Dry Sump Monitoring and Water Management Using IoT

D.O.I - 10.51201/12509
https://doi.org/10.51201/12509

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Abstract**:** *Water is one of the leading sources of energy available for living things on earth. The use of this source is crucial for ensuring a safe present and future lifestyle. As a result, the efficient use of this source is essential in our day-to-day life. The proposed research work aims at developing a system that will prove to be beneficial in avoiding wastage of water constantly occurring due to human mediation required for switching operations in everyday routine work. The setup enables the user to automate water storage activities and thereby assuring the availability of water whenever required.*

Keywords— Storage Tanks, Water pump, Sensor and NRV

I. Introduction:

The developing countries around the globe are fostering their growth at a hefty price of demolishing and deteriorating natural resources available with them [1]. Water is one of the most basic resources for a human being's survival. Industrial growth, rapidly increasing population, and drastic climatic changes causing insufficient rainfall are all factors contributing to the increasing scarcity of water[2] [3]. The irresponsible usage of water in urban areas is eventually leading to an irregular supply of water in their localities. In the 21st century, automation is ruling the roost thereby reducing the human mediation in daily mundane tasks. In case of any housing system of water transfer from one storage tank to the other, a human is required to manually control the electrical motor involved in the process. The presence of an individual is always required in such a system which becomes quite tiresome for the operator. The proposed assembly provides the user with an automated system that will reduce the wastage of water[4].

II. PROPOSEDSYSTEM

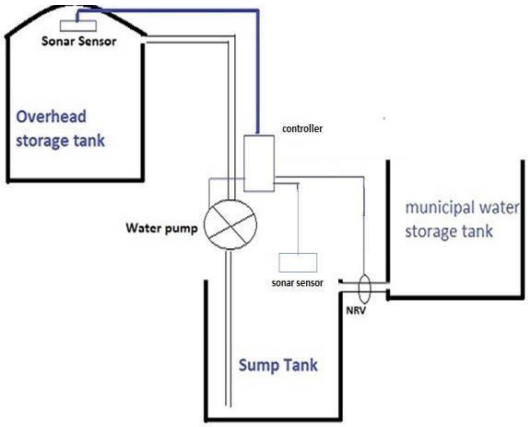


Fig. 1. Block diagram of the proposed system

A) Block Diagram

The block diagram of the proposed system resembles the water storage and transfer system installed in our residencies. It consists of two types of tanks which store the water. One being the sump tank which gets water supply from the municipal corporation body responsible for water supply throughout the city. The overhead storage tank is set- up at a certain height above the house for further storage.

B) Components Used

1) **Piezo buzzer**:- A device that is used to notify the individual by producing a sound or alarm is known as a piezo buzzer. Its principle of an operation mainly depends on the relationship between electric potential and pressure. Piezoelectric material in presence of electric potential generates pressure. This mechanism is implemented in piezobuzzer to create loud and sharp sounds. Lightweight and low cost are two major factors that make them preferable over other available options in the market.

2) **Sonar sensors**: - A device that measures the distance to an object with the help of sound waves is called a sonar sensor. This distance to an object is computed by transferring a sound wave at a specific frequency and waiting for the same wave to reflect. This sensor works on the emission of a sound wave whose frequency is higher than the hearing capacity of a human. Sonar sensor is analogical to the radar system which measures the time taken by the radio wave to return after it coincides with an object.

3) **Water pump**:- It performs mainly the function of transferring the water/ coolants from one tank to the other by the use of water cool engines. It uses the concept of centrifugal force thereby drawing out fluid from the center and send it outside while it keeps spinning. These type of pump have vast applications for pumping out water from wells, tanks and is also used for filtering of ponds, aquariums, etc.

4) **Arduino**:- It is an open-source platform enabling the user to compute various desired parameters. It is a microcontroller board based on the Atmega328P which is a single chip micro-controller created by Atmel. It consists of 6 analog pins and 14 digital pins.

5) **Solenoid valve**:- This device is an electromechanically operated valve. It is predominantly used while controlling fluid materials. The various tasks of control which include shutting off, dosing, distributing or releasing are quite effectively accomplished by solenoid valves. It is advantageous over other options available in the market due to its noteworthy reliability, quick and safe switching, and dynamic product life.

Table 1 : Specifications of Arduino UNO

Microcontroller	ATmega328P
Operating voltage	5V
Input voltage (recommended)	7-12V
Input voltage (limit)	6-20V
Digital I/O pins	14(of which 6 provide PWM output)
PWM Digital I/O pins	6
Analog input pins	6
DC current for 3.3V pin	20mA
DC per I/O pin	50mA
Flash memory	32KB (ATmega328P) of which 0.5 KB used by the boot loader
SRAM	2KB (ATmega328P)
EEPROM	1KB (ATmega328P)
Clock speed	16MHz
LED_BUILTIN	13
Length	68.6mm
width	53.4mm
Weight	25g

6) **Non-return valve**:- The non-return valve (NRV) is used to control the flow of water from the municipal corporation supply to the sump tank. A 12V solenoid valve is used as a non-return valve for representation purposes.

7) **Relay**:- The relay is used to operate the pump and NRV by energizing and de-energizing the circuit breakers.

C) Software used

1) **IoT**: -The rapid development in the fields of science and technology has made humans more relaxed and efficient enough to reduce their intervention in mechanical operations. One such technology reducing the human effort is of IoT (Internet of Things). One of the major functions performed by IoT is of transferring the data over a network without requiring human mediation. This tool executes the tasks like data transfer from any part of the world and monitoring of devices linked with it.

2) **Cloud Storage**: -The Measured values through Arduino UNO by the means of IoT tools are sent to the cloud storage. It is a model in which data can be stored, maintained, and backed up remotely on servers accessed from the internet. A service provider operates it on storage servers.

3) **Wi-fi Module**: - Wi-fi module is used to give access to the Wi-fi network. The ESP8266 wifi module is used which has enough flash build memory to transfer data from Arduino to Thing speak Server platform. ESP8266 is a wi-fi SOC (System on a chip) produced by Eris.

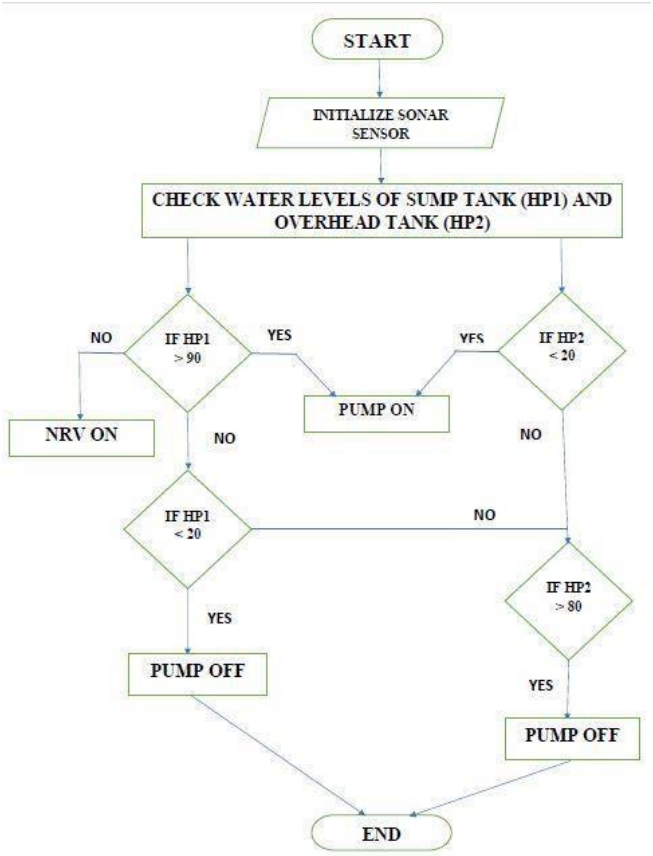
III. SYSTEM DESIGN AND IMPLEMENTATION

The proposed system consists of mainly two tanks namely the sump tank and overhead tank. The water supply coming from the municipal corporation side is stored in the sump water tank which is at the ground level of the housing system. Another tank installed on the higher level of the housing system is the overhead storage tank which is fed by the water stored in the sump tank followed by filling of the sump tank through the municipal corporation. Both the tanks consist of sonar sensors which sense and measures the height of water level in respective tanks. The water stored in the sump tank is fetched up to the overhead tank through the water pump. As the sonar sensors are connected to both the tanks it will detect the height of the water and thus indicates the piezo buzzer to ring the alarm to make the user aware about filling of the tanks. This will avoid the water to go on the wane

and thus leading to the conservation of water.Thewastage of water due to the carelessness of humans is prevented and the whole system gets managed automatically through the sensors. The Arduino is installed to provide us the numerical value of the level of water in both the tanks. This system can be implemented in houses, apartments, industries, institutions, etc.

IV. RESULT

1. ALGORITHM



The sonar sensors check the water levels in the overhead and sump tanks using the principle of reflection of sound. The calculated levels of both tanks are compared and the following cases arechecked-

Case 1: if the overhead tank level is below 20% and the sump tank level is above 90%; then pumping action will start.

Case 2: if the overhead tank level is above 80% and the sump tank level is above 20%; then pumping action shall be stopped.

Case 3: if the overhead tank level is below 80% and the sump tank level is below 20%; then pumping action shall be seized for dry sump protection of the pump.

The dry sump protection stops the supply to the pump which is operating on no-load as the water level is below the pump's reach; thus, reducing the risks of pump malfunctioning as well as reduces the energy consumption.When the water level of the sump tank is below 90% the NRV is turned on to refill the sumptank.

2. ANALYTICAL OUTPUT:-

Created at	Tank 1 level	Tank 2 level
2020-03-03 14:38:51 UTC	87.16	31.75
2020-03-03 14:39:07 UTC	76.98	40.55
2020-03-03 14:39:23 UTC	70.36	49.49
2020-03-03 14:39:39 UTC	64.4	57.93
2020-03-03 14:39:55 UTC	54	65.78
2020-03-03 14:40:11 UTC	45.49	76.69

3. GRAPHICAL OUTPUT:

Fig.(2) Sump tank water level.
The above graph depicts the sump tank water level and it decreases as the pump is on supplying water to the overhead tank.

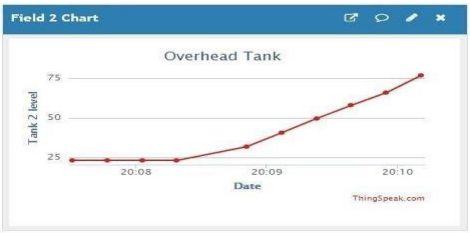


Fig.(3) Overhead tank water level.
The above graph depicts the overhead tank water level supplied from the sump tank by the action of pump.

Fig.(4) Pump ON/OFF indicator.
This figure depicts that when the pump is on it will show GREEN indication otherwise it will remain dim.

Fig.(5) NRV ON/OFF indicator.
This figure depicts that when the non-return valve is on it will show GREEN indication otherwise it will be remain dim.

V. CONCLUSION

The implementation of the assembled setup ensures that unwanted wastage of water in different instances can be easily combated. The adversity of water scarcity can be adroitly handled with utmost ease by storing and managing an ample amount of water by using the proposed system.

VI. REFERENCES

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