SMART WASTE MANAGEMENT SYSTEM

Efficient Tracking & Optimized Garbage Collection

PROJECT BASED LEARNING PRESENTATION-MAY-2025

(P07-Smart Waste Management System)

by

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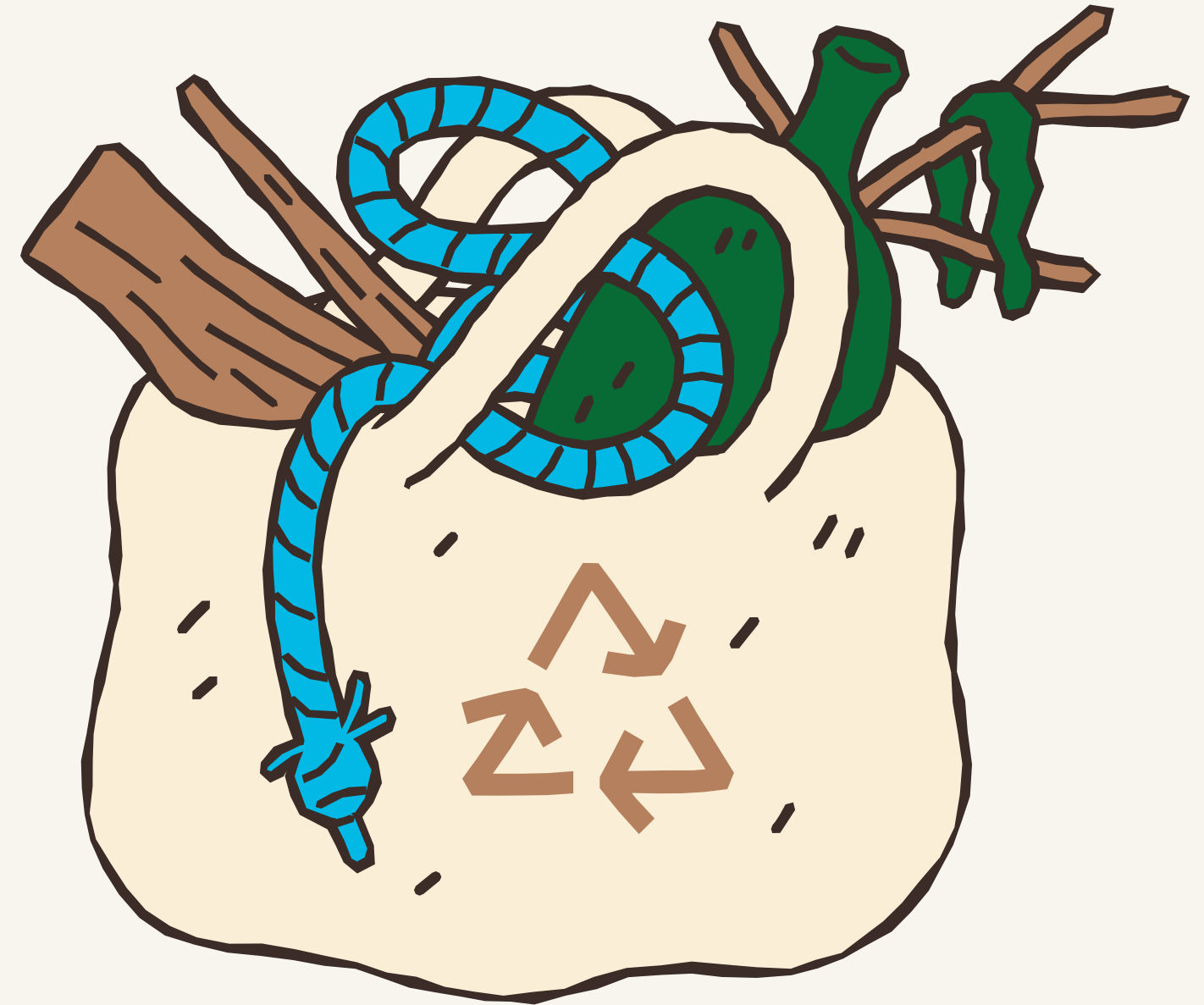
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To develop a Smart Waste Management System using C.

Main Goals:

- **Detect full bins in real time**
- **Send console alerts**
- **Log sanitation activities**
- **Improve collection efficiency**

Problem Statement

Current Issues in Waste Management:

- Overflowing bins due to late collection
- No real-time monitoring of bin status
- Fixed schedules ignore actual fill levels
- Manual tracking leads to inefficiency

Proposed Solution

How It Solves the Problem:

1. Detects full bins in real time
2. Sends alerts for timely collection
3. Logs sanitation events
4. Reduces manual errors and delays

Result:

- No more overflowing bins
- Efficient garbage collection
- Less public complaints

Impact:

- Cleaner streets
- Healthier urban environment
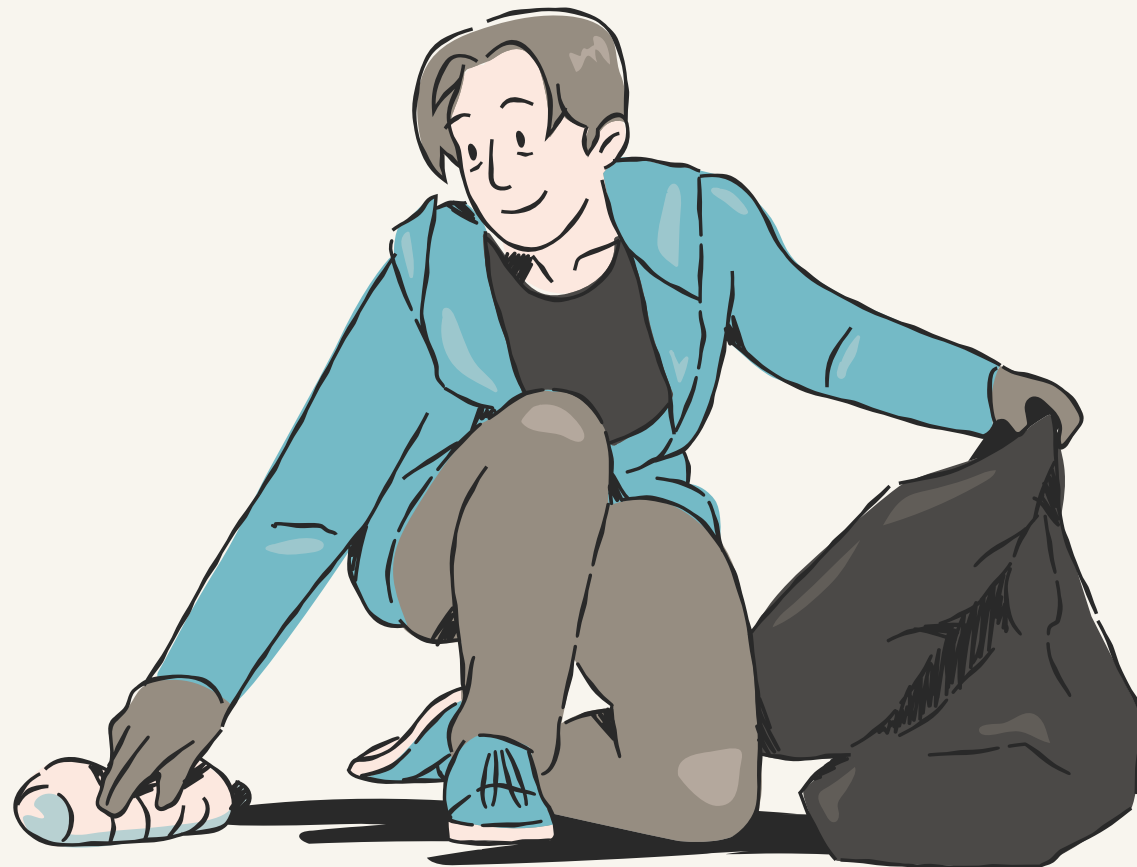- Step toward smart city goals

Program Overview

💻 *Language Used*: C

Key Components:

- struct WasteBin – Stores bin data: ID, location, fill %, cleaning time
- bins[ ] – Predefined bins with initial values

Core Functionalities:

- Update Bin Data: Fill level + hours since cleaned
- Alert System: Notifies if bin is ≥80% full or uncleaned >48 hrs
- Display Status: Shows current info of all bins
- Log to File: Saves sanitation log to sanitation_log.txt
- Sends real-time alerts
- Prevents overflow & unhygienic delays

```c
void sendNotification(WasteBin bin) {
    printf("🔔 ALERT: Bin ID %d at '%s' is %d%% full. Immediate collection required!\n",
           bin.binID, bin.location, bin.fillLevel);
}


void checkFullBins(int count) {
    for (int i = 0; i < count; i++) {
        if (bins[i].fillLevel >= FULL_THRESHOLD) {
            sendNotification(bins[i]);
        }
    }
}
```

What It Shows:

- *Checks each bin's fill level*
- *Triggers an alert when bin is full (≥80%)*
- *Alerts are shown directly on the console*

Simple but powerful logic to keep waste levels under control!

Sample Console Output

```
🚨 ALERT: Bin ID 2 at 'Hostel' is 85% full. Immediate collection required!
⚠️ WARNING: Bin ID 4 at 'Admin Block' has not been cleaned in over 48 hours!
✅ Bin updated successfully.
📋 Bin Status Report:
Bin ID: 1 | Location: Library | Fill Level: 40% | Hours Since Cleaned: 12
Bin ID: 2 | Location: Hostel | Fill Level: 85% | Hours Since Cleaned: 10
Bin ID: 3 | Location: Canteen | Fill Level: 30% | Hours Since Cleaned: 5
Bin ID: 4 | Location: Admin Block | Fill Level: 50% | Hours Since Cleaned: 50
Bin ID: 5 | Location: Playground | Fill Level: 20% | Hours Since Cleaned: 8
```

- Alerts help prioritize cleaning and collection

- Status reports give a clear view of all bins

Logs & Optimization

Sanitation Logs:
Saves bin status to sanitation_log.txt
Includes bin ID, location, fill level, and cleaning delay
Useful for historical tracking and reports

Sample Log Entry

Bin ID: 2 | Location: Hostel | Fill Level: 85% | Hours Since Cleaned: 10

Optimization Support:
Prioritizes bins needing urgent attention
Fill level ≥ 80%
Not cleaned for > 48 hours
Helps create smarter collection routes (future-ready)

Benefits of This Project:

Timely Waste Collection
Instant alerts prevent overflow and delays

Improved Sanitation
Regular tracking helps maintain cleanliness

Data-Driven Management
Logs provide useful insights for planning

Low-Cost Solution
Runs on basic C program without extra hardware

Future Scope

1. Integration with IoT Sensors
Real-time bin monitoring using hardware sensors
2. Mobile App Notification System
Alerts for cleaning staff via SMS or app
3. AI-based Route Optimization
Use AI to plan most efficient collection paths
4. Dynamic Scheduling
Adjust garbage pickup schedules based on live data
5. Dashboard for Authorities
Centralized monitoring and control panel for municipality

Conclusion

Summary:

- Designed a simple yet effective waste monitoring system using C
- Tracks bin fill levels and cleaning delays
- Sends alerts and maintains logs for action and analysis

Key Takeaway:

- Even basic programming can contribute to smart city solutions and improve urban hygiene.

Next Steps:

Enhance the system with sensors, automation, and data intelligence.

THANK YOU VERY MUCH!