# An IoT-Based Complete Smart Drainage System for a Smart City

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# Introduction

- □ A remarkable technological innovation of modern science is the Internet of Things, which refers to an interconnected network among various physical objects/devices.
- □ Smart City is aimed to manage different resources of a city electronically in an efficient manner and establish a significant connection between the urban community and urban infrastructure.
- □ An essential part of a sustainable environment of a city is a healthy drainage system where the excess surface water is being removed from an area naturally or artificially to provide a hygienic environment.
- □ A healthy drainage system is strongly associated with an effective waste management system.
- □ Managing wastes that create blockage inside drainage system through manual intervention is time consuming and takes too much effort.
- □ An automation of such system would result in a smart drainage management system that would direct towards improving quality of life of urban community.

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# Related Works

Ref. No.	Objective	Area of Application
[1]	A cost-effective automated drainage management system concerning how drain clogs could be detected in the sewage pipelines using acoustic sensors through the WSN platform so that immediate actions can be taken.	Drainage System (sewage pipelines)
[2]	The design and implementation of an IoT based smart manhole monitoring system using IoT that will generate an alarm based on the status (open lid, overflow etc.) of the manhole.	Drainage System (Manhole)
[3]	A new intelligent approach for recognizing multi-featured objects using optical sensor based technology for processing solid wastes.	Waste Management (ground surface waste)
[4]	A monitoring system of dustbins by using a unique ID where all dustbins are interconnected through an Android App which sends a message to the concerned people when the bins are full.	Waste Management (ground surface waste)

## **Research** Motivation

- There have been individual solutions but none of the works focus on both the underground drainage mechanism and the drainage waste management system.
- There are many solutions regarding drainage systems that mainly concerns how a drainage system is managed if any overflow occurs, without solving the root cause of overflow (i.e. waste materials).
- The need for a drainage management system along with its waste management system in urban areas is inevitable, especially in a under-developed countries.
- Manually handling these systems is often time-consuming and requires too much effort (human labor to collect waste that creates obstruction in the drainage system).

# Research Objective

# To propose an IoT-based effective smart drain management system for a smart city in order to solve the particular reason that causes overflow and to manage that cause efficiently.

# Proposed System: Conceptual Features

## **Target Feature**

- To prevent the clogging of drains using IoT so that it does not lead to drainage overflow and further inconvenience. This is achieved by -
  - Considering all types of sources (roadside drains, infrastructure home, industry, etc.) and their drainage mechanisms leading to the proposal of an integrated solution.

## **Additional Feature**

- To manage different waste materials efficiently using IoT that clogs the drainage system. This is achieved by -
  - > Collecting all types of materials are sorting them using a smart sorting system.
  - An associated database with this sorting system will record the type and amount of incoming materials of a particular area.
  - > The sorted materials are packaged separately, which notifies various organizations that can further process these materials for recycling, fertilizer production, etc.
  - There will be another database associated with this packaging system that will generate monthly/weekly/yearly reports regarding the amount and type of outgoing packaged materials to different organizations.

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Fig 1. Flow diagram for system architecture.

- Prevention of drain clogging for different drainage mechanisms
  - Drainage mechanism for infrastructure (home, industry, etc.)



Fig 2. Drainage mechanism for infrastructure.

- Prevention of drain clogging for different drainage mechanisms
  - Drainage mechanism for roadside drains



Fig 3. Drainage mechanism for roadside drains.

Collection of solid waste products responsible for drain blockage



Drainage pipeline passing wastewater along with solid wastes

Fig 4. Collection of solid waste products responsible for drain blockage.

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Sorting and packaging of solid waste products for further processing



Drainage pipeline passing solid wastes

Fig 5. Sorting and packaging of solid waste products for further processing.

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Combined system



Fig 6. The proposed complete IoT based drainage management system.

## Working Procedure



Fig 7. A flow diagram for the working procedure of the system.

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## **Research** Contribution

- Proposing a comprehensive smart solution for both surface drainage mechanism and waste management system.
- Detailing the crucial components of the proposed system.
- Specifying the methods for preventing and managing the solid wastes that are responsible for creating blockage inside drainage pipelines and drain covers.
- Emphasis on the fact that if the root cause for drain clogging can be solved, the city can be protected against the consequences of environment pollution.

## Conclusions & Future Work

- An essential smart city component is the smart drainage management system that aims to provide an effective and effortless systematic method to preserve a healthy environment.
- A comprehensive system design has been proposed for such a smart drainage management system that collectively considers drainage mechanism for both roadside drains and infrastructures, including a mechanism for drainage waste management.

✓ <u>Future Work</u>

- > To practically implement the system according to the design.
- ➤ To perform an experimental analysis in order to bear significant contribution in preserving a healthy environment of the urban community.

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