



WATER OVERFLOW DETECTION SYSTEM

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Abstract: Water is one amongst the basic necessary survival elements which we need in our day-to-day life. So, our primary concern must be to save every drop of water. We must have observed in many of the societies in India due to negligence there is overflow of water from the overhead water tank. In order to solve this issue, we have built a fully controlled water overflow detection system which would help us to save a lot of water which otherwise gets simply wasted. The whole system would be quite easy to use as not much human involvement would be required in the whole process thus would save a lot of time and energy of the user. Every little update about the upper as well as lower tank will be intimated to the user, right from the tanks being empty to the filling up of the overhead tank. Even in the worst-case scenarios like if the water overflows or if there is any leakage in either of the tanks, an update would be given to the user and the motor would be automatically turned off. The user would not only get an update about the current status of the tanks and the motor on the screen but also would receive a notification via his phone.

Index Terms – Automatic, Notification, Overflow, Water.

I. INTRODUCTION

As we know water is one in all the fundamental necessary survival elements which we want in our day-to-day life. In most of our daily activities such as washing, cleaning, bathing, watering plants as well as in the farming and industrial sector water plays a very important role. Almost everybody needs water for their survival. Most of the countries till date face a lot of issues regarding water scarcity as well as a lot of water gets wasted during its transmission. Thus we need to take necessary precautions to save it.

It is observed that the majority of water wastage is in city life due to their lifestyle. According to the Environmental Protection Agency, a common person on a daily basis unknowingly wastes up to 30 gallons of water which is a really large amount.

II. WATER WASTAGE IN INDIA

Knowingly or unknowingly we waste a lot of water every day. There are some of the common ways of water wastage which we do on a daily basis for example by not turning off the tap while brushing teeth, shaving, leakages, washing vehicles with fresh water etc.

In India on an average a single person wastes about 0-45 litres of water per day, which is about 30% of water requirement for each person per day. 125 million litres of water wasted daily. Bathing and toilets use about 27% of water. A leaking faucet can approximately waste up to 4,000 drops of water, which is equal to a litre of water. A toilet flush uses six and a half gallons of water. An approximate count of 163 Million Indians doesn't have access to clean drinking water.

On an average a family can waste up to 180 gallons per week, or 9,400 gallons of water annually, from household leaks. That means nearly 900 billion gallons of water is used every year.

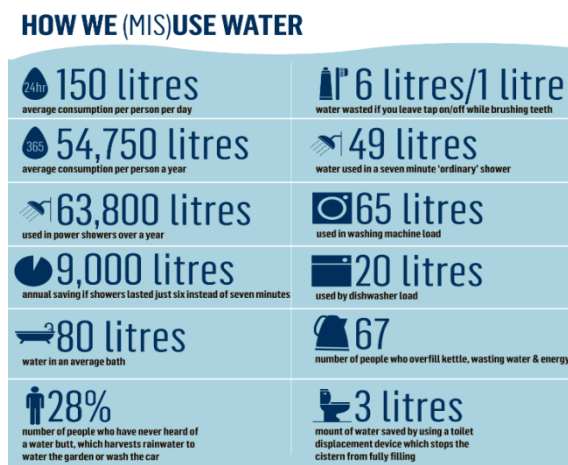


Fig. 1: Chart displaying average misuse of water per person per day.

III. MOTIVATION AND BACKGROUND

Water shortage is one of the major issues confronting most countries, wastage during transmission has been described as a major contributor; this is one of the reason which motivates us for this project, to deploy computing techniques to create a waste barrier, not only to provide more financial gains and to help the environment as well as the water cycle, which in turn ensures that we save water for the future.

As we know in cities it is essential to keep overhead tanks in apartments as well as in the industrial sector in order to store water. Here, the water from the ground level is pumped to overhead tanks as per water level requirement within the tank. It's difficult to manually activate an OFF pump to monitor water level in both upper and lower tanks. Also it results in overflow and wastage of water.

In most of the places we must have observed that there are no such methods being implemented to detect or stop the overflow of water taking place from the overhead tanks. While at some places an alarm system has been designed which gives an indication or buzzer sound only when the tank is either fully empty or fully filled. This system still has some major drawbacks such as -

- 1) There is no form of prior indication or update given to the user about the tank getting filled.
- 2) Human involvement is required, that's the reason it becomes time consuming and the information about the level of water is less accurate.

To check the level of water in the tank the user needs to open and close the lid of the tank in order to check the level of water which is quite risky.

IV. METHODOLOGY

For the implementation of this project, we studied different monitoring and detection systems which are currently being used. Then a sample circuit diagram was being made for reference purposes. The code was written and executed on Arduino IDE software. The circuit was simulated using Proteus software while the full implementation of the same was carried out on a breadboard.

This project will allow the display of the level of water in a tank and was maintained automatically by an Arduino microcontroller. Codes were written in order for it to perform as a water level controller as well as to detect leakage of water.

V. BLOCK DIAGRAM

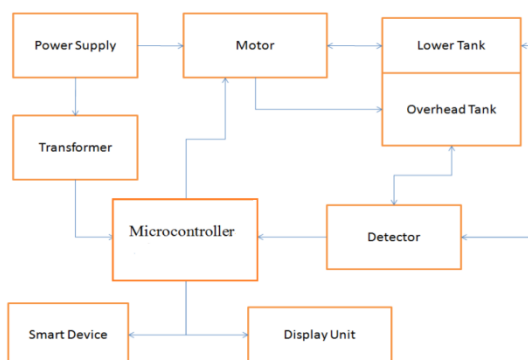


Fig. 2: Block Diagram of Water Leakage and Level Detection System.

Figure 1 shows the Block Diagram of the proposed system. Lower tank has a water pump in it and the upper tank is fixed with probe sensors which sense the water level and that is reported by Arduino. Both the tanks have a leakage sensor placed outside their base to detect overflow or leakage of water. Upper tank is defined with three levels i.e. Full, Half-Full and Empty level. When the water level in the upper tank is low i.e. greater than max level the sensor sends data Empty through the Arduino to the water pump is switched ON and water flows from lower tank to upper tank. When water reaches the predetermined level or Full level the sensor sends data full through the Arduino to the water pump to switch it OFF and stops flowing from lower tank to upper tank.

A. Microcontroller

Arduino Uno [7] is a microcontroller based Board with 8 bit Atmega328P [6] microcontroller is used here. It contains 2KB of static RAM memory and 1KB of EEPROM memory. 14 digital input/output pins present in the arduino board. In these 14 pins 6 pins can also be used as pulse width modulation pins and there are 6 analog I/O pins. Power to Arduino Board can be given by USB connection or external power supply, recommended voltage range is 5-12V. Arduino Uno is the first developed board and it is considered as a model of reference for all future developing arduino boards.

B. Detectors

Probe Sensors and Leakage Sensors are used in order to detect the water levels and leakage or overflow of water respectively. The probe sensor has a reference voltage of 5V to detect the water levels. Operating voltage is 5V DC for both the sensors.

C. Motor

The Water Pump operates with 12V DC and is submerged in the liquid to be pumped.

VI. ALGORITHM

Algorithms that explain the sequence of operations for the code and steps for the design were written thus enabling the diagrammatic representation of flow of process. This simplifies the writing of the project codes. The steps of algorithm for this project are as follows:-

- 1) Start the program.
- 2) Initialize the LCD.
- 3) Define analog port 0 to 5 as I1 to I6 and digital pins 6, 8, 9, 10, and 11 to the motor, red led, green led, blue led and yellow led respectively.
- 4) Declare variables for both the tank levels i.e full, half, empty.
- 5) Initialize $i=0$ as the motor status and $v=1$ as the standard reference voltage.
- 6) Declare I1 to I5 as inputs and pin 10,9,8,6 as outputs.
- 7) Set up the LCD's number of columns and rows (20x4)
- 8) Reading and storing the data from the input pins into the variables assigned.
- 9) Check if values of variables u_q and l_q are less than v , then both the tanks are empty, the RED led glows, and go to step 16.
- 10) Check if the value of variable l_f is greater and u_q is less than v , then the upper tank is empty and the lower tank is full, the RED led glows, and go to step 16, else go to step 11.
- 11) Check if the values of variables u_q and l_h are greater than v , then then the upper tank is quarterly filled and the lower tank is half full, the RED led glows, and go to step 16, Else go to step 12.
- 12) Check if values of variables l_q and u_h are greater than v , then the upper tank is half full and the lower tank is quarterly filled, the Blue LED glows, and go to step 16, else go to step 13.
- 13) Check if the value of variable u_f is greater and l_q is less than v , then the upper tank is full, the lower tank is empty, and the Green led glows. Turn the motor off and go to step 16.
- 14) Check if the value of i is equal to 1; if so, print "motor on" and go to step 16. Otherwise, print "motor off" and go to step 16.
- 15) Check if the value of w is equal to 1; if so, print "leakage is detected" and go to step 16. Otherwise, print "No leakage"
- 16) Display an alert/error message.
- 17) Stop.

VII. PROTEUS SIMULATION

The project was set up in Proteus for simulation. Proteus is a simulation and design software developed by labcenter electronics. Water sensor and water tanks in the **Figure 3** are for representation purpose only.

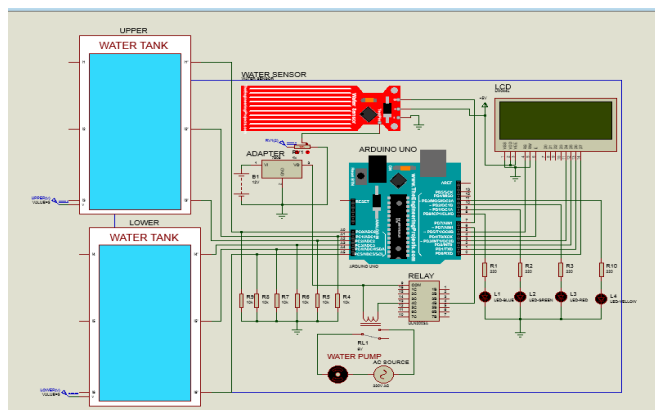


Fig. 3: Circuit Diagram for Software simulation.

The hardware implementation is been done in various steps such as, implementation of LCD, LED, and Water sensor for the Leakage & Overflow Detection in the system. Next step is the implementation of the Probe sensors and motor for the Level Indication. A snapshot of the implementation of Water Levels and Leakage/Overflow system is as shown below.

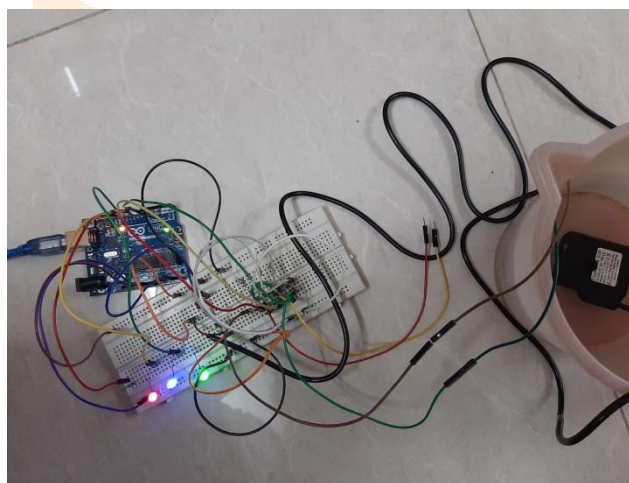


Fig. 4: Display of Water Levels through Leds.

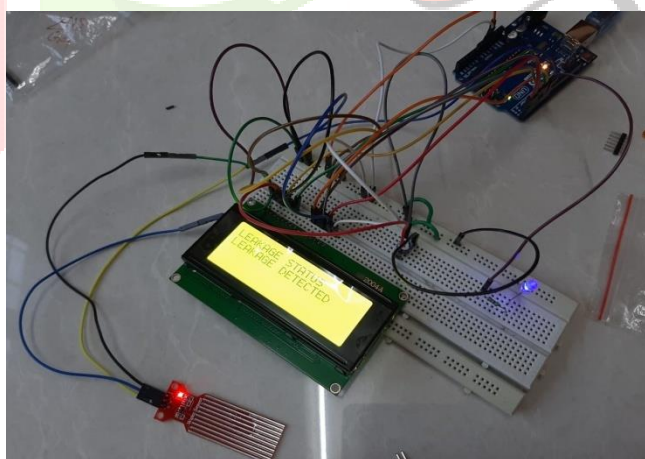


Fig.5: Detection of Leakage or Overflow using the Water Sensor.

VIII. EXPECTED RESULT

Taking the initial condition, when the water level in both the lower and upper tank is empty, the LCD will display a message stating that the above said tanks are EMPTY. The system would resume when the lower tank starts filling. The status of water level in the lower tank will be displayed on the LCD. Once it's FULL, the water pump will get turned ON and start filling the upper tank. The status of water level in the lower and upper tank will be displayed on the LCD. Also the water levels of the upper tank would be displayed by the LEDs. Once it's FULL, the water pump will get turned OFF. The message indicating the tank's status will be displayed on the LCD. Hence water level in both tanks can be monitored.

IX. ADVANTAGES AND APPLICATIONS

A. Advantages

- 1) Implementing this project in our surrounding would solve our purpose of minimizing the wastage of water, energy consumption, maintenance, and monitor water level automatically.
- 2) The circuit is easy to understand and implement.
- 3) Human involvement is quite low.

B. Applications

This project can be used in Irrigation system in agriculture, hotels, industries, apartments, buildings, colleges, complexes, etc. to monitor water level in the tank automatically.

X. CONCLUSION

Water Overflow Detector and Leakage Indication System controlled by Arduino is a system where the water level in the upper and lower tanks is monitored and according to that the water pump is turned ON or OFF automatically. This paper overcomes the disadvantages of existing automatic systems which use Ultrasonic sensors which senses the water level by measuring the depth of water as it may vary due to the pressure flow of water from lower tank to upper tank. While other systems use level sensors which senses the water level when the sensor comes in contact with water because of this the sensor may corrode with some chemicals or iron presence in it. Hence the probe sensors provide corrosion free and accurate water level measurement. Also the leakage sensor is useful to detect any overflow or leakage of water due to uncertain reasons. Thus, this system can be implemented practically in any field to reduce the wastage of water and control the water level automatically.

Future Enhancement:

It can be modified by adding different languages so that everyone can understand the message. Also by adding more components like temperature sensor flow rate sensor, etc., this project can be upgraded. It can be further modified and put to great use like taking preventive steps when some natural calamities like floods, drainage overflows etc are detected and for avoiding highly in-toxic liquid overflows in chemical plants etc. This could save precious lives of a number of living beings.

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