International Journal of Engineering Sciences &Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

IJESRT

RESEARCHERID
THOMSON REUTERS

[Nandi* *et al.*, 8(5): May, 2019]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

IOT BASED WATER MANAGEMENT SYSTEM

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DOI: 10.5281/zenodo.3228738

ABSTRACT

During the past decade, water needs have increased unpredictably in India. Increasing demand of water supply has become a major challenge for the world. Wasteful usage of water, climate changes and Urbanization has further depleted the resource. Conservation and management of the resource must be given utmost importance. In this paper, we present an IOT design for water monitoring and control approach which supports internet based data collection on real time bases. The system addresses new challenges in the water sector-flow rate measuring and the need for a study of the supply of water in order to curb the water wastage and encourage its conservation. We also measure the quality of water distributed to every household by deploying pH sensors. The traditional water metering systems require periodic human intervention for maintenance making it inconvenient and often less effective. For shortcoming of the existing model for a ubiquitous usage of wireless systems for smart quality monitoring and communicate data wirelessly.

KEYWORDS: IOT, PIC.

1. INTRODUCTION

Water is an essential component present on earth. The earth comprises 75% of water. But the drinking water available for consumption is very less and is around 10% of 75% water as major water is available as sea/ocean water which is hard to consume as it is saline in nature. Henceforth water supply distribution to mankind is the major issue concerning whole of the world. The drinking water distribution facility in developing countries like India is very erroneous as it involves theft and leakage in the water driving lines. Another major concern is the control of the lines is done through man power which isn`t efficient as it takes lot of time for switching on and switching off the valves, hence only one locality gets bountiful of water rather than other. our system tries to give an efficient system which resolves all the problems stated above at its best. Water quality can be assured by utilizing pH sensor which consists of measuring electrode and reference electrode. Water is said to be with perfect quality if its pH value is 7. In the proposed idea, water supply is stopped if water is not with desired quality. Providing sufficient water of appropriate quality and quantity has been one of the most important issues in human history. As populations grew, the challenge to meet user demands also increased. People began to transport water from other locations to their communities.

Today, a water supply system consists of infrastructure that collects, treats, stores, and distributes water between water sources and consumers. For example, reclaimed water has become an essential water resource for potable and non-potable uses. Structural system additions including new conveyance systems and treatment and recharge facilities and operation decisions, such as allocating flow and implementing conservation practices, are made with the present and future demands in minds. As additional components and linkages between sources and users are developed, the complexity of the water supply system and the difficulty in understanding how the system will react to changes grows.

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As water demands pressures raise increasingly on the existing water supply system, many studies attempted to develop a general water supply system to assist decision makers to design more reliable systems for a long range operation period. Under given situations such as pipeline maintenance, non-revenue water, advanced metering infrastructure, the ultimate goal of this paper is to ensure water distribution system challenges are overcome and supply water sources to users reliably in a more sustainable and timely manner as a long-term plan. The purpose of distribution system is to deliver water to consumer with appropriate quality, quantity and pressure. Distribution system is used to describe collectively the facilities used to supply water from its source to the point of usage.

Requirements of Good Distribution System

- Water quality should not get deteriorated in the distribution pipes.
- It should be capable of supplying water at all the intended places with sufficient pressure head.
- It should be capable of supplying the requisite amount of water during firefighting.
- The layout should be such that no consumer would be without water supply, during the repair of any section of the system.
- All the distribution pipes should be preferably laid one metre away or above the sewer lines.
- It should be fairly water-tight as to keep losses due to leakage to the minimum.

2. MATERIALS AND METHODS

Power Supply

A) TRANSFORMER: Transformer is a electromagnetic device which induces the voltage due to magnetic field present between primary and secondary windings. It has two windings called as primary winding and secondary winding. We are giving input 230V input voltage at primary side. The output of transformer is 9V (AC only). Here we are using 9V step down transformer.

B) RECTIFIER: Rectifier is circuit which converts the AC in to DC. We have two types of rectifier.
1. Full wave rectifier
2. Half wave rectifier

Full wave rectifier again classified as follows:
Bridge rectifier
Centre tapped full wave rectifier
In this project we are using bridge rectifier because the efficiency of the bridge rectifier is high compared to all rectifiers.

FILTER: The output of rectifier is not pure DC. It may contain some ripple components that is pulsating DC. To eliminate this ripple component which are present in output we are using filter. Filter is a circuit which is used to eliminate the ripples present in rectified output. We have many types of filters. Most of the power supplies are using capacitor filter to filter out the ripples present in output.

REGULATOR: The output of filter is not constant output voltage it will vary according to changes in input but we want constant output voltage. For this purpose we are using voltage regulator. Regulator is defined as it is a device which will maintain constant output irrespective of changes in input. The most popular regulator series is 78xx series. This series have more advantages. We are using 7805 voltage regulator to maintain constant 5V output voltage irrespective of changes in input voltage.

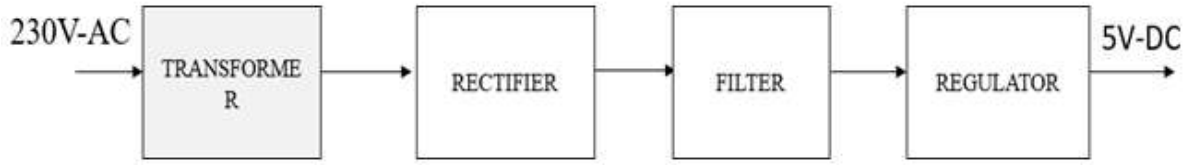

Fig.1 Block Diagram of Power Supply

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Water level indicator

The use of water level controller cum indicator is common nowadays. This circuit is built using timer NE555, inverter buffer CMOS IC CD4049. The components used here are to build and install on the overhead tank so as to prevent wastage of water. It is used to switch on the motor pump when the level of water falls below the lowest level and turns off the motor when the tank is full. This water level indicator has a very simple circuit consisting of 3 probes which are used for automatic fill and cut of the water supply in tank. These are GROUND, HIGH and LOW. The GROUND probe is used for the reference. The circuit requires working at 12V battery or 230V AC mains using a 12V adaptor.

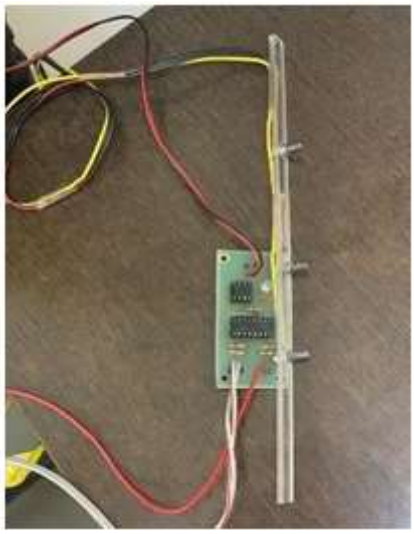

Fig.2 Water level indicator

Water leakage sensor

The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

3. Adopts high quality of RF-04 double sided material.
4. Area: 5cm x 4cm nickel plate on side.
5. Anti-oxidation, anti-conductivity, with long use time.
6. Comparator output signal clean waveform is good, driving ability, over 15mA.
7. Potentiometer adjusts the sensitivity.
8. Working voltage 5V.
9. Output format: Digital switching output (0 and 1) and analog voltage output AO.
10. With bolt holes for easy installation.
11. Small board PCB size: 3.2cm x 1.4cm. Uses a wide voltage LM393 comparator.

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Fig.3 Water leakage sensor

Relay

The circuit used for driving a relay can be termed as a relay driver circuit and it can be designed using various integrated circuits.

These relays are needed to be driven for activating or to turn ON. Relays require some driver circuitry to turn ON or OFF (based on the requirement). The relay driver circuit can be realized using different integrated circuits such as ULN2003, CS1107, MAX4896, FAN3240,A2550, and so on. Here the relay driver circuit is using IC ULN2003.

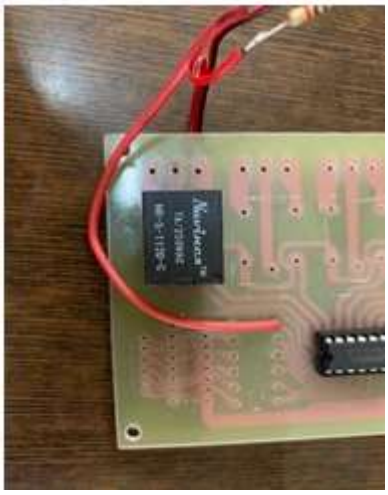

Fig.4 Relay

Wi-Fi Module

ESP8266 is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to load all Wi-Fi networking functions from another application processor Specifications:

- 802.11/g/n
- Wi-Fi Direct (P2P)
- Integrated TCP/IP protocol stack
- +19.5dBm output power in 802.11b mode
- Integrated low power 32-bit CPU could be
- used as application processor
- Wake up and transmit packets in < 2ms
- Standby Power.

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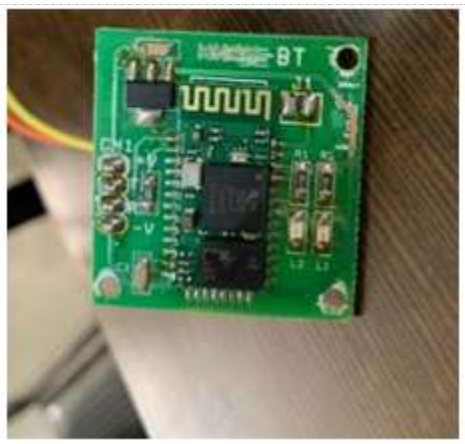

Fig.5 Wi-Fi Module

PIC Controller

The PIC16F72 features 5 channels of 8-bit Analog-to-Digital (A/D) converter with 2 additional timers, capture/compare/PWM function and the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus. All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

Specifications:

- Program Memory Type-Flash
- Program Memory Size (KB)-3.5
- CPU Speed (MIPS/DMIPS)-5
- SRAM Bytes-128
- Digital Communication Peripherals-1-SSP(SPI/I2C)
- Capture/Compare/PWM Peripherals-1 Input Capture, 1 CCP
- Timers-2 x 8-bit, 1 x 16-bit
- ADC Input-5 ch, -bit
- Temperature Range (C)- -40 to 125
- Operating Voltage Range (V)-2 to 5.5
- Pin Count-28

Fig.6 PIC Controller

Cloud

Cloud allows you to aggregate, visualize and analyze live data streams in the cloud. Some of the key capabilities of Cloud include the ability to:

- Easily configure devices to send data to cloud using popular IOT protocols.
- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources.
- Use the power of MATLAB to make sense of your IOT data.
- Run your IOT analytics automatically based on schedules or events.

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- Prototype and build IOT systems without setting up servers or developing web software.
- Automatically act on your data and communicate using third-party services.

1. RESULTS AND DISCUSSION

Block Diagram

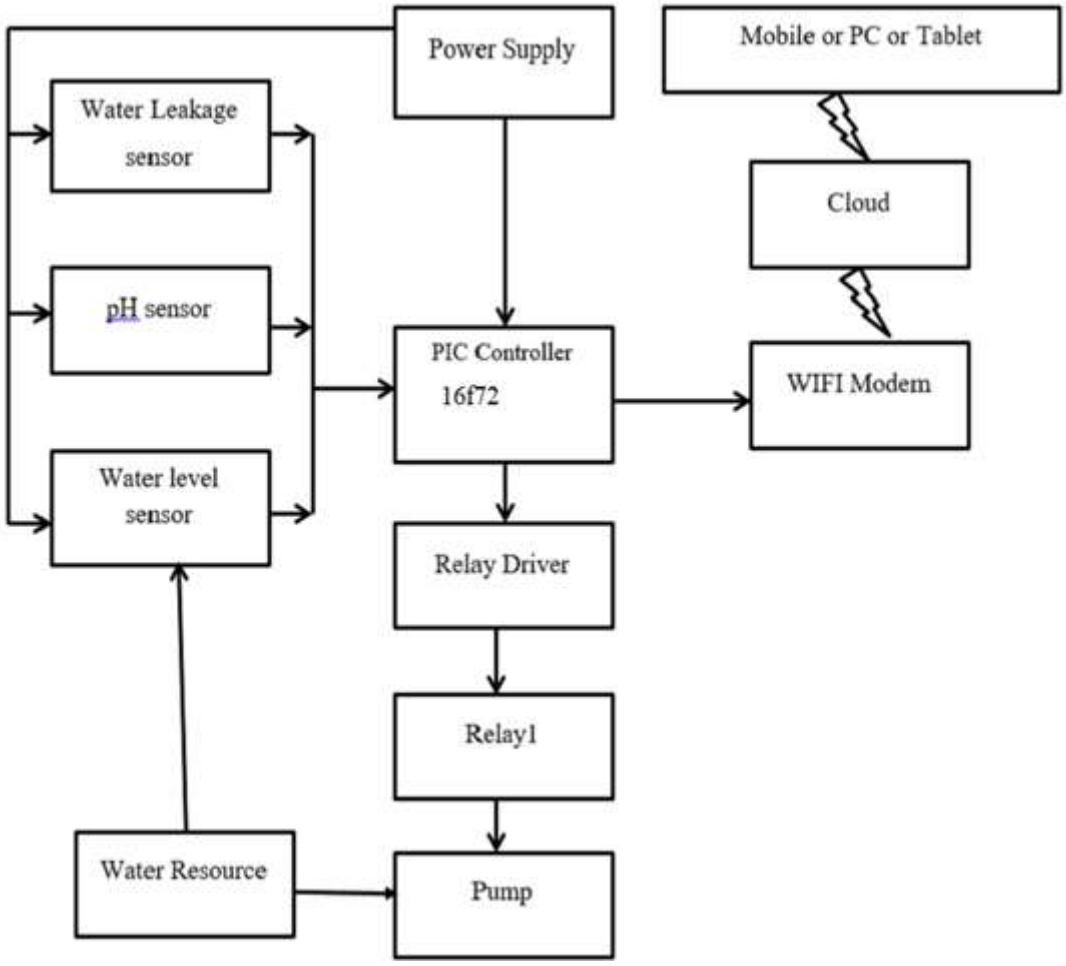

Fig.7 Block Diagram

Working

The system placed in this area consists of three sensors which include water leakage sensor, pH sensor and water level sensor. The water leakage sensor is employed near the valves connected to the pipeline to detect the leakage of water which sends the output signals and the water leakage can be prevented. The pH is employed to check the pH level of water. if the pH level of water is in range suitable for portability of water, the valves are monitored to open, else the valves close automatically. The water level sensor is employed in the tank or reservoir that senses the level of water, and if the water level is less compared to the required level of water, the valves are monitored to close if the level of water is at the optimum level; the valves are monitored to open. A power supply of 12V/5V DC is supplied to system. The output of the sensors is fed to the PIC Controller which monitors the opening and closing of the valves through Relay Driver. When the valves are open, the water is pumped from the reservoir or tank and supplied to the respective areas. The whole process is monitored remotely using a PC or Mobile with the help of a WI-FI Modem and the Cloud, which stores the data required concerning the particular area or locality.

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2. CONCLUSION

Enormous growth of developing world has led to huge need of water. Automated water distribution and performance monitoring system focuses on various entities such as proper supply, over consumption alert and water quality assurance. Those factors can be effectively monitored by employing flow sensors and pH sensors along with communication support provided by IOT technology. Future work deals with tasks such as water level detection and intimation of less volume of water in main tanks which are gathered from other tanks located in different places.

Water distribution system should be based on a pipe layout that is suitable and have no or less water stagnation within the pipe to avoid tuberculation, encrustation and sediment deposits. Through a wealth of specialized publications and software development is now well understood that water distribution system management is technically difficult, but with current technologies, software systems, and highly specialized equipment (flushing and scraper), this is simply not the case anymore. Again, water distribution system management should not be a one-time activity. Although an intense and comprehensive water distribution system reduction program is suitable to reduce the backlog of required water distribution system reduction measures, it should not lead to a sustainable low level of water distribution system unless water distribution system management becomes part of the normal day-to-day activities of the water utility.

3. ACKNOWLEDGEMENTS

We would like to thank Mr. Kiran Nandi, Assistant Professor, S.G.B.I.T, Belagavi for his valuable guidance, support and continuous encouragement during the completion of paper.

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