

Centralized Decision Support System for Water Sustainability Using Artificial Intelligence

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Abstract— Water scarcity is becoming a serious global issue due to factors like increasing population, pollution, and climate change, which leads to uneven rainfall distribution some areas face drought, while others experience flooding. To address this challenge, a centralized knowledge sharing platform has been developed to help communities learn water-saving techniques without needing physical visits from experts. This online tool allows users to sign up, log in, and share or access expert ideas, techniques, tools, and videos related to water conservation. All contributions are stored on a centralized server and can be accessed anytime through a mobile or laptop with internet connectivity. One of the key features is a live map highlighting the most drought-affected areas, helping experts identify regions that need immediate attention. The system promotes self-education and community driven solutions by making expert advice easily available. It empowers users to contribute knowledge and encourages collective action towards saving water, ensuring a more sustainable future.

Keywords— Water Scarcity, Knowledge Sharing, Centralized Platform, Expert Advice, Water Conservation, Drought Mapping, Online Tool, Community Awareness, Environmental Sustainability, Water Management.

I. INTRODUCTION

Water is one of the most essential natural resources for sustaining life, yet its availability is increasingly threatened by rapid urbanization, population growth, climate change, and environmental degradation. Uneven rainfall patterns, prolonged droughts, and unexpected floods are becoming more frequent, placing immense pressure on water resources across the globe. Traditional water management practices are often insufficient to

address these dynamic challenges, especially in regions where access to expert knowledge and modern infrastructure is limited. As a result, there is a growing need for innovative, technology-driven solutions that can support efficient and sustainable water resource management. In recent years, advancements in smart technologies such as the Internet of Things, intelligent monitoring systems, and automated control mechanisms have significantly contributed to improving water management practices. For instance, automated water level sensors and controllers enable efficient monitoring and regulation of water storage systems, reducing wastage and ensuring optimal utilization [1]. Similarly, IoT-based systems facilitate real-time monitoring of water quality, leakage detection, and consumption patterns, enhancing decision-making and operational efficiency [8–10]. These technologies form the backbone of smart water management systems, which are integral components of the broader concept of smart cities. Smart cities leverage data, communication technologies, and digital platforms to improve urban sustainability and resource management [2–4].

Despite these technological advancements, a critical gap remains in the accessibility and dissemination of knowledge related to water conservation and management. Many communities, particularly in rural or underdeveloped areas, lack direct access to experts, training programs, or real-time guidance. Intelligent systems and smart infrastructure can only be effective when users are aware of how to utilize them efficiently [5]. Therefore, knowledge sharing becomes a crucial element in achieving sustainable water management. Centralized platforms that enable users to share, access, and learn from expert knowledge can bridge this gap by promoting awareness and encouraging community participation. The integration of IoT-based monitoring systems, intelligent metering, and data-driven approaches has demonstrated significant

potential in optimizing water usage and detecting inefficiencies such as leakages and overconsumption [6,7,15].

Furthermore, advancements in communication technologies have enabled seamless data exchange and real-time insights, which are essential for effective water resource planning and management [12,18]. However, the success of these systems largely depends on the availability of accessible and user-friendly platforms that can connect experts with communities.

In this context, a centralized AI-driven knowledge-sharing platform offers a promising solution by combining technological innovation with collaborative learning. Such a platform empowers users to access expert insights, share local solutions, and contribute to a collective knowledge base. By fostering self-education and community-driven action, it supports sustainable water management practices and helps build resilience against water scarcity challenges, ultimately contributing to a more sustainable and water-secure future.

II. RELATED WORK

Getu, B.N.; Attia, H.A. (2017) This study focuses on the design and implementation of an automatic water level sensor and controller system aimed at improving water usage efficiency. The authors propose a system that uses sensors to continuously monitor water levels in tanks and automatically control pumps to prevent overflow and dry running. The system operates using microcontrollers, which process sensor data and trigger appropriate actions such as switching motors on or off. One of the key advantages highlighted is the reduction of human intervention, which minimizes water wastage and energy consumption. The system is particularly beneficial in residential and agricultural applications where manual monitoring is inefficient or impractical. Additionally, the solution is cost-effective and easy to implement, making it suitable for developing regions facing water scarcity issues. [1]

Oberascher, M.; Rauch, W.; Sitzenfrie, R. (2022) This paper provides a comprehensive review of the concept of “smart water cities,” focusing on the integration of advanced technologies for efficient urban water management. The authors analyse various applications, including water distribution monitoring, flood prediction, wastewater management, and real-time data analytics. A key aspect of the study is the identification of data

requirements and communication technologies necessary to support integrated water systems. The paper highlights the importance of sensors, IoT devices, and data platforms in collecting and processing large volumes of water-related data. It also discusses challenges such as data interoperability, infrastructure costs, and cybersecurity concerns. The authors emphasize that smart water cities rely heavily on digital transformation and cross-sector collaboration to achieve sustainability goals. [2]

Keshavarzi, G.; Yildirim, Y.; Arefi, M. (2021) This article reviews existing literature on smart cities, with a particular focus on how scale influences their design and implementation. The authors explore different dimensions of smart cities, including technological infrastructure, governance, and socio-economic factors. A key argument presented is that the effectiveness of smart city initiatives depends on their scale—whether they are implemented at a neighbourhood, city-wide, or regional level. The study highlights that smaller-scale implementations often allow for more flexibility and faster innovation, while larger-scale systems provide broader impact but face greater complexity. The paper also examines the role of digital technologies such as IoT, big data, and cloud computing in enabling smart city functionalities. Furthermore, it discusses the importance of citizen participation and policy frameworks in ensuring successful implementation. The findings suggest that there is no one-size-fits-all approach, and solutions must be tailored to specific contexts. The research contributes to a deeper understanding of how scalability affects the sustainability and efficiency of smart city systems, including water management.[3]

Pellicer, S.; Santa, G.; Bleda, A.L.; Maestre, R.; Jara, A.J.; Skarmeta, A.G. (2013) This survey paper presents a global overview of smart cities, focusing on the technologies and frameworks that enable intelligent urban environments. The authors examine the role of mobile and internet-based services in creating interconnected systems that enhance urban living. Key components discussed include sensor networks, cloud computing, and communication infrastructures that facilitate real-time data exchange. The study highlights various application domains such as transportation, energy, healthcare, and water management. It emphasizes that smart cities aim to improve efficiency, sustainability, and quality of life through the integration of information and communication technologies (ICT). The paper also addresses challenges such as system interoperability, data privacy, and the need

for standardized protocols. By analyzing different case studies and implementations worldwide, the authors provide insights into best practices and future directions. [4]

Omar, O. (2020)
This paper explores the role of intelligent systems in enhancing the functionality and efficiency of buildings. The author discusses how advanced technologies such as automation, artificial intelligence, and sensor-based systems can optimize resource usage, including water and energy. Intelligent building systems are capable of monitoring environmental conditions, detecting inefficiencies, and making real-time adjustments to improve performance. For example, automated water management systems can regulate consumption, detect leaks, and ensure optimal distribution within buildings. The study highlights the benefits of such systems in reducing operational costs and environmental impact. It also emphasizes the importance of integrating these technologies into building design from the early stages to maximize their effectiveness. Challenges such as high initial costs, system complexity, and the need for skilled personnel are also discussed. Overall, the paper demonstrates that intelligent systems are essential for achieving sustainability goals in modern infrastructure, contributing to smarter and more efficient urban environments [5].

III. PROPOSED METHODOLOGY

The proposed system is a centralized AI-based knowledge-sharing platform designed to promote sustainable water resource management through community participation and expert collaboration. The platform is developed as a web and mobile-accessible application that enables users to register, authenticate, and interact within a unified digital environment. The architecture follows a client-server model, where user interfaces (mobile or web) communicate with a centralized cloud server that stores data, processes requests, and delivers personalized content.

The system consists of three main modules: user management, knowledge repository, and intelligent recommendation engine. The user management module handles registration, login, and profile creation, allowing users to identify their location, interests, and expertise level. The knowledge repository acts as a centralized database where experts and users can upload water conservation techniques, case studies, videos, and tools. All content is categorized and tagged to ensure easy retrieval and efficient organization.

A key feature of the platform is the integration of an AI-driven recommendation system. This component analyses user behaviour, geographic location, and environmental conditions to suggest relevant water-saving techniques and best practices. For example, users in drought-prone areas receive targeted content related to rainwater harvesting, efficient irrigation, and water recycling methods. Additionally, the system incorporates a live geospatial map that highlights drought-affected regions using real-time or periodically updated data. This enables experts and policymakers to identify critical areas and respond promptly.

The platform also supports interactive features such as discussion forums, feedback systems, and content rating, encouraging community engagement and continuous knowledge improvement. To ensure scalability and reliability, cloud technologies and APIs are used for data storage, communication, and integration with external data sources such as weather and water monitoring systems. Overall, the proposed method combines AI, cloud computing, and user-generated content to create an accessible, scalable, and intelligent solution for sustainable water management and knowledge dissemination. The proposed centralized AI-based knowledge-sharing platform demonstrates significant potential in addressing the challenges of water scarcity through digital innovation and community engagement. By integrating user-generated content with expert knowledge, the system bridges the gap between technological advancements and real-world application.

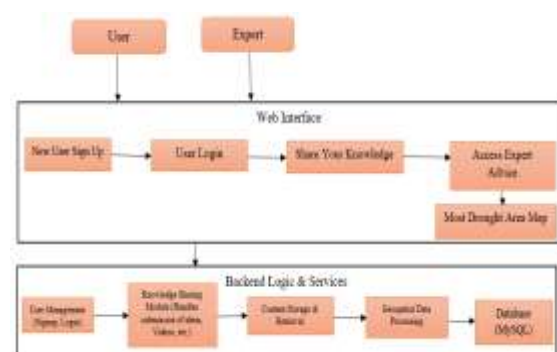


Figure [1]: Smart Parking System Architecture

Figure [1] The proposed system architecture consists of three main layers: the user layer, web interface, and backend services. At the top level, two types of users—general users and experts—interact with the system. Users can register and log in, while experts contribute knowledge and provide

guidance on water conservation practices. The web interface acts as a bridge, offering features such as user authentication, knowledge sharing, access to expert advice, and visualization of drought-prone areas through an interactive map.

The backend layer handles the core functionality of the system. It includes user management for handling login and registration, a knowledge-sharing module for storing content such as techniques and videos, and content storage and retrieval mechanisms. Additionally, geospatial data processing is used to analyse and display drought-affected regions. All data is maintained in a centralized MySQL database. This layered architecture ensures efficient communication, scalability, and real-time access to water management information.

IV.RESULT AND DISCUSSION

The implementation of the centralized AI-based knowledge-sharing platform demonstrated promising outcomes in improving awareness and adoption of water conservation practices. Users were able to successfully register, access, and share relevant content, indicating the platform's usability and accessibility across different devices. The AI-driven recommendation system effectively delivered personalized suggestions based on user location and preferences, increasing user engagement and content relevance. The live geospatial mapping feature accurately highlighted drought-prone areas, enabling users and experts to identify critical regions and prioritize solutions.



Figure [2]: Dashboard Interface of the Centralized AI Knowledge-Sharing Platform

Figure [2] illustrates the main dashboard of the system after successful user login. It provides navigation options such as sharing knowledge, accessing expert advice, viewing drought area maps, and logging out. The interface confirms successful login and enables users to interact with

key features for water conservation and knowledge exchange.



Figure [3]: Knowledge Sharing Interface of the Centralized AI Platform

Figure [3] illustrates the knowledge-sharing module where experts contribute water-saving techniques and ideas. It displays expert details, posted content, date of submission, and options to download related videos. This interface enables users to access, learn, and implement practical water conservation methods efficiently.

DISCUSSION

The proposed centralized AI-based knowledge-sharing platform demonstrates significant potential in addressing the challenges of water scarcity through digital innovation and community engagement. By integrating user-generated content with expert knowledge, the system bridges the gap between technological advancements and real-world application. One of the major strengths of the platform is its accessibility, allowing users from diverse regions to learn and contribute without requiring physical interaction with experts. This is particularly beneficial for rural and drought-prone areas where resources and guidance are often limited. The inclusion of AI-driven recommendations enhances the relevance of shared information by tailoring suggestions based on user location and environmental conditions. Additionally, the live geospatial mapping feature provides a clear visualization of critical regions, enabling timely interventions by experts and authorities. However, challenges such as data accuracy, user participation, and internet accessibility may impact the system's effectiveness. Ensuring the credibility of shared

content and maintaining user engagement are also crucial factors for long-term success.

V. CONCLUSION

In conclusion, the centralized AI knowledge-sharing platform offers an innovative and practical approach to sustainable water resource management. By leveraging modern technologies such as artificial intelligence, cloud computing, and geospatial mapping, the system enables efficient dissemination of knowledge and promotes informed decision-making. It empowers individuals and communities to adopt water-saving techniques by providing easy access to expert insights, tools, and real-time information. The platform not only addresses the issue of limited access to expertise but also fosters a sense of collective responsibility towards water conservation. Its ability to adapt content based on user needs and regional conditions makes it a highly effective tool for tackling diverse water-related challenges. Furthermore, the integration of interactive features encourages continuous learning, collaboration, and innovation among users. While certain limitations such as digital literacy and infrastructure availability must be considered, the overall impact of the system is highly promising. With proper implementation and continuous improvement, the platform can play a vital role in promoting sustainable water practices on a global scale. Ultimately, it contributes to building resilient communities and ensuring a secure and sustainable water future for generations to come.

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