

**HYDROCHECK: Water leak reporting and alert app**

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DR. EMILIO B. ESPINOSA SR. MEMORIAL  
STATE COLLEGE OF AGRICULTURE AND TECHNOLOGY  
[www.debesmscat.edu.ph](http://www.debesmscat.edu.ph)**

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**PRECY R. ADORICO  
ANGELINE L. ALAHID**

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## **Chapter I**

### **Introduction**

#### **Project Context**

Water is one of the most vital resources for life, playing a fundamental role in human survival, agriculture, industry, and sanitation. However, despite its importance, water continues to be wasted at alarming rates due to undetected leaks, aging infrastructure, and inefficient monitoring systems. Water leakage is a persistent problem in both urban and rural settings, causing significant environmental, economic, and structural damage. If left unaddressed, leaks can escalate into larger issues, leading to property damage, high utility costs, and even public health concerns.

One of the biggest challenges in addressing water leaks is detection. Many leaks occur underground or within walls, making them difficult to identify until substantial damage has already been done. Traditional methods of leak detection often rely on visual inspections, physical audits, or waiting for abnormally high water bills before taking action. These reactive approaches lead to unnecessary delays, resulting in wasted water, increased repair costs, and in some cases, disruption of essential water services.

Municipalities and utility companies have attempted to implement solutions such as scheduled maintenance, infrastructure upgrades, and smart water metering systems. While these efforts have been helpful, they are often limited in reach due to budget constraints, lack of personnel, and the complexity of implementing new technologies across entire communities. In many areas, especially in developing countries or less urbanized regions, water infrastructure remains outdated, making proactive leak detection even more difficult.

To address these challenges, digital technology has emerged as a powerful tool in water management. The rise of mobile applications, cloud computing, and real-time data monitoring has made it possible to develop innovative solutions for leak detection and water conservation. However, many existing smart water management systems depend on expensive IoT (Internet of Things) sensors and automated detection technologies that require extensive installation and maintenance. These solutions, while effective, are not always feasible for widespread adoption, particularly in resource-limited communities.

Recognizing the need for a practical and accessible alternative, this project introduces HYDROCHECK: A Water Leak Reporting and Alert App. Unlike automated leak detection systems, HYDROCHECK relies on active user participation to report leaks as they occur. This community-driven approach not only ensures that leaks are detected in real time but also fosters a sense of responsibility and awareness among residents.

The app serves as a digital platform where users can quickly report leaks by submitting location details, descriptions, and supporting images. Upon submission, municipal water service providers receive instant notifications, allowing them to prioritize and address issues efficiently.

HYDROCHECK is designed to bridge the gap between citizens and municipal authorities by providing an intuitive, user-friendly interface for leak reporting and management. The app empowers residents to take action when they notice water leaks, reducing the time it takes for authorities to respond and ultimately preventing unnecessary water wastage. Additionally, it serves as a valuable data collection tool, enabling municipalities to analyze trends, track recurring issues, and make informed decisions about infrastructure improvements.

Water conservation is a shared responsibility that requires the active involvement of both authorities and citizens. By leveraging digital technology and community participation, HYDROCHECK aims to create a sustainable, long-term solution for leak management. Through early detection and prompt reporting, this project contributes to water conservation efforts, reduces financial burdens on property owners, and helps municipalities optimize their resources for infrastructure maintenance and repair.

Furthermore, this initiative encourages individuals to take a proactive role in safeguarding their water supply. It raises awareness about the impact of water wastage, promotes responsible water usage, and cultivates a sense of accountability within communities. When citizens are given the power to report and track leaks, they become active stakeholders in the preservation of this essential resource.

Additionally, HYDROCHECK contributes to reducing the strain on local water distribution systems by ensuring that leaks are addressed before they escalate into major water losses. It also minimizes risks associated with waterborne diseases caused by stagnant water from leaks and broken pipelines. In commercial and industrial settings, this tool helps businesses comply with environmental regulations, ensuring that water conservation remains a priority in both public and private sectors.

Another key consideration is the app's potential impact on disaster preparedness and resilience. Water leaks, if not addressed promptly, can weaken infrastructure and contribute to flooding in urban areas. HYDROCHECK can serve as an early warning system by enabling residents to report leaks that could lead to larger structural problems. In the long term, this proactive approach can help prevent infrastructure failures and support disaster risk reduction efforts.

Another important aspect of HYDROCHECK is its potential application in disaster risk management. Water leaks, if ignored, can lead to severe damage such as road collapses, flooding, and contamination of clean water supplies. By enabling citizens to report issues as soon as they arise, the app contributes to early warning systems and helps municipalities prevent major infrastructure failures. Additionally, by ensuring quick action on reported leaks, HYDROCHECK reduces the risks of waterborne diseases caused by stagnant water and contamination.

With increasing concerns over climate change and water scarcity, innovative and cost-effective solutions like HYDROCHECK are essential. By harnessing the power of digital technology and citizen engagement, this project seeks to revolutionize how water leaks are reported and managed. Ultimately, HYDROCHECK aims to create a more efficient, responsive, and environmentally conscious approach to water leak detection and repair, contributing to long-term sustainability and better resource management.

## **Purpose and Description**

The primary purpose of HYDROCHECK is to provide a structured and efficient platform for detecting, reporting, and managing water leaks. Unlike sensor-based monitoring systems that rely on automated detection, HYDROCHECK is a community-driven solution where users actively participate in leak detection and reporting. This approach ensures that leaks are addressed in a timely manner without the need for costly infrastructure investments or complex monitoring systems.

HYDROCHECK functions as a mobile and web application designed to simplify the process of reporting leaks and tracking their resolution. By allowing users to submit real-time reports with accurate location details, descriptions, and photos, the app ensures that water-related issues are documented effectively. Upon submission, municipal authorities and maintenance teams receive immediate notifications, enabling them to respond quickly and efficiently.

### **Key Features of HYDROCHECK:**

#### **1. User-Driven Leak Reporting:**

Empowers individuals to report leaks they encounter in their homes, neighborhoods, or public areas.

Allows users to submit descriptions, images, and geolocation data for precise identification of leak locations.



## 2. Instant Notifications to Authorities:

Sends real-time alerts to municipal water departments and maintenance staff.

Reduces response times by ensuring that relevant personnel are notified as soon as a report is submitted.

## 3. Tracking and Transparency:

Provides users with a dashboard to monitor the status of their reported leaks.

Allows authorities to update the status of repairs, promoting transparency and accountability.

## 4. Municipal Management System:

Offers an administrative panel for water service providers to track incoming reports, assign repair teams, and generate statistical insights. Helps identify patterns in leak occurrences, allowing for proactive infrastructure planning and maintenance.

## 5. Community Engagement and Awareness:

Encourages residents to participate in water conservation efforts by actively reporting issues. Includes educational resources on leak prevention, water conservation tips, and best practices for responsible water usage.

#### 6. Cloud-Based Storage for Data Management:

Ensures secure storage of user-submitted reports for future reference and analysis. Allows municipalities to build a comprehensive database of leak occurrences to inform policy-making and budget allocation.

#### 7. Cross-Platform Accessibility:

Available as a mobile app for Android and iOS users, as well as a web-based platform for broader accessibility. Designed to be user-friendly, ensuring that people of all ages and technical backgrounds can navigate the system effortlessly.

#### 8. Integration with Municipal Services:

Enables seamless coordination between citizens and municipal water departments. Supports automated ticketing systems for tracking maintenance requests and ensuring that reports do not go unnoticed.

By implementing HYDROCHECK, the project seeks to revolutionize how communities handle water leaks. This system provides an efficient, cost-effective, and highly scalable solution for leak detection and reporting. Instead of waiting for authorities to detect leaks through scheduled inspections or expensive monitoring equipment, HYDROCHECK places the power in the hands of the people who experience these issues firsthand.

Furthermore, the app has the potential to improve municipal infrastructure management by offering valuable insights into leak patterns and high-risk areas. With a well-documented database of reported leaks, authorities can prioritize repairs, allocate resources more efficiently, and prevent further damage before leaks escalate into major problems.

The long-term goal of HYDROCHECK is to encourage responsible water usage, reduce unnecessary wastage, and ensure that communities have access to safe and sustainable water resources. By fostering a culture of awareness and collaboration, this project contributes to global water conservation efforts and helps build a future where every drop of water is used efficiently and responsibly.

HYDROCHECK is more than just a mobile application—it is a step toward a smarter, more sustainable approach to water management. Through active community participation and digital innovation, this project aims to create lasting change, ensuring that water leaks are no longer overlooked but are instead addressed promptly and effectively.

## **Objectives**

The primary objective of this study is to develop HydroCheck, an innovative water leak reporting and alert system with the following key features:

1. User Dashboard:

Enable users to report water leaks by submitting reports with images, location data, and detailed descriptions. Provide real-time updates on the status of reported leaks, ensuring transparency in resolution efforts.

2. Admin Panel:

Allow municipal authorities to monitor incoming reports, validate information, and assign repair teams efficiently. Generate statistical reports on leak occurrences, trends, and response times to improve infrastructure management.

3. Notification System:

Send push notifications to users regarding water leaks reported in their area. Alert municipal staff for immediate action, ensuring timely repairs and minimizing water wastage.

4. Integration and Security:

Implement cloud-based storage for efficient data management and easy access to records. Ensure user data security by adhering to industry-standard data protection regulations.

## **Scope and Limitations**

The HydroCheck project will focus on developing a web and mobile application for reporting and tracking water leaks. The system will be piloted in a specific municipality or community before expanding to a larger audience. Unlike sensor-based leak detection systems, HydroCheck will rely entirely on user-reported data. It will not include automated IoT-based leak detection in its initial phase, but future enhancements may integrate such technology to improve efficiency. The system's effectiveness will depend on user engagement and the prompt response of municipal authorities.

## **Definition of Terms**

**Leak Detection:** The process of identifying unintended water loss due to broken pipes, faulty plumbing, or infrastructure damage through user reports.

**Reporting System:** A digital platform that allows users to submit and track reports of water leaks and related issues.

**Real-Time Notification:** Instant alerts sent to users or municipal authorities regarding reported water-related issues to ensure prompt response and resolution.

**Dashboard:** A centralized interface that allows users and municipal staff to monitor reported leaks, track responses, and oversee maintenance activities efficiently.

**Cloud-Based Storage:** A secure and scalable digital solution for storing, managing, and retrieving water leak report data and system records remotely.

**Municipal Water Services:** Government or private entities responsible for maintaining and managing water distribution, leak repairs, and infrastructure improvements.

**Push Notification:** An automated message sent to users and municipal staff to inform them about new reports, status updates, and urgent water-related alerts.

**Infrastructure Management:** The structured administration, repair, and enhancement of water supply systems to ensure sustainability and efficiency in water distribution.

**User-Driven System:** A system that depends on users actively reporting water leaks rather than relying on automated sensors or AI-based detection methods.

**Community Engagement:** The active involvement of citizens in identifying and reporting leaks, ensuring that the system is effective in addressing local water concerns.

**Mobile Application:** A smartphone-based software designed to allow users to report, track, and receive updates on water leaks conveniently.

**Incident Tracking:** A feature that enables users to follow the progress of their reported leaks, from submission to resolution, ensuring transparency in the process.

**Geolocation Tagging:** The ability of the app to capture and attach the exact location of reported leaks, making it easier for repair teams to locate and fix the issue.

**User Authentication:** A security feature that ensures only registered users can submit reports, preventing spam or inaccurate leak reports from affecting the system.

**Data Encryption:** A security measure implemented to protect user information and prevent unauthorized access to sensitive data stored in the system.

**System Reliability:** The ability of the application to function consistently and accurately in receiving reports, sending notifications, and maintaining data integrity.

**Pilot Testing:** The initial phase of implementation where the app is tested in a specific community to evaluate its effectiveness before a broader launch.

**Water Conservation:** The practice of using water efficiently to reduce unnecessary waste and promote sustainable water management within communities.

**Maintenance Request System:** A feature in the app that allows users to request follow-ups on unresolved leak reports, ensuring continued attention to serious water issues.

**Automated Report Logging:** The system's ability to systematically store and organize user-submitted reports, enabling easy retrieval and analysis of water leak incidents.

