SMART SYSTEMS AND THE INTERNET OF THINGS(IOT) FOR WASTE MANAGEMENT

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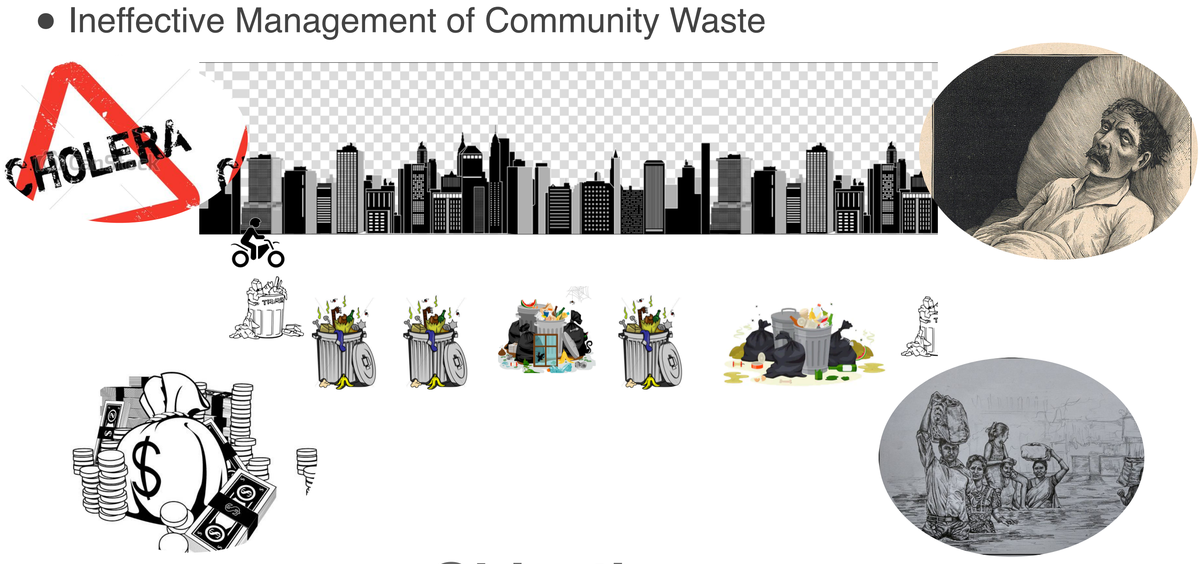
Abstract

Waste management is a raising concern faced by many nations in the world today. On the streets of major cities, it has become almost common to find waste, which poses health hazards and other concerns to its communities and inhabitants. This project focuses on the use of smart systems and the Internet of Things(IOT), to provide an efficient and effective approach to waste management. This project designed and manufactured a prototype of a solar powered, self compacting bin with a server side monitoring application. This prototype smart bin is capable of monitoring internal rubbish levels, compact it, freeing approximately 25% of space with each compaction. The bin also monitors total weight and is capable of sending all this information to a secure server side application. The accompanying web application monitors the state of each bin and proposes optimal routes for pickup. This approach will contribute to a smart and efficient waste disposal system, improving the cities waste management.

Problem

- Ineffective Management of Community Waste

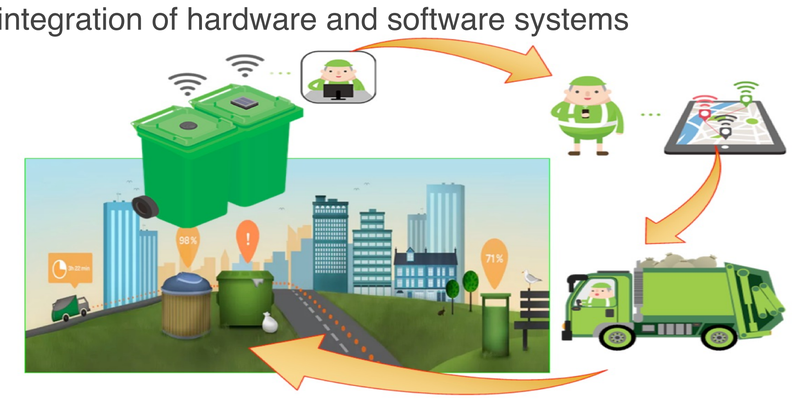


Objective

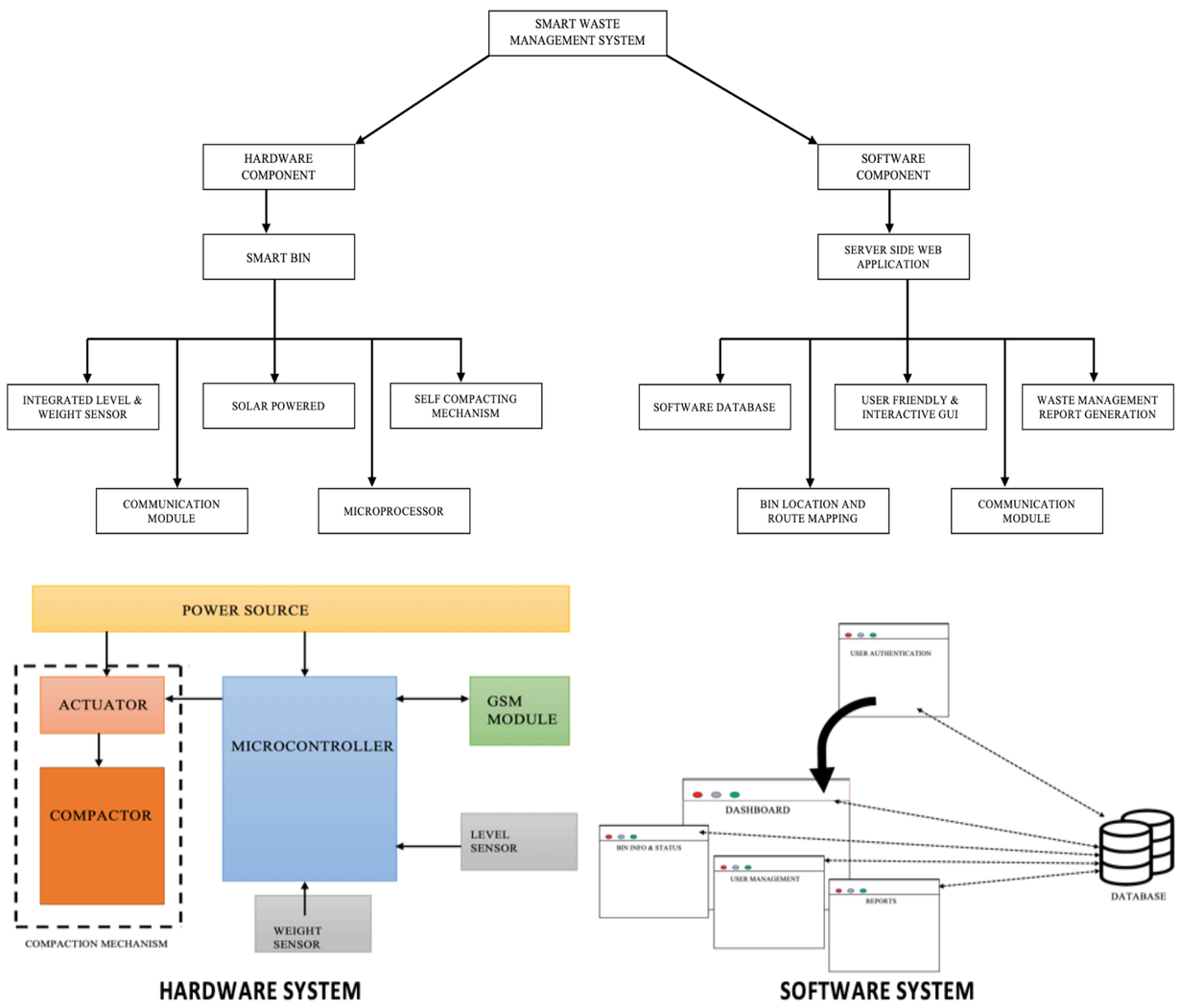
1)Develop a solar powered self-compacting bin with integrated rubbish and weight sensors

2)Develop a user friendly/ interactive server side web application for hardware monitoring and management

3)Effective integration of hardware and software systems

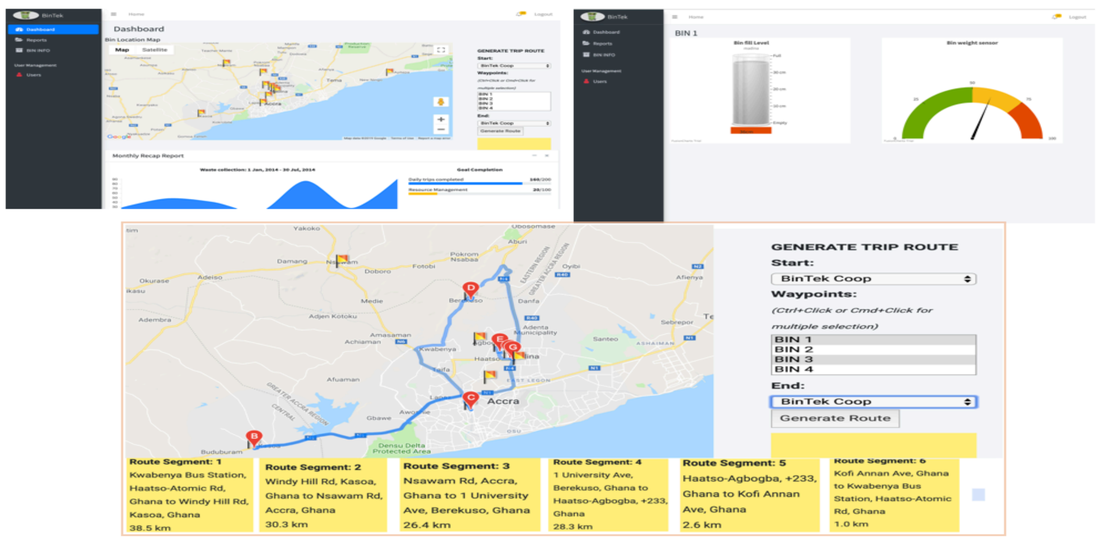


Design & Implementation



Fabricated Smart Bin

Smart Bin Monitoring Web Application



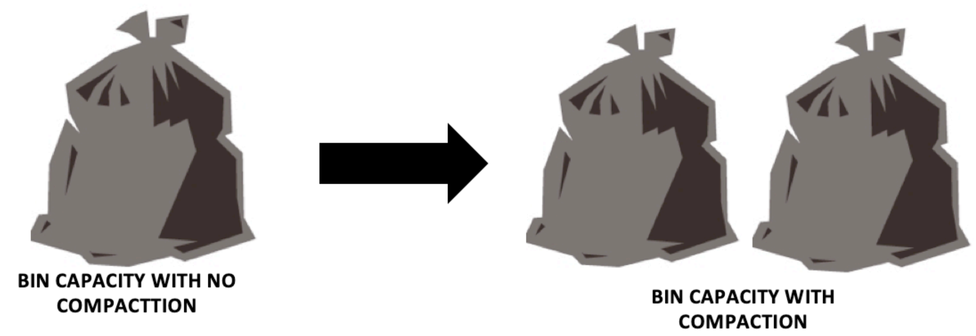
Tests & Results

Compaction Test

Total Bin Capacity = 40cm

- All percentages are in reference to the half way capacity of 20cm

Test Cases	Space created after compaction	%Space Created
Test 1	4cm	20%
Test 2	5cm	25%
Test 3	5cm	25%
Test 4	6cm	30%
Test 5	5cm	25%
Average	5cm	25%



Routing Engine Efficiency

Routing Tool	Trip Distance	Trip duration
Web App generated Route	44.5km	2hrs 2mins
OSRM generated Route	48.4km	2hrs 30mins

Challenges

- No readily available data on community waste management
- Less number of prototypes to enhance system testing

Conclusion

The User Web Application and the sensor composed hardware system (Smart Bin) developed in this project establish the basis of how technology can be used in the effective management of waste, introducing a revolutionised approach to waste management in the Ghanaian community and possibly spread across the African continent. With this smart system, waste companies will use less resources in waste management and improve their efficiency on waste collection. The system also plays a key role in the country's strive to keeping its communities clean and ensuring good sanitation.