River Depth Measuring and Water Quality Monitoring System Using Iot

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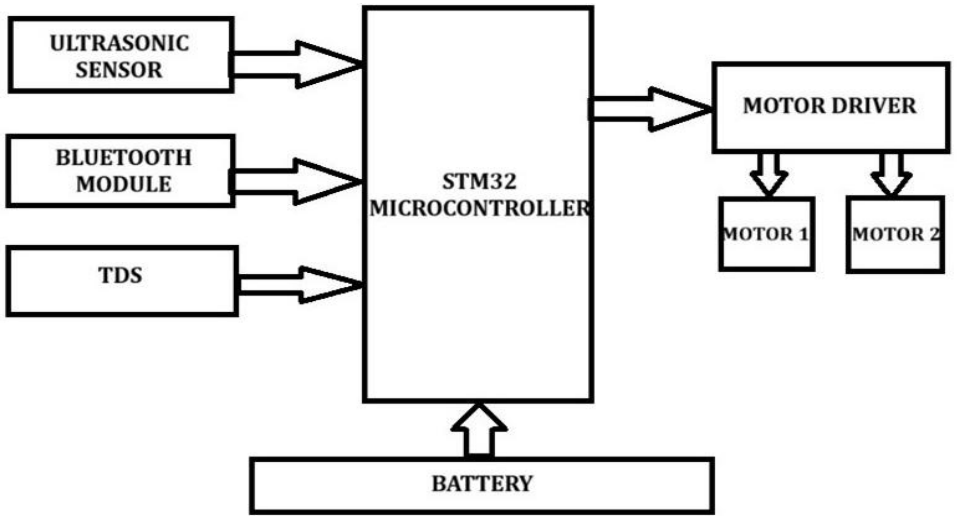
***Abstract*—The "River Depth Measuring and Water Quality Measuring System Using IoT" is an innovative solution designed to monitor and safeguard aquatic environments. This project integrates real-time sensing technology with wireless communication to measure key parameters such as river depth, Total Dissolved Solids (TDS), and geographical location. Built around an Arduino Uno microcontroller, the system employs an ultrasonic sensor to detect depth variations, a TDS sensor to assess water quality, and a GPS module to pinpoint locations. Sensor data is processed and transmitted via an HC-05 Bluetooth module to a smartphone application, enabling users to monitor river conditions remotely.**

1. INTRODUCTION

Water bodies such as rivers, lakes, and reservoirs are vital natural resources, but they also pose significant risks, including drowning due to sudden depth variations and contamination from dissolved pollutants. Traditional methods of monitoring water depth and quality often rely on manual measurements, which are time-consuming, labor-intensive, and lack real-time data. To address these challenges, this project proposes an automated, Bluetooth-controlled robotic boat equipped with advanced sensors for real-time depth detection, location tracking, and water quality analysis.

2. METHODOLOGY



The proposed system is built around an Arduino Uno microcontroller that integrates three primary sensors:
Ultrasonic Sensor (HC-SR04): Measures depth.
TDS Sensor: Monitors water quality.
GPS Module (NEO-6M): Captures location data.
A Bluetooth module (HC-05) wirelessly transmits the data to a mobile application. The mobile interface visualizes the depth, TDS levels, and GPS

coordinates, and allows remote control of the robotic boat. The system's software is developed using the Arduino IDE and embedded C programming.

3. COMPONENTS REQUIRED

The system is composed of the following essential hardware components:
Arduino Uno - Central microcontroller for data processing.
Ultrasonic Sensor - Detects water depth.
TDS Sensor - Measures total dissolved solids.
NEO-6M GPS Module - Captures real-time geographic location.
HC-05 Bluetooth Module - Transmits sensor data to mobile devices.
Motor Driver L293D - Controls motor functions.
DC Motors (200 RPM) - Enables boat movement.
Li-Ion Battery (3.7V) Powers the robotic system.

4. IMPLEMENTATION

4.1 Software Implementation

The software implementation involves:

- Initialization of sensor modules.
- Continuous data acquisition via analog and digital I/O.
- Serial communication through Bluetooth.
- Mobile UI integration for data visualization and boat control.
- The system is tested in different water bodies to validate the accuracy of sensor readings and reliability of communication.

Steps:

- Code development using Arduino syntax
- Sensor calibration
- Integration with LCD and relay modules
- Upload via USB to NodeMCU

4.2 Hardware Setup

The project follows a structured design approach to integrate hardware components, sensor data processing, and wireless communication into a functional system. The robotic boat is built around Arduino Uno as the central controller, which processes inputs from three key sensors: an ultrasonic depth sensor (HC-SR04), a TDS sensor, and a GPS module (NEO-6M). The HC-05 Bluetooth module enables wireless communication between the boat and a smartphone app, allowing real-time data monitoring and remotecontrol.

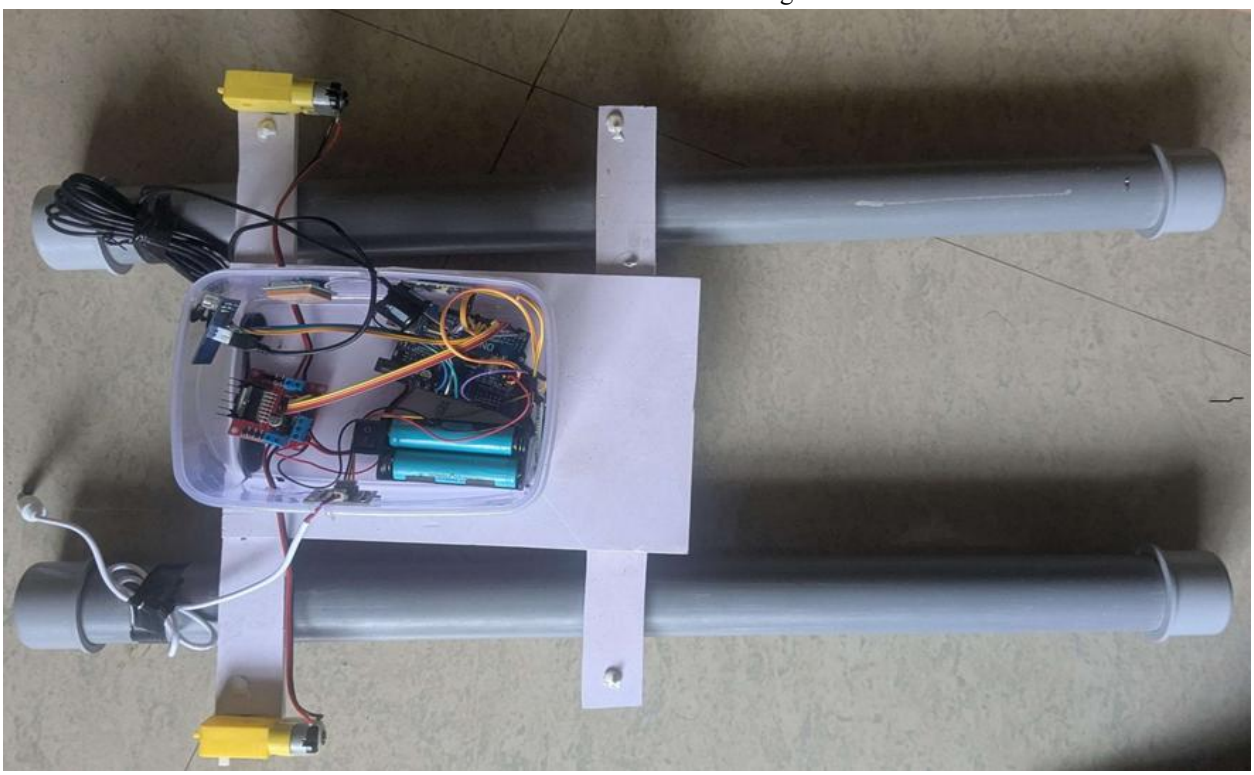


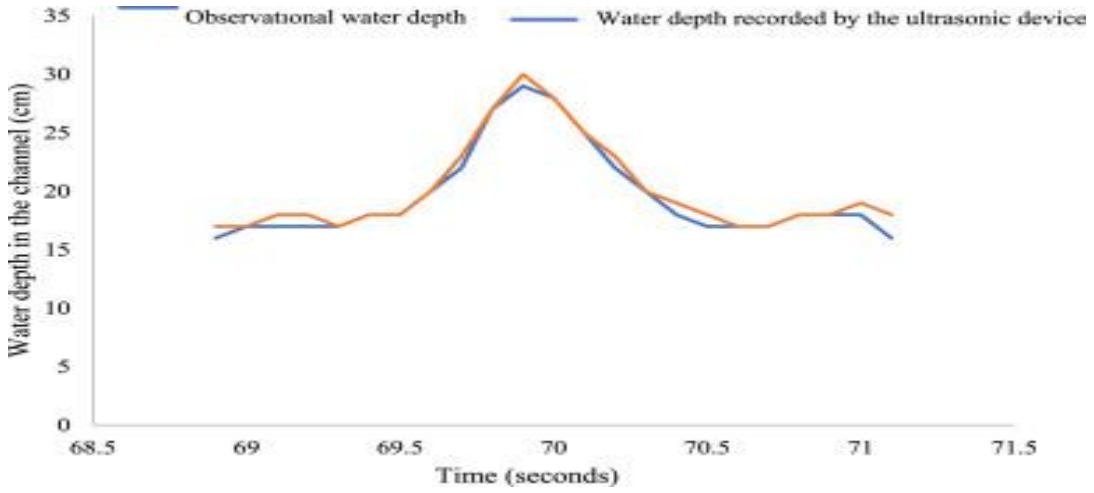
Fig: Hardware setup of river depth measuring and water quality monitoring system using IOT

5. RESULTS AND DISCUSSION

The Bluetooth-Controlled River Depth Detection System with Live Location and TDS Monitoring represents a significant advancement in water safety and environmental monitoring technology. This innovative project successfully integrates multiple sensor technologies with wireless communication to create a comprehensive solution for real-time water body analysis.

Key accomplishments of this project include:

- Effective Hazard Prevention: The system's depth monitoring capability provides crucial data to identify potential drowning risks in water bodies, offering a proactive approach to water safety.
- Comprehensive Water Quality Assessment: By incorporating TDS measurement, the solution addresses both safety and environmental concerns, providing valuable data for water purity evaluation.
- Precision Tracking: The GPS integration enables accurate location mapping of hazardous areas and pollution sources, facilitating targeted interventions.
- User-Friendly Operation: The Bluetooth-controlled interface with mobile app visualization makes the system accessible to both technical and non-technical users.
- Cost-Effective Solution: Utilizing affordable, readily available components makes this technology potentially scalable for widespread implementation.



6. CONCLUSION

This project demonstrates its ability to measure both river depth and key water quality parameters in real time. By integrating ultrasonic and environmental sensors with the ESP32 microcontroller, the system provided accurate, continuous data on water level , turbidity, temperature, and TDS. Cloud connectivity allowed for remote monitoring, data logging, and timely alerts for potential flooding or pollution events. Despite minor limitations such as reduced performance in harsh environments and reliance on stable internet and power, the system proves to be a cost-effective and scalable solution for environmental monitoring. It holds significant potential for supporting disaster management, improving water resource planning, and promoting sustainable river ecosystem management.

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