DESIGN & IMPLEMENTATION OF A RAINWATER HARVESTING SYSTEM FOR A RESIDENTIAL STRUCTURE IN A COMPOSITE CLIMATIC ZONE

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ABSTRACT

Rainwater harvesting is a sustainable way to collect and reuse rainwater for drinking and utility needs. This study presents an IoT- based smart system using Adriano UNO and sensors (rain, flow, level, leak, pH, and turbidity) to monitor and manage water efficiently. Real- time data is tracked via an Android app linked to Thing Speak. A case study in rooftop harvesting with solar-powered smart controls, while Durgapur models include recharge pits and storage tanks. The system ensures safe, efficient water use, reduces groundwater reliance, and supports sustainability through smart monitoring and solar energy integration.

Rainwater harvesting is an environmentally friendly method used to collect and reuse rainwater for drinking and other domestic or utility purposes. It helps conserve water resources and reduces dependence on conventional water supplies.

This study presents an IoT-based smart rainwater harvesting system developed using Arduino UNO. Various sensors such as rain, flow, water level, leak detection, pH, and turbidity sensors are used to continuously monitor the quantity and quality of harvested rainwater, ensuring efficient management. The system sends real-time data to the Thing Speak cloud platform, which can be easily accessed through an Android mobile application. This allows users to monitor water conditions remotely and take timely actions when required.

A rooftop rainwater harvesting case study demonstrates the use of solar-powered smart controls to operate the system sustainably. Additionally, the Durgapur model includes storage tanks and groundwater recharge pits, enhancing water conservation

Overall, the proposed system ensures safe and efficient use of rainwater, reduces reliance on groundwater resources, and promotes sustainability through smart monitoring and the integration of renewable solar energy.

Keywords: Rainwater Harvesting, Sustainable Water Management, IoT-Based Smart System, Adriano UNO, Sensors Rain Sensor, Flow Sensor, Water Level Sensor, Leak Sensor, pH Sensor

1. INTRODUCTION

Water is essential for life, yet increasing population, urbanization, and industrialization are putting immense pressure on freshwater resources, especially groundwater. India faces a severe water crisis, with many states expected to face critical shortages by 2025 Despite its potential, only 10–20% of rainwater is harvested, [1] largely due to urban infrastructure preventing natural infiltration.

Urban areas, with growing water demands, are particularly at risk. Decentralized solutions like rainwater harvesting (RWH) at household and community levels can help. RWH involves collecting and storing rainwater for various uses and can significantly aid in groundwater recharge and reduce reliance on municipal water.

Integrating Internet of Things (IoT) technology into RWH enhances its efficiency [2]. IoT systems use sensors to monitor water levels, flow, and quality in real-time, with data sent to cloud platforms for analysis. This allows users to detect issues, optimize usage, and plan effective water management.