Hybrid Purity Checker

Internet of Things

By

RATHNAYAKE R M I R
PARANAGAMA H M T
DASANAYAKA S A R S
PERERA K P R

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Problem Identification

Access to clean and safe water is a fundamental necessity, **many homes get their water through long pipelines, but people usually have no idea what happens to the water on its way from the source to their taps.** Sometimes, water that starts out clean can get dirty during the journey, maybe because of rusty pipes, blockages, or even harmful materials leaking into the system. Most current water systems don't warn people when this happens. They also can't tell where the problem occurred or if there's a blockage in the pipe. This means people could be using unsafe water without even knowing it.

Key Problems

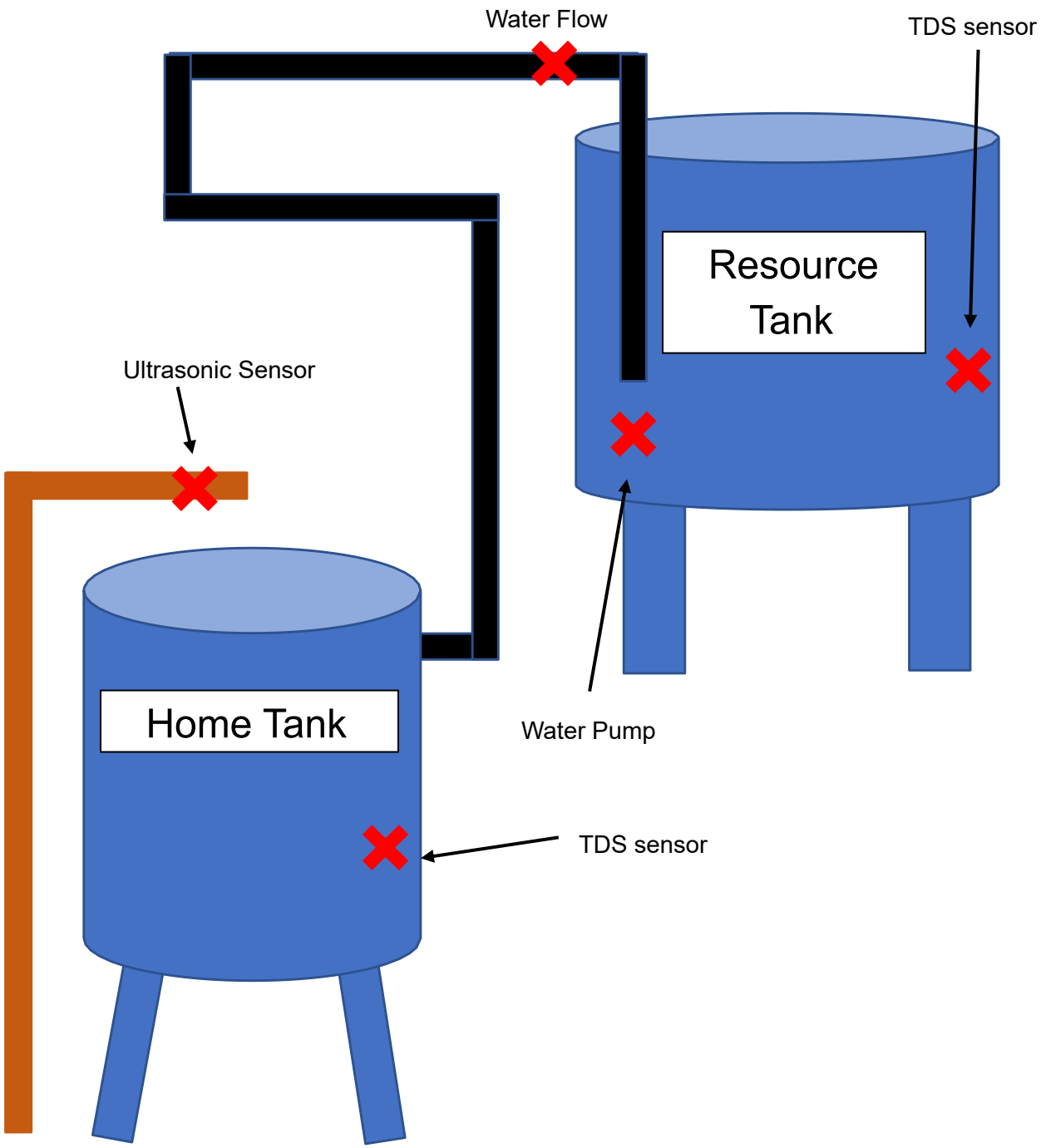
- Undetected water pollution during transit
- Inability to locate contamination points
- No detection of abnormal pipeline conditions
- Manual monitoring of water levels and pump
- control No automated alert or control system

Proposed IoT Solution

This project proposes a **smart IoT-based system** that continuously monitors the water quality at **two points**: near the **water source** and the **home tank**, allowing users to pinpoint where pollution occurs. Further **flow and level monitoring** to improve control and reduce waste.

- Dual TDS Sensor monitoring (before and after transit)
- Flow rate monitoring
- Automatic control of water pump
- Water level monitoring in home tank
- Real-time mobile notifications
- Cloud storage of sensor data for trend analysis

Proposed IoT Design



System Description

The presented IoT-based water monitoring and control system is developed to ensure efficient and automated water management between a central **Resource Tank** and a **Home Tank**. The system utilizes several sensors to monitor both water levels and water quality in real-time.

- An **Ultrasonic Sensor** is installed on the Home Tank to measure the water level and determine when refilling is necessary.
- A **TDS (Total Dissolved Solids) Sensor** is deployed in both the Resource Tank and Home Tank to assess water quality and ensure it is safe for domestic usage.
- Water is transferred from the Resource Tank to the Home Tank via a **DC Brushless Water Pump**, which is automatically controlled based on sensor data.
- A **Water Flow Sensor** is positioned along the pipeline to measure the water flow rate, helping to detect anomalies such as leaks or blockages.

All components work together under a microcontroller-based system (such as NodeMCU/ESP8266), connected via Wi-Fi to a cloud platform like **Firebase** for real-time data storage and remote monitoring. This allows users to track water quality, and tank status from any location through an IoT dashboard.

This system improves water resource efficiency, reduces manual intervention, and promotes intelligent decision-making in household water distribution and monitoring.

Components

1. Microcontroller

- **ESP8266** – Wi-Fi-enabled board for sensor integration and cloud communication.

2. Water Quality Detection

- **TDS Sensor** – Detects total dissolved solids (a proxy for chemical contamination).

3. Water Level Monitoring

- **Ultrasonic sensor**

4. Water Flow Detection

- **Water Flow Sensor (YF-S201)** – Measures flow rate of water.

5. Actuators

- **DC Brushless Water Pump (optional)** – To transfer water betwean tanks.

6. Communication and Alerts

- **Wi-Fi Module (NodeMCU ESP8266)** – Sends data to cloud/server

Other materials

- 2 tanks
- Transparent pipes
- Eslon pipes
- Tissue papers
- Fabric paint
- Tapes
- Glue
- Scissors
- Covering Caps(big)
- Pipe connector

Software Requirements

- Mobile app/dashboard
- Cloud database (e.g., **Firebase**)
- Notification services (Firebase Cloud Messaging)

Bill of Materials

	Material	Quantity	Description	Price
1	NodeMCU ESP8266	2	Main Microcontroller with Wi-Fi	Rs. 2200.00
2	Ultrasonic Sensor	1	Detect the home water tank water level	Rs. 550.00
3	TDS Sensor	2	Measures total dissolved solids	Rs. 5000.00
4	Waterflow Sensor (YF-S201)	1	Measures water flow rate	Rs. 700.00
5	Water Pump	1	Pump the water from the resource	Rs. 1650.00
6	Power Supply Adapter (12V)	1		Rs. 520.00
7	Transparent Pipes	2m		Rs. 380.00
8	Covering Caps(big)	2		Rs. 700.00
9	S-lone pipes	1 1/2m		Rs. 225.00
10	Pipe connector	1		Rs. 250.00
11	Small pipes + caps			Rs. 225.00
12	Jumper wires			Rs. 480.00
13	Relay Module	1	Control high power devices	Rs. 220.00
		Total Amount		**Rs.13,880.00**

Research paper article regarding the topic

- Olisa et al. (2021) emphasise that water quality and water level monitoring remain critical challenges in both residential and industrial settings.

  This observation is directly relevant to the current project, which aims to address these gaps by providing a dual-point monitoring system. By measuring water quality at both the resource tank and the household tank, the proposed system can detect contamination that occurs during water transit — a problem identified in Olisa et al. (2021). Additionally, by continuously monitoring water levels and controlling the pump automatically, the system overcomes manual intervention issues, aligning with the need for improved water management noted in prior research.

- Olisa et al. (2021) explain that an ultrasonic pulse-echo technique can be employed to monitor water levels, while ultrasonic sensor signals can also contribute to water quality assessments.

  This finding is directly relevant to the proposed system, which uses an ultrasonic sensor to measure the home tank's water level with high precision. By applying the pulse-echo principle, the project ensures reliable detection of water height, thereby supporting effective automatic pump control. This integration of ultrasonic sensing aligns with proven methods in the literature and reinforces the system's aim of providing accurate, real-time water managemenOlisa et al. (2021) describe how their system communicates with an Android mobile application via Firebase to provide real-time updates and control. This approach supports the proposed project, which also plans to use Firebase Cloud Messaging for instant notifications and app-based management of water quality and tank levels. Integrating a cloud-connected mobile application enables users to monitor their water system remotely and receive alerts about poor water quality or low tank levels, thereby improving responsiveness and user confidence in the automated control process.

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Full Citation

Olisa, S. C., Asiegbu, C. N., Olisa, J. E., Ekengwu, B. O., Shittu, A. A. and Eze, M. C. (2021) *Smart two-tank water quality and level detection system via IoT*. Heliyon, 7(7), e07651. Available at: https://doi.org/10.1016/j.heliyon.2021.e07651

Real Implementation