

**Detecting and Mending the Water Leakage using Robotic Arm**

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Abstract:- This paper deals about how to prevent the water leakage with the help of Robotic Arm. It is a multipurpose system. This system is not only control the water leakage but also maintains water level in the tank with the help of solenoid valve. This system can be used in both domestic & industrial usage. The objective is to detect the water leakage and close the leakage without the help of human.

Keywords—Rain Sensor, Water Level Sensor, Flow Sensor Solenoid valve, ArduinoMicrocontroller, Zigbee module, Arduino IDE

I. INTRODUCTION

Nowadays drinking water is that the most immeasurable and valuable for all the mortals, drinking water services face new challenges in real-time processing. This challenge appeared because of finite water resources growing population, developing infrastructure etc. Hence so there is a use of higher methodologies for observance the water quality system [1].

Water services in many components of the world face growing challenges in their makes an attempt to meet the necessity for water. For example, in the US also 36 states expect to expertise water shortages over successive 10 years [2]. Another major example is China where conjointly 400 of its 600 massive and medium sized cities endure from water economic condition, with at least 100 cities, including Peking, actively threatened (Tai, 2004). A few factors are conducive to the current position. Climate change, demonstrate by extended periods of drought, is adversely impacting water resources [11]. Population growth caused by exodus to large urban centers and temperate regions is exerting higher pressure on existing water provides. The problem is amalgamated if water treatment infrastructure is working close to capability and funds needed for development area unit scarce. Limited treatment capability will represent drinking water economic condition even in water-rich countries in these challenges, the improvement of water loss from leaks in transmission and delivery tanks can offer an answer, at least partially, to poverty caused by faulty water resources and /or limited treatment capability.

Water is lost due to leakage in numerous elements of the networks that embody transmission pipes, delivery pipes, service connection pipes, joints, valves, fireplug, and tanks and reservoirs [3]. The water monitoring technologies have created an important progress for supply water police investigation and water plant operation. The use of their technologies having high cost combined with installation and standardization of an oversized scattered array of observance sensors. The algorithm meant on the new technology should be relevant for specific space and for massive system isn't appropriate.

II. PROPOSED SYSTEM

This system consists of Arduino board, Water level sensor, Flow sensor, Rain sensor, Solenoid valve, Zigbee module is placed in the water tank. Arduino board, DC motor, Relay, Motor driver, Zigbee module & robotic arm module. If the water level is low the solenoid valve will open and vice versa. The flow sensor is used to detect the water leakage in the pipe. The water leakage result will display in the LCD module. The rain sensor is used to detect the water leakage in the tank. When there is a leakage in the water tank, the buzzer starts ringing and the same will display in the LCD module. The Zigbee module which is placed in the robotic module will receive the signal from transmitter Zigbee Tx. Then the Robotic Arm will move near to the leakage area & close the leakage in the tank.

III. SENSING AND CONTROLLING

A. Transmitter Section

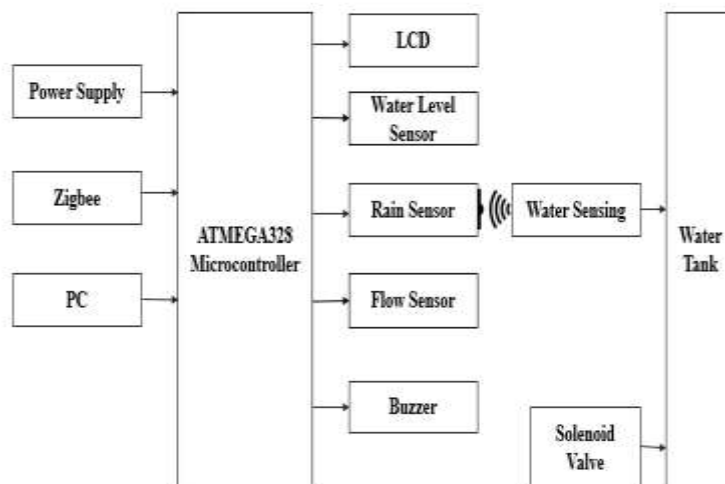


Fig 1: Block Diagram of Sensing Section

B. Receiver Section

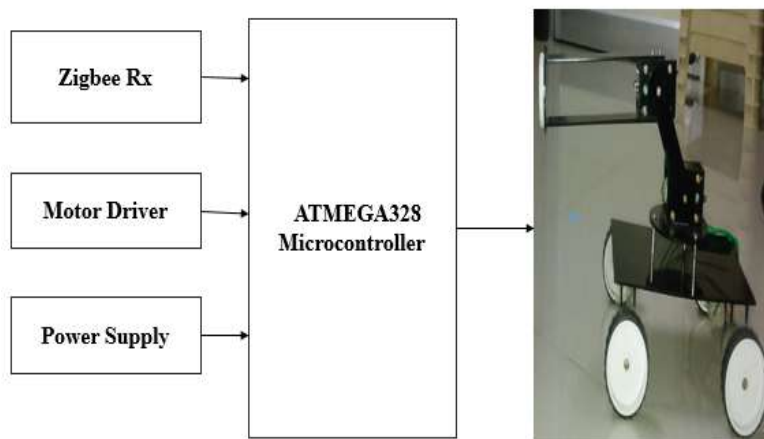


Fig 2: Block Diagram of Controlling Section

There are two section 1. Transmitter Section 2. Receiver Section.

1. Transmitter section

Power supply connected to the microcontroller. Zigbee is used to transfer the information. Code is dumped in PC. Then the information is displayed in the LCD module. Rain Sensor is used to sense the water leakage.

2. Receiver Section

Motor Driver is used to control and interface of a DC motor with a microcontroller. And Robotic arm is used to close the leakage.

IV. SYSTEM OVERVIEW

A.Arduino Module

Arduino is a single board microcontroller. It is proposed to create the appliance of interactive substance or environments additional usable. There are several varieties of Arduino accessible. The ARDUINO UNO model has been used. The Arduino Uno is a microcontroller board supported ATmega328P. It has 14 digital input/output, 6 analog inputs, USB connection, power jack, ICSP header, and reset button. It consist of everything essential to support the microcontroller; easily connect it to a laptop with a USB cable Associate in Nursing AC-to-DC adapter to induce started [4].

In order to the program, Arduino, Arduino IDE (i.e.) Arduino programming terrace is installed in a Windows computer. The program is written in the Arduino ide then tranfered to the Arduino with the employment of a serial cable Universal Serial Bus straightly connected to the pc. The Arduino will browse the data from the Zigbee and convert it because it is programmed. The data that's received from the Zigbee within the variety of analog information is regenerate to digital pulses by Arduino and read it.

B.Zigbee Module

ZigBee Module is a low-price, low-power, wireless mesh networking standard. The low price permits the technology to be typically used in wireless management and observance application, the low power-usage allows long life with tiny batteries, and the mesh networking maintains high reliability and bigger vary. This module is in line with the Industry common applications of wireless information communication module [2].



Fig 3: Zigbee Module

This module can get clear information transmission between additional devices, and it can kind a mesh network. This device has the individual of small volume, ultra-low power consumption and low-price. It can be either as self-sufficient information transmission termination or be well embedded into a variation of artefact to make a short-range wireless information transmission resolution.

i. Maximum Transmission Distance:

Internodes Barrier Free: 200meters.

ii. Wireless Frequency:

2.4G ISM License-free Frequency Band.

iii.Node Type:

Center Node, Routing Node, Terminal Node.

iv.Serial Rate:

1200-115200

v.Send Mode:

Broadcast Send or Destination Address Send

vi. Working Voltage

DC-3.3V.

vii. Peak Current:

40Ma.

viii. Short range:

10~ 200 m.

C. Solenoid Valve

The valve is controlled by an electrical current through a coil. Arduino Uno controls the operation of the electro-valve [10]. The image of the electro-valve to control the flow of water is shown within the fig.4. The operating voltage of the solenoid-valve is 12V. The solenoid valve operates at a minimum of around three psi and acquiesces around three L/min of flow, and it uses enough pressure to operate. It will interrupt the flow till 12V is activate to the fast-on connectors on the coil.



Fig 4: Solenoid Valve

The electro valve is connected to the ON – OFF switches. The Solenoid valve is connected to the Arduino module, which makes the valve to open or shut in accordance with the water level detected. When the OPEN switch is activated the valve gets dissimulated and lets the water to flow and once the shut switch is ironed the valve gets stirred up by the Arduino board and it gets closed and will not permit the water to flow [7].

D. Water Level Sensor

Level sensors discover the extent of liquids such as water, oil, etc. Quite obvious from its name, level sensors are used to measure the extent of the flow substances. Such substances embody liquids like water, oil, slurries, etc. yet as solids in granular/powder kind (solids which might flow).



Fig5: Water level Sensor

These substances tend to urge settled within the instrumentation tanks imputable to gravity and maintain their level in rest state. Level sensors live their level against a pre-set reference. The sensing probe component consists of a special wire cable that is capable of accurately sensing the surface level of nearly any fluid, as well as water, salt water and oils.

E Flow Sensor

This water flow sensing element is actually a small low rotary engine whose communication is also a series of digital pulses. The frequency of the pulses is proportional to the flow of the liquid passing through the sensing element. That digital signal, whose frequency is within the vary between 0Hz and 100Hz, is browsed directly through one in all the digital input/output pins of a microcontroller. It has mirrored sensitive, long service life, action fast, safe and reliable, joins convenient traffic blessings like the beginning low, deeply the final user feeling. The most parts of rotary engine area unit rotor flow switch shell, magnetic rotor, and brake ring composition.



Fig 6: Flow Sensor

F.Rain Sensor

Each perform of the rain sensing part has the whole connections compared to the alternative inside an equivalent mode; that the user features a ton of flexibility inside the design of hardware interface. The electrical phenomenon detector includes a rain sensitive area that in dry conditions assumes the face price. Furthermore in presence of the rain, the capacitance goes to high values compared to dry conditions and therefore the relation can-do is over 300.



Fig 7: Rain Sensor

G.DC Motor

When the electrical device is battery-powered, it constitutes a magnetic field (excitation flux) within the air gap, directed by the radii of the motor. The magnetic field “enters” the motor on the North Pole side of the inductor and “exits” it on the pole facet.



Fig 8: DC Motor

When the motor is battery-powered, its maestro placed below one electrical device pole (on the equal side as the brushes) area unit cruised by currents within the same direction and then area unit manipulated to a physicist law force. The conductors below the other pole area unit subjected to a afford of an equivalent strength and within the other way. Both forces represent a torsion that rotates the motor (Fig 9). When the motor is battery-powered by a direct or improved voltage and also the rotor is rotate, counter-electromotive effort E is produced. Its value is $E = U - \text{Ocean State}$. RI represents the drop in Ω voltage within the motor. The counter-electromotive force E is relevant to the speed and excitation by $E = k \omega \phi$ where:

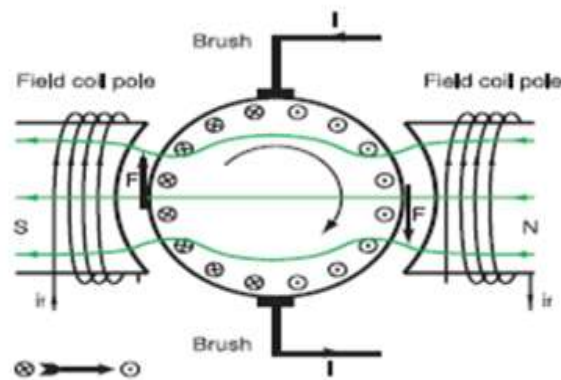


Fig 9: DC Motor working principle

- k is a constant,
- ω is the angular speed,
- ϕ is the flux.

In this relationship shows that, at constant k commotion, the counter-electromotive force E , proportional to ω , is figure of the speed. The torque is relevant to the electrical device flux and also the current within the motor by:

$$T = k \phi I$$

H. Stepper Motor

A stepper motor is rotate one step at a time, unlike those typical motors, which spin often. If we command a stepper motor to rotate some specific variety of steps, it rotates incrementally that more variety of steps and stops. Because of this basic of a stepper motor, it is widely utilized in low worth, open loop position control systems. Open loop control method no feedback data regarding the position is essential. This eliminates the need for valuable sensing and feedback devices, such as optical encoders.



Fig 10: Stepper Motor

V. RESULT

Water level has monitored by using water level sensor. Whenever the water level increased the solenoid valve closed automatically and vice versa. The flow sensor detected the water leakage in the pipe & the result displayed in the LCD module. The tank water leakage has detected by using Rain sensor. The buzzer starts ranging once the water leakage has been detected. This information is passed to the robotic arm through Zigbee. The robotic arm moved near the leakage area & the leakage portion has been closed.



Fig 11: Monitoring the leakage

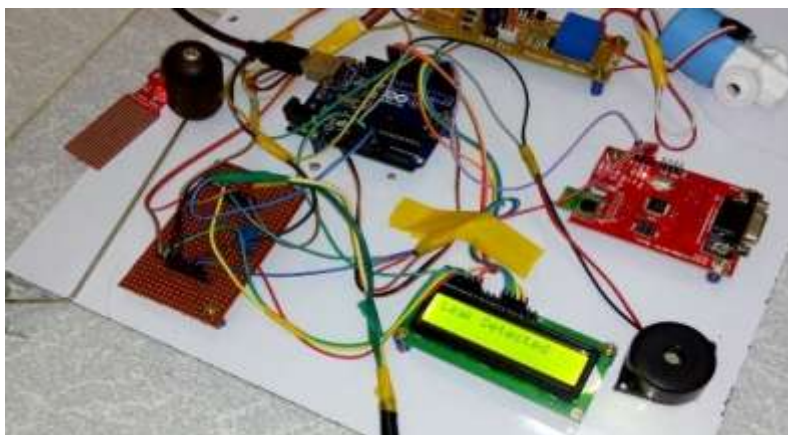


Fig 12: Leakage Detection



Fig 13: Robotic arm moves near to the leakage area

VI. CONCLUSION

The Embedded system was designed and had been fabricated in this device with the help of flow sensor, rain sensor, solenoid valve & robotic arm. The hardware implementation was done and the system was tested and evaluated. This kind of device can be used in various industries.

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