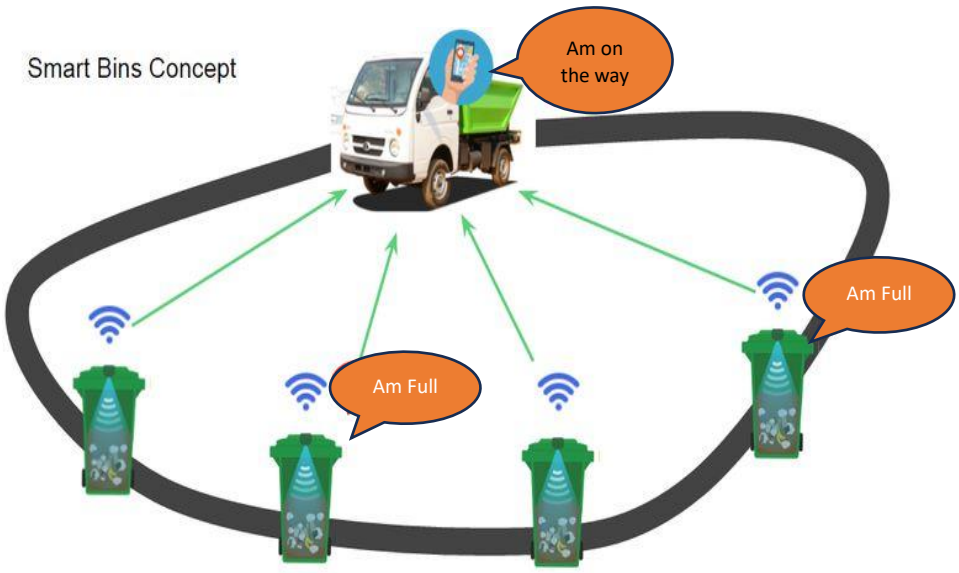
GROUP:04

Smart Waste Bin for Waste management



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Project Idea: Smart Waste Bin for Waste Management

Waste management is a significant challenge in modern cities. With increasing population density, cities struggle to maintain efficient waste collection schedules, often leading to either overflowing bins or unnecessary trips by waste collection services. This results in higher operational costs, wasted resources, and an increased environmental footprint. By leveraging IoT technology, smart waste bins can optimize waste collection, reduce operational costs, and minimize the environmental footprint.

Incorporating sensors and data-driven decision-making ensures that waste is collected at the right time, reducing pollution and enhancing the quality of urban life. Efficient waste management contributes to cleaner cities, reduced carbon emissions, and better resource management. As urban populations continue to grow, the need for smarter, more sustainable waste solutions becomes even more critical.

I intend to pursue a business model approach for this project. The goal is to develop a commercially viable solution for smart waste management. This approach will involve designing the smart waste bin system with market needs in mind, ensuring it addresses main points such as cost reduction, environmental impact, and ease of deployment.

Fig.1. (Generated by Chat GPT) (Prompt: “can you generate an image for this scenario. like cartoon. One person with waste in hand waving in front of the wastebin, then a wastebin with waste sending signal, then a collector vehicle receives the signal”)

The smart waste bin system offers several key advantages. The system will have real-time fill level monitoring via a distance sensor, alerting waste collection teams when the bin is full, to avoid unnecessary trips. Integrated CO2 sensors monitor gas buildup from waste decomposition, notifying authorities if levels exceed safety thresholds.

USERS: -

- Waste Management Authorities: They can use the smart waste bin system to optimize collection schedules, reduce operational costs, and lower carbon emissions by minimizing unnecessary trips to empty bins.
- Private Businesses and Institutions: These entities, such as universities, hospitals, or large corporate campuses, can deploy smart waste bins to improve their internal waste management processes, ensuring bins are emptied before they overflow.
- Citizens and Residents: Individuals can benefit from cleaner neighbourhoods with fewer overflowing bins, improving hygiene and reducing unpleasant situation in public areas.

The architecture/components

M5Stack Core2: This will act as the central control unit of the smart waste bin, collecting data from various sensors and sending alerts or updates to waste management systems.

Distance Sensor: Mount the distance sensor on the lid of the waste bin, facing downwards towards the waste. Use the sensor readings to measure the waste level. When the distance to the waste is below a certain threshold, trigger an alert.

CO2 Monitoring: CO2 sensor inside the bin to detect any harmful gases due to waste decomposition. Trigger alerts if CO2 levels exceed a predefined safe threshold, indicating the need for cleaning or earlier emptying.

Motion Sensors can also be integrated to detect usage frequency and provide insights into peak times of use.

Acknowledgment:

Some portions of this proposal, including phrasing and image generation, were assisted by ChatGPT. All content was reviewed and customized to ensure relevance and coherence with the project's goals.

Prompts: -

1) ” I have an idea of developing smart waste bin using IOT device. Where the waste management team will get real time alert, if the bin is full, it will send alert to authority for pick up. Also measures the CO2 level for safety reason. Please generate an explanation”.

2) ” The smart waste bin can benefits Waste Management Authorities, Private Businesses and Institutions and Citizens and Residents, can you provide an explanation. Ex: Waste Management Authorities can schedule there picking plan effectively, residence benefits from clean environment etc”.

EVALUATION PART:

Measuring Customer Satisfaction

Since our smart waste bin system is aimed at waste management authorities and large businesses, the focus will be on key performance areas that are critical to these users. These include efficient waste collection, cost savings, and the reliability of real-time alerts. Here's how we will measure satisfaction and use their feedback for continuous product development:

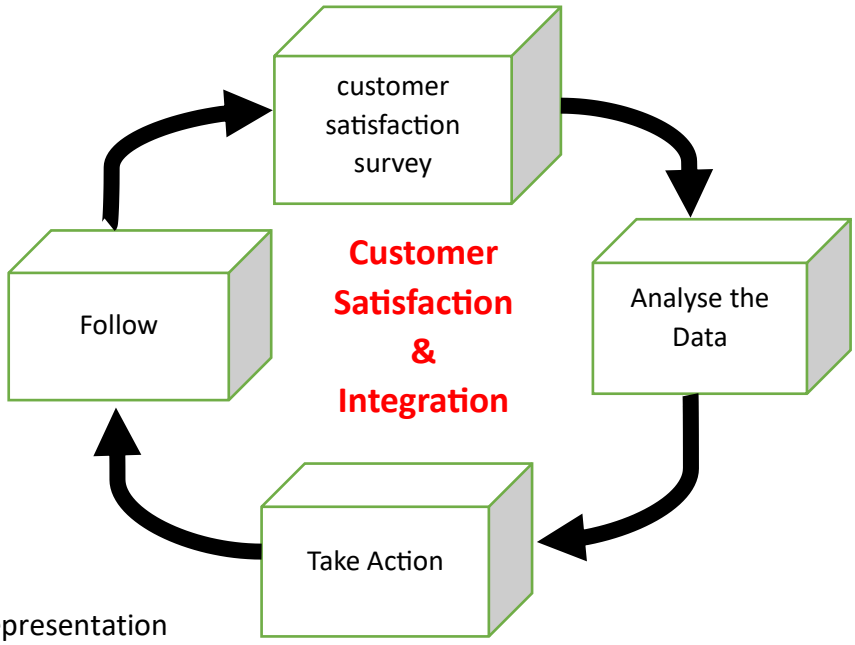

Fig.2. Own Representation

Customer Satisfaction Survey

a) Questionnaire

This questionnaire is evaluated automatically. Please answer the following questions to the best of your knowledge and experience to help us improve the system and enhance waste management.

☐ Comment ☒ Selected ☒ Undo select

○ Single-choice (select only one option) ● Selected ● Undo select

1. Surveys and Questionnaires with Waste Management Authorities:

1.1 Are alerts being received on time when bins are full? Is the system trustworthy, and do you feel confident in relying on it for their operations?

agree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ disagree

1.2 Has the smart bin system reduced unnecessary trips to empty bins, optimizing the routes of collection vehicles? How much time and fuel savings have been seen as a result?

1.3 Have you observed significant cost savings due to fewer visits to empty bins and fewer instances of overflowing bins requiring emergency pickups?

agree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ disagree

2. Surveys and Questionnaires or Large Businesses and Companies:

2.1 Are waste bins being emptied before they overflow? Does the system help in preventing unpleasant situations like overflowing bins?

agree ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ disagree

2.2 Has the smart bin system helped in streamlining waste management operations within the company? Has it reduced manual monitoring of bin levels?

2.3 Have you observed a reduction in the costs associated with waste collection (e.g., fewer overflow incidents or emergency pickups)?

b) User Experience (UX) Testing and Beta Trials

In UX Testing helps real users to interact with the product in a controlled environment, allowing us to observe how they navigate, complete tasks, and respond to features. This testing uncovers any usability issues, confusion points, or design flows, guiding improvements to make the product more intuitive. Beta Trials, on the other hand, involve releasing a nearly finished version of the product to a limited group of users. These users interact with the product in their everyday settings, providing feedback on functionality, ease of use, and any encountered bugs. Both UX Testing and Beta Trials provide valuable insights into real-world product performance, ensuring that the final product is both effective and enjoyable to use.

c) Focus Groups and Interviews

Focus Groups and Interviews helps in gathering detailed feedback directly from target customers. Focus Groups provide a collaborative setting for discussing the product, while one-on-one interviews allow for in-depth insights. Both methods reveal user preferences, identify pain points, and help shape the product to align with customer needs.

2. Analyse The Data

Once the data is collected, the data must be analysed to identify common themes, patterns, and insights. Advanced data analytics tools and AI-driven sentiment analysis will be employed to sift through large volumes of data, allowing for the extraction of meaningful information that can guide product development decisions. Not all feedback is equally relevant or feasible to implement. The next step involves prioritizing the feedback based on various factors such as the frequency of the feedback, its impact on user experience, alignment with business objectives, and resource availability.

3. Integrating Feedback into Product Development

In this project, we will employ Agile development to effectively integrate user feedback into the smart waste bin system. “Agile development is a project management and software development approach that focuses on delivering small, functional pieces of software incrementally, instead of delivering one complete product at the end.” By utilizing iterative sprints, we can continuously gather and incorporate insights from users, such as waste management teams and local authorities, throughout the development process.

Agile Iterations:

Bug Fixes: For immediate issues, such as delayed alerts or false signals, we will roll out quick software updates to fix these problems.

Feature Updates: For larger feature requests, such as integrating additional analytics tools to optimize waste collection routes, we will prioritize these in future product versions based on the demand and feedback.

4. Follow

The "Follow" phase emphasizes the importance of ongoing engagement with users after the smart waste bin system is deployed. This includes conducting regular follow-up surveys and feedback sessions to assess performance, gather additional insights, and address any emerging issues. By maintaining open lines of communication, stakeholders can ensure that the system continues to evolve based on user needs, enhancing satisfaction and promoting long-term success in waste management.

Reference:

1. (n.d.). “*How to integrate customer feedback in the product development cycle*”. Method. Retrieved October 27, 2024, from https://www.method.com/insights/integrate-customer-feedback-development-cycle/
2. (n.d.). “*The role of customer feedback in product development*”. Strategic Advisor Board. Retrieved October 27, 2024, from https://www.strategicadvisorboard.com/blog-posts/the-role-of-customer-feedback-in-product-development