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IOT Based Water Monitoring System Using Rainwater And Groundwater Consumption

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Abstract

Water is an essential requirement for our lives. Water contamination and its wastage is one of the enormous issues in the world. So as to contribute a little and save the groundwater which is used for various purposes like agrarian, household, etc. the water is ought to be monitored. This paper introduces a model which is focusing on the consumption of rainwater along with groundwater and its monitoring using a smart water tank based on IoT operated using an android application. Due to a decrease in the underground water level, it will help the society to use filtered rainwater for their daily needs. The idea of the proposed model is based on using rainwater and groundwater collectively. This model will immensely affect the increasing trend of using future technology. Moreover, it will help in using the rainwater effectively and reducing the human work.

Keywords: *Arduino Uno, GSM Modem, Smart water tank, Rain water consumption, Ultrasonic sensor.*

1. INTRODUCTION

In today's world water, a vital resource required for sustaining life is becoming scarce, which is leading to an impure water supply and water shortages. To prevent this, not only are water preservation techniques like rainwater harvesting required but also water wastage must be prevented. In recent times, the use of android apps and IoT devices have gain greater importance for daily life. In day-to-day activities, water wastage in the houses has increased and the proper supply of water from the main source is getting wasted.

We have developed two IoT devices, one for an automatic water tank that senses the water tank level and stores it in the cloud for analysis using GPRS module and a second device, motor with an Arduino and GSM module to get automatically on and off.

With more advancement of IoT and different use of sensors, water level, and checking sensor it will make a big impact on upcoming application. Basically, with this smart water tank user can easily check the water level and quality of water. This sensor or device can communicate with any network using various gsm modem and WIFI networks. Due to this water crisis in the world, humans must manage and conserve water [6]. We are using rainwater and groundwater for monitoring the smart water tank using an android application. An android application "Tank Monitor" has been developed to monitor the water level, control the motor, detect the water level and gives the approximate value of the water in the tank.

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The IoT is a hi-tech transformation that speaks to the eventual fate of figuring and correspondences between the front-line PC. Water is a basic asset and the most significant component required by people. Internet of Things (IoT) empowers us to assemble a framework without human obstruction [6]. In this project, we can control the water level locally and the operator can keep eye on proper functioning. A smart water tank implements IoT, in which users can directly monitor and can control the working of the system through smartphones and from any place in this world.

The Paper is branched into the following sections: Section II represents the literature survey of different research papers related to water monitoring; section III represents the proposed system and system architecture of the smart water tank section IV synopsis of the conclusion and V shows the future work.

2. LITERATURE SURVEY

As indicated by Wikipedia, water within the seas is about 97%, while just 3% of water is accessible for Human Resources. Out of which only1% is used for utilization. The examination which has been done throughout the years is tremendous, the most ideal answer to spare the water carefully is to observe/monitor the water which is being utilized within the households, industries, agriculture, and etc.to diminish the water wastage and raising better approaches to revive water.

In paper [1], the creator has actualized a technique of monitoring water by utilizing a (water level marker) which may be a straightforward circuit containing LEDs to point out the water level in a Tank. In any case, this frame features a downside because it cannot be executed for a large scope. Also, the equipped segments are placed within the water which makes it unacceptable to utilize it consistently for households.

In paper [2], the author has indicated that, recently, the Tremendous development of applications on the (Internet of Things) in trendy houses. A good range of various IoT applications typically results in criteria for interoperability that require to be executed. **T**he most recent IoT project is realized with physical implementation Platforms that lack decision-making intelligence. An Architecture applying the Event-Condition-Action (ECA) approach to handle heterogeneous IoT control in smart homes is proposed. The constructive architecture, built with central storage stores that store permanent IoT's schema data, has proved to be a perfect approach to tackle smart home interoperability.

In paper [3] the author shows how the water level of Water resources includes lakes, dams, wetlands, and manually drilled wells. They also learned how the Pump operation is automatically and remotely controlled and can be used to track the area affected by floods remotely wirelessly, and information can be sent wirelessly to the mobile.

This paper [4] contains a prototype of a (water surveillance system) using IoT Is featured. Many sensors are used for this the information once collected; All the sensor data is analysed for research purposes to assist solve water issues. Data was sent to Cloud service over ESP8266 Wi-Fi cable. And this Technology is going to be the best competitor for the real-time monitoring and control program which can be used to overcome all the issues.

So far, these are the explanations why we want a faster, more accurate, and stronger precise device for monitoring water level and leakage. The value-based method is required, where efficiency and results would supply Improvement for defined goals in resolving such questions on the urge **to** save lots of water and rather restore water and use it.

3. PROPOSED SYSTEM

The smart water monitoring system mainly focuses on water usage monitoring and the smart water quantity meter which ensures water conservation by monitoring the amount of water consumed by notifying the same to the user. On crossing the limit of the water capacity of the tank, the user will be

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initiated by SMS along with detail of the water level [4]. It also manages to check whether the water level is below the tank limit and it automatically uses the rainwater stored in the tank instead of groundwater. The framework comprises of Arduino, microcontroller, an alternate sort of sensors like the water stream sensor, and ultrasonic sensors. The Arduino is the primary processor of the framework which controls and procedures the information produced by the sensors [1]. A GSM module is associated with the Arduino gadget which assists with moving the information to the android application. At the point when the water stream arrives at a specific level then the water stream can be halted consequently by killing the engine or close the water stream in the channel by the assistance of Arduino.

3.1. Arduino Uno

It is an associate degree IoT platform that has an external Wi-Fi module that may connect with the net via hotspot mistreatment its SSID and identification it's a microcontroller board upheld the ATmega328P and it contains fourteen computerized information and yield pins, vi simple data sources, sixteen rate quartz, USB affiliation, a force jack, ICSP header, and a push. It's an associate degree IoT platform that has an external Wi-Fi module that may connect with the net via hotspot mistreatment its SSID and identification [4]. It is programmed to implement a logic statement as per the demand of the project. The unheard able device reads the space of the water surface and sends it back to Arduino. Once it's connected to the net the Arduino can receive the signal and send it back to the user mistreatment gsm electronic equipment. There is a unit wholly 3 ways by that you'll power your Uno.

USB Jack: Connect the mini USB jack to a phone charger or laptop through a cable and it'll draw power needed for the board to operate

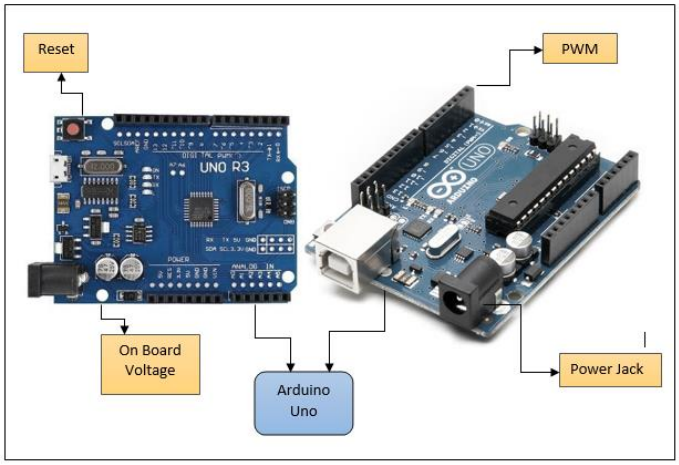

Figure1. Arduino Uno circuit

Vin Pin: The Vin pin is provided with an unregulated 6-12V to power the board. The on-board transformer regulates it to +5V

+5V Pin: If you have got a regulated +5V to provide then you'll directly give this o the +5V pin of the Arduino.

3.2. Ultrasonic Sensor

An ultrasonic sensor is used to generate ultrasonic sound waves that are bombarded on a different level. This sensor consists of a speaker that emits an ultrasonic sound wave and a mic that detects that particular sound wave and sends it back to the user using Arduino [11].

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Transmitters convert signal into ultrasound and collectors convert ultrasound into electrical signs, henceforth handsets can both send and get ultrasound. This assists with estimating the water level. Ultrasonic sensors are also used as level sensors to detect, monitor, and regulate liquid levels in closed containers [4].

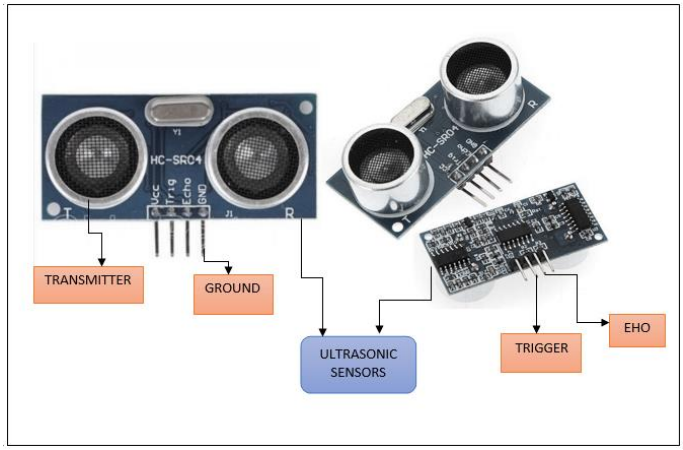

Figure 2. Ultrasonic Sensor circuit

3.3. GSM Modem

GSM electronic equipment is used to attach the mechanical man application and Arduino mistreatment Wi-Fi thus user can get all the notification. A GSM electronic equipment or GSM module could be a hardware device that uses GSM mobile phone technology to supply an information link to a distant network [3]. GSM modems usually give TTL-level serial interfaces to their host. When a GSM electronic equipment is connected to a laptop, this enables the pc to use the GSM electronic equipment to speak over the mobile network. Whereas these GSM modems square measure most often accustomed give mobile net property, several of them can even be used for causing and receiving SMS and MMS messages.

A GSM electronic equipment is an ardent electronic equipment device with a serial, USB, or Bluetooth affiliation, or it is a mobile that gives GSM electronic equipment capabilities.

For the aim of this document, the term GSM electronic equipment is employed as a generic term to see any electronic equipment that supports one or a lot of the protocols within the GSM biological process family, together with the two. 5G technologies GPRS and EDGE, also because of the 3G technologies WCDMA, UMTS, HSDPA, and HSUPA.

A GSM electronic equipment exposes an associate interface that permits applications like SMS to send and receive messages over the electronic equipment interface. The mobile operator charges for this message causing and receiving as if it was performed directly on mobile. To perform these tasks, a GSM electronic equipment should support associate "extended AT command set" for sending/receiving SMS messages, as outlined within the ETSI GSM 07.05 and 3GPP T's twenty-seven.005 specifications [2].

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GSM modems is a fast and economical thanks to starting with SMS, as a result of a special subscription to associate SMS service supplier isn't needed. In most components of the globe, GSM modems square measure a value effective answer for receiving SMS messages, as a result of the sender is paying for the message delivery.

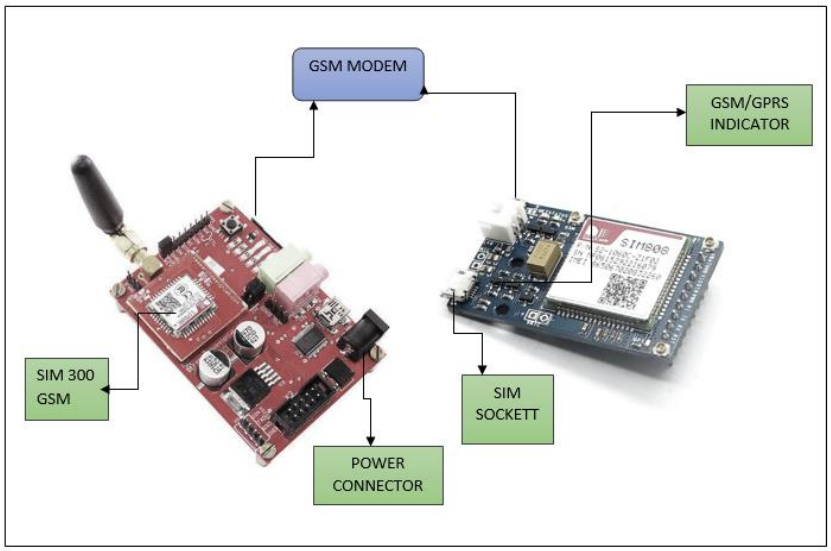

Figure 3. Image of GSM Modem circuit

A GSM electronic equipment is an ardent electronic equipment device with a serial, USB, or Bluetooth affiliation. To begin, insert a GSM SIM card into the electronic equipment associated connect it to an offered USB port on your laptop [13].

3.4. Flow sensors

The Flow sensing elements area unit ordinarily accustomed measure the progression of water and this sensor comprises of a plastic body, a rotor, and a detecting component [4]. The rotor pivots once the water is flowed or passes through the pipe and its speed is going to be directly proportional to its flowing rate. The Water Flow sensing element is enforced employing a Hall impact sensing element [7]. So, the operating of the Water Flow sensing element is simply understood if you're acquainted with a Hall impact sensing element.

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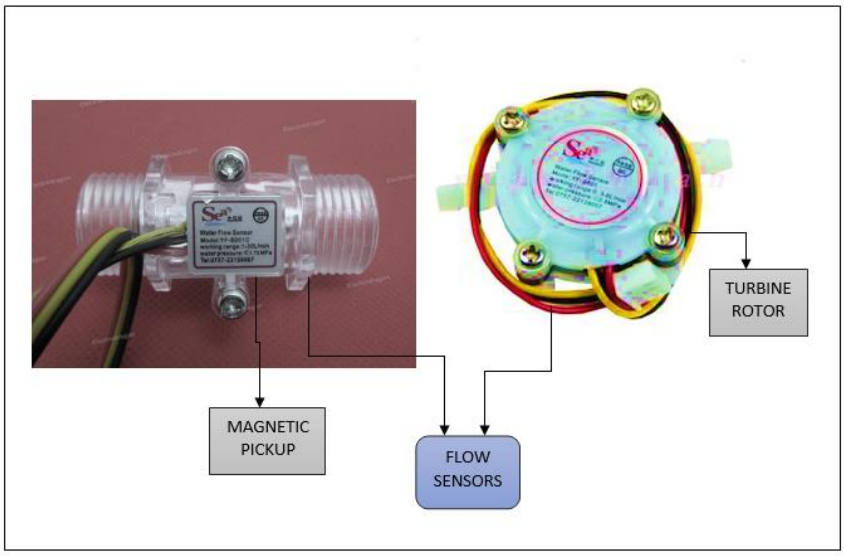

Figure 4. Image of Water Flow Sensor

3.5. Raspberry pi

The Raspberry Pi could be a low price, credit-card sized laptop that plugs into a laptop monitor or TV, and uses a customary keyboard and mouse. It's a capable very little device that permits individuals of all ages to explore computing and to find out a way to program in languages like Scratch and Python [6]. It's capable of doing everything you'd expect a microcomputer to try to, from browsing the web and enjoying the high-definition video, to creating spreadsheets, word-processing, and enjoying games.

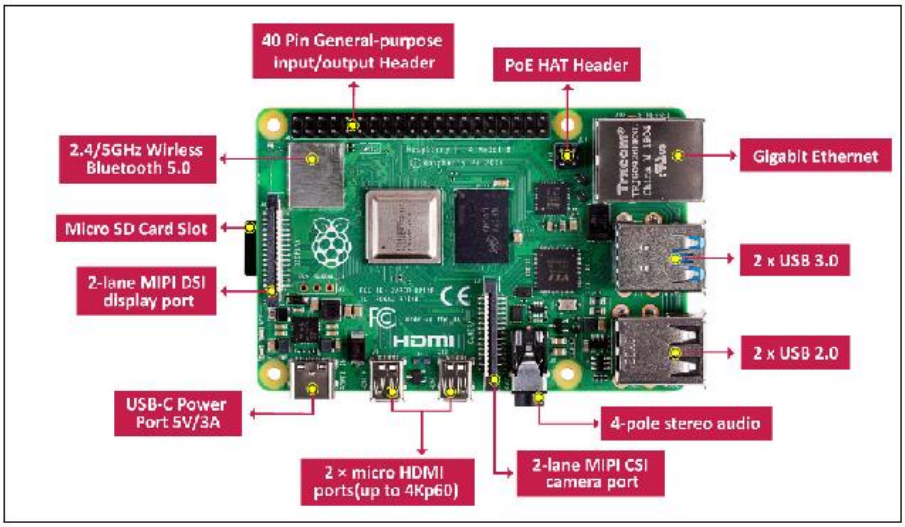

Figure 5. Image of Raspberry Pi circuit

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3.6. Cloud-Based Server

A cloud server is influential physical and virtual infrastructure which performs the application and information-processing storage. Hence Cloud servers are created using virtualization software to divide a bare metal server into multiple virtual servers. Organizations use an infrastructure-as-a-service (IaaS) model is used to process workloads and store information which can access virtual server functions remotely with an online interface.

Cloud servers can be organized at different levels of security and performance of a dedicated server. With the help of cloud servers, it can be used to optimize the performance without the huge costs associated with the infrastructure of the system.

- Some key features of cloud-based server such as Computing infrastructure that can be physical, virtual and mixture of two depending on use case.
- It has all the abilities of a cloud computing server.
- It allows the users to process intensive workloads and store huge amount of information.
- Automated services are edited on demand of Application Programming Interface (API).
- It gives the choice of monthly or as-you-go payment
- Users can select for a shared hosting plan which scales are depending on needs.

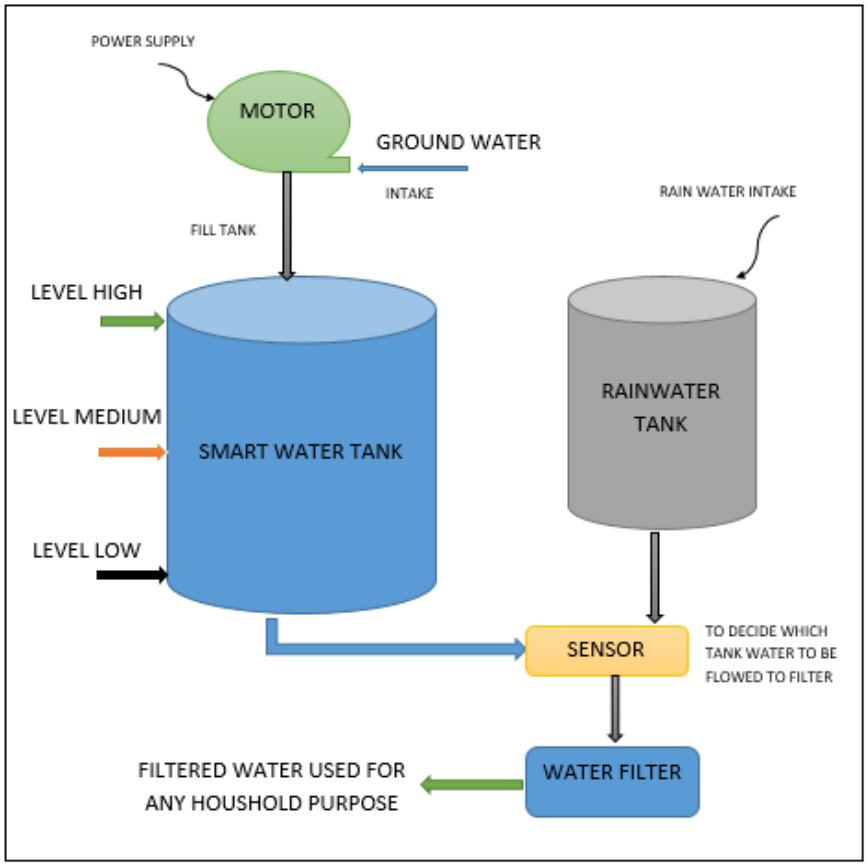

Figure 6. Architecture of proposed system

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4. WORKING

This proposed system for (water monitoring and rainwater consumption) is a small initiative to hold upon a change of restoring the rainwater for efficient use and reducing the wastage of groundwater. Here, we are considering two different tanks connected to the installation chain. The primary tank is employed to store the rainwater while the second tank, which is a smart storage tank is employed for storing the groundwater and is connected to a pump. This tank has three sensors in it to mark the level of water.

The first sensor is at the underside of the tank, which alarms the user when the tank is empty. The second sensor is within the middle, leaving user with a choice whether to fill the tank completely of switch of the pump and the third sensor is at the highest, which notifies us when the water is overflowing from the tank.

These alarming notifications are sent to the user through an android application providing the user, full control over the water supply chain. Both the water tanks are connected to a standard junction having an ultrasonic sensor to direct the flow of water from a specific tank to the water supply chain. The user holds complete control over the system and therefore the user can switch OFF/ON the pump as and when required/needed. Users can decide which tank water would flows to the water chain.

In the end, a pipe through the junction is connected to a filter. It filters the water, be it rainwater or groundwater and makes it better for the household use. The system works on IoT devices and promotes the employment of technology. Through this method, Human work are often immensely reduced up to a percentage of 47 %.

5. CONCLUSION

This paper has proposed the “Tank Monitor” which automatically turns on/off with the help of an android application using the IoT devices according to the tank levels. The real-time tank monitoring allows the immediate remote access to the quantity of water and it does not require much human interface which reduces the error. All these measures help in bringing down the unnecessary wastage of water and prevention to the consumption of impure water. With the advanced procedures we can design and develop real time water monitoring system [4].

Various other automated water level monitoring systems are also present, but so far most of the methods have some limitations. We have tried to overcome the problems related to water consumption and have implemented an efficient monitoring system. We have used Ultrasonic sensors and flow sensors which effectively reduces the cost of the project. Although there’s no need for some special water tank it can be performed over an existing tank by adding sensors to it.

The water level and motor status can be seen by users from anywhere and can easily operate it. This system can be used for more than one tank or container such as. This can be used with a connected set of tanks as well. Thereby especially the industrial organizations can manage the water effectively.

6. FUTURE WORK

In near future, the knowledge assortment and additionally testing are essential to audit the example of the water level, water stream and water appropriation for execution and abilities for each the starter and ammo. Examinations are to be made. On head of that, the usage is frequently drawn out to all or any tanks and dissemination pipes and along these lines the information gathered are regularly used

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for examination like predicting water utilization, stream rate, output and outpouring detection [6]. This application will be the best competitor in real time monitoring and control system which is use to solve all the water related problems. Detecting more parameters for more secure purpose in near future. By adding multiple sensors, the parameter of the monitoring can be increased.

Project has enormous applications and it can be installed within the following areas:

- Private houses or bungalows
- Housing societies
- Apartments
- Institutions like schools and colleges, hostels
- Hospitals
- Offices
- Municipal overhead tanks (with slight changes in hardware).
- Industrial applications
- Areas Facing Heavy Rainfall.

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