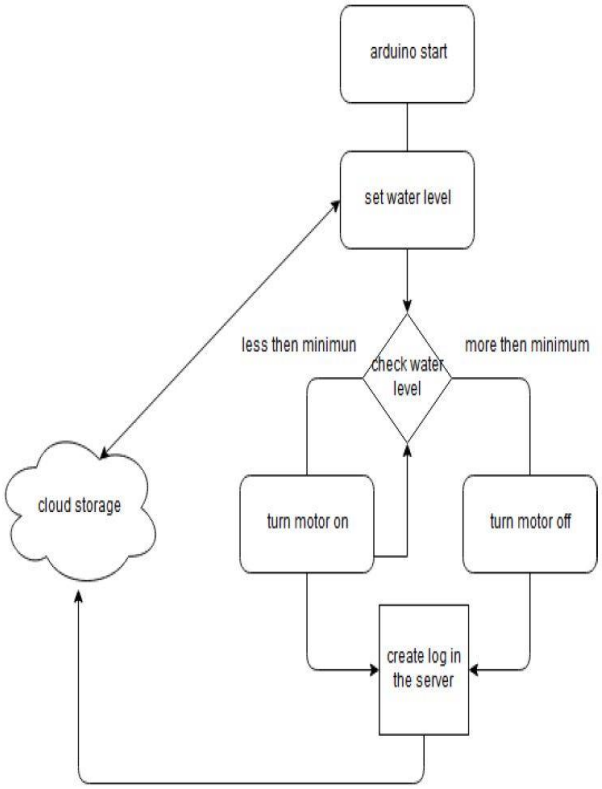
Motor Pump is used to move water into the tank. The Motor Pump is connected to the Ultrasonic sensor via the embedded system. When the Ultrasonic sensor detects water level between the lower range and the upper range, the motor is switched on. And when the Ultrasonic sensor detects water level below the lower range and above the upper range, the motor is switched off.

Fig.5 Motor Pump

7. WORKING

Arduino Uno is connected to an ultrasonic sensor(HC-SRO4), Wi-Fi module (ESP8266) that processes and transfers recorded data using sensors to the cloud. Wi-Fi module will trigger the Atmega 328 microcontroller, which will get +5-volt DC supply from the supply voltage. Stored data is accessed by the user through the web. This enables the user to check the level of water. User logs in to the integrated website and set the minimum water level and maximum water level in the tank. Tank Water Level management is used to avoid overflow by intimating the level of water in the tank. Water controlling system implementation makes a potential significant presence in homes and offices. The existing automated method of level detection is based on measure of minimum and maximum level of water in the tank which facilitates the automatic switching ON/OFF of the motor. If minimum input water level value is reached, the Motor is turned ON. It begins to fill water in the tank until maximum input water level value is reached in the water tank. Once the maximum water level value is reached, the motor is turned OFF.

8. FLOW CHART



9. CONCLUSIONS

The IoT is an important technological advancement which takes the internet and networks to everyday life domains like controlling home appliances, management of water intake and keeping the overall energy intake under control. It encapsulates several technologies such as information technology, cognitive sciences, communication technology, and low-power electronics. IoT creates a newer information society and knowledge economy. The development of the IoT brought into light many new challenges including the lack of fundamental theory supporting, unclear architecture, and

immature standards. This concept has helped improve the basic outline of water management techniques by keeping the user up to date by storing the information regularly, obtained using certain variables with the help of network sensors. The existing automated method of level detection is based on measure of minimum and maximum level of water in the tank which facilitates the automatic switching ON/OFF of the motor. If minimum input water level value is reached, the Motor is turned ON. It begins to fill water in the tank until maximum input water level value is reached in the water tank. Once the maximum water level value is reached, the motor is turned OFF. The user can keep track of the usage of water and plan accordingly the range of water level to be administered. Thus, this device helps achieve certain level of optimal usage of water which in turn makes water management more effective.

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