Web /Mobile based tool for mapping of Water supply network

Batch Number: COM 52

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Problem Statement Number: PSCS_95

Organization: Ministry of Jal Shakti

Category : Software

Problem Description:

Jal Jeevan Mission was launched with the vision of providing drinking water in adequate quantity of prescribed quality on regular and long-term basis to every rural household. A cost effective technology is required for providing web/ mobile based tool for mapping of water supply network through creating geospatial database of all major structure of Water supply system with provision with grievance redressal and IoT system for alert monitoring.

Objectives

The project's objectives are:

- **Develop a geospatial database:** Create a comprehensive database of all major water supply network structures, including pipelines, pumping stations, and distribution points.
- **Build a web-based mapping tool:** Design and develop a web application for visualizing and managing the water supply network data.
- **Create a mobile application:** Develop a mobile app for field workers to collect and update data on the water supply network in real-time.
- **Implement a grievance redressal system:** Integrate a feature that allows users to report issues and track the status of their complaints.
- **Integrate an IoT alert system:** Incorporate an IoT system for monitoring key parameters (e.g., water pressure, flow rates) and generating real-time alerts for system anomalies.

Background and Related work for title selection

The project's background is rooted in the

- **Jal Jeevan Mission**, a government initiative aimed at providing clean drinking water to every rural household. This mission necessitates a streamlined system for managing and monitoring water infrastructure.

- **Related work highlights** the limitations of existing GIS (Geographic Information System) solutions. While tools like Esri's ArcGIS are effective for mapping utilities, they often come at a high cost and may not include specific features crucial for this project, such as integrated grievance redressal and low-cost IoT monitoring.

- The project's innovation lies in creating a **cost-effective**, integrated platform that addresses these gaps by combining geospatial mapping with a grievance redressal system and an IoT-based alert system, a feature that is often missing from generic solutions. This approach directly supports national goals for efficient water infrastructure management.

Analysis of Problem Statement

The project aims to provide a **cost-effective technology** solution for the **Jal Jeevan Mission**. The primary goal is to create a **geospatial database** of the water supply network, including all major structures. A key part of this project is the integration of a **grievance redressal system** and an **IoT system for alert monitoring**. The presentation for this project cover' the problem statement, objectives, background research, innovation, and a project timeline.

- **What**: A cost-effective web/mobile tool for mapping water supply networks.

- **Why**: To create a geospatial database of the water supply network and integrate grievance redressal and IoT-based alert monitoring for the Jal Jeevan Mission.

- **Who**: The project is being developed for the Jal Jeevan Mission.

- **When**: The project has a timeline that will be presented as a Gantt Chart.

- **Where**: The tool is designed to map water supply networks, specifically in the context of the Jal Jeevan Mission, which operates in rural areas.

- **How**: The solution will be provided through a web and mobile-based tool.

Analysis of Problem Statement (contd...)

Technology Stack Components:

Frontend

- **Web Application**: React.js or Angular, used for creating a dynamic user interface. Mapbox GL JS or Leaflet for displaying and interacting with maps.
- **Mobile Application**: React Native or Flutter, to enable cross-platform development with a single codebase.

Backend

- **Server-Side**: Node.js or Python (using frameworks like Django/Flask) to handle the backend logic and APIs.
- **Database**: PostgreSQL with the PostGIS extension, specifically for storing and managing geospatial data.

Other Components

- **IoT**: The MQTT protocol is recommended for communication with IoT devices.
- **Grievance System**: A service like Firebase or a custom API will be used to manage user complaints.

Software and Hardware Requirements:

Software Requirements

- **Operating System**: Windows, macOS, or Linux for development.
- **Development Tools**: VS Code, Git, Node.js, and Python are needed for coding and version control.
- **Mapping Libraries**: Leaflet or Mapbox GL JS to handle the mapping functionalities.
- **Database**: PostgreSQL with the PostGIS extension is required to store and manage the geospatial data.
- **Cloud Platform**: A cloud service such as AWS, Google Cloud, or Azure will be needed for deploying the final application

Hardware Requirements

- **Server**: A virtual machine hosted on a cloud platform will serve as the application's host.
- **Mobile Devices**: Android or iOS smartphones are necessary for using the mobile application in the field.
- **IoT Sensors**: Low-cost sensors for measuring water pressure and flow rate are required.
- **Microcontrollers**: Devices like Arduino or ESP32 will be used to process sensor data.
- **Gateway Device**: A gateway is needed to send the processed sensor data to the server.

Innovation or Novel Contributions

- **Integrated, Holistic Solution**: Our project distinguishes itself by combining geospatial mapping, IoT-based monitoring, and a grievance redressal system into a single, cohesive platform. This integrated approach goes beyond what generic GIS tools offer.

- **Cost-Effective and Scalable**: By utilizing open-source technologies, the solution is designed to be affordable and easily scalable, making it highly practical for a large-scale government initiative like the Jal Jeevan Mission.

- **Proactive System Monitoring**: The integration of IoT allows for real-time alerts and data collection, enabling proactive maintenance and management of the water network. This shifts the focus from reactive problem-solving to a more efficient, predictive model.

- **Purpose-Built for the Mission**: The tool is specifically tailored to meet the unique needs of the Jal Jeevan Mission, ensuring its relevance and high utility for the intended users.

Github Link

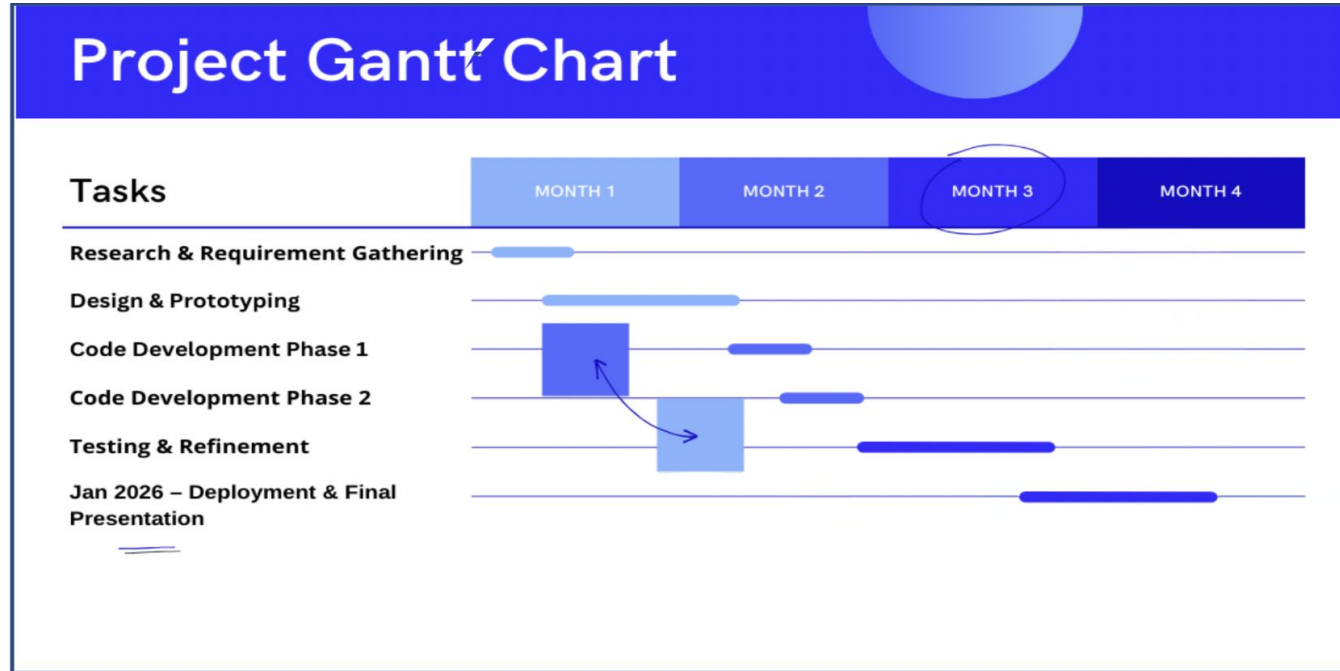The Github link provided is public access.

Github Link

Timeline of the Project (Gantt Chart)

References (IEEE Paper format)

[1] M. A. Hasan and M. R. A. Rahman, "Development of a GIS-based urban water supply network management system with an integrated complaint management module," *IEEE Transactions on Sustainable Computing*, vol. 5, no. 2, pp. 250–261, Jun. 2020.

[2] B. Chandra, K. Kausalya, Poornima. B, and Yamini Babu, "IoT based Water Flow Monitoring System using Wireless Network (LoRaWAN)," in *2024 4th International Conference on Pervasive Computing and Social Networking (ICPCSN)*, 2024, pp. 878-885.

[3] Ministry of Jal Shakti, Department of Drinking Water and Sanitation, "Jal Jeevan Mission - Har Ghar Jal," *Government of India*, 2019. [Online]. Available: https://jaljeevanmission.gov.in/. [Accessed: Aug. 10, 2025].