TRASH*CA$H - SRS Document*

(Reward Based Trash Disposal System)

1. Introduction

TRASHCA$H revolutionizes waste management by seamlessly integrating advanced technology with environmental sustainability. At its core, TRASHCA$H presents a comprehensive solution comprising both hardware and software components. While the hardware aspect focuses on the development of a smart dustbin system capable of autonomously sorting biodegradable and non-biodegradable waste, the software side plays a crucial role in enhancing user engagement and facilitating efficient waste management practices. Key software features include user identification and point allocation, streamlined

point management and redemption, social engagement functionalities, dynamic prize distribution, and insightful data analytics.

1.1. Purpose

In our project, we will utilize Computer Vision, Machine Learning, and Image Processing Methods to identify the type of trash. Based on this identification, points will be awarded to the user of the system. Additionally, QR scanners will be installed on the bin to facilitate user login through the mobile app and to track the points rewarded for trash disposal. One of the primary purposes of TRASHCA$H is to issue badges to users, generated by the app based on their accumulated points, which can be shared on social media platforms. Different sensors will be incorporated to detect trash, while motors will be utilized to move the lid of the trash can accordingly.

1.2. Project Scope

The scope of this project encompasses the design, development, and implementation of a smart waste management system aimed at promoting environmental sustainability and user engagement. This system will include:

- Trash detection and classification
- Points calculation based on disposal category
- Points redemption system
- Real-time monitoring of trash

2. Overall Description

2.1. Product Perspective

Trash Detection and Classification: Utilizes computer vision, machine learning and image processing methods to identify and classify different types of trash.

QR Scanner Integration: Facilitates user login through the mobile app and tracks points rewarded for trash disposal.

Points Allocation System: Automatically awards points to users based on the type of waste disposed.

Badge Generation: Generates badges within the app based on user's points, which can be shared on different social media platforms.

Sensor Integration: Incorporates various sensors to detect trash and manage lid movement.

Real-time Monitoring: Provides real time monitoring of trash levels and disposal activity through the mobile app.

Points Redemption System: Enables users to redeem points for rewards through the mobile app.

2.2. Product Functions

Trash Detection and Classification: Utilizes advanced computer vision algorithms and sensor technology to identify and classify different types of wastes deposited into the smart dustbin. Employs image processing techniques to distinguish between bio-degradable and non-biodegradable materials. Dynamically adjusts lid movement based on detected trash for proper disposal.

User Identification and Points Allocation: Integrates QR scanner technology for user authentication and points allocation upon trash disposal. Tracks individual user activity and points through the mobile app. Implements secure login mechanisms to safeguard user data and privacy.

Badge Generation and Reward System: Automatically generates badges within the mobile app based on users points fostering a sense of achievement. Offers rewards for reaching specific points and incorporates gamification elements to enhance user engagement and promote participation in the reward program.

Real time monitoring and Maintenance: Enables real time monitoring of trash levels, bin status and system performance through a centralized dashboard. Alerts maintenance people of operational issues. Alerts garbage collectors when trash in the bin reaches a certain threshold facilitating timely emptying of the bin.

Social Media and Community Engagement: Facilitates social sharing of user achievements and badges through integrated social media features. Cultivates a sense of community and collaboration among users through shared goals, challenges and initiatives. Empowers users to organize community clean-up events, share tips, and celebrate collective achievements.

2.3. Operating Environment

2.3.1. Hardware Specifications

- Processor with minimum 2GHz speed
- 1GB memory or higher
- Wi-Fi or Bluetooth Low Energy (BLE) Connectivity
- Ports for Sensors
- Power management circuitry
- Ability to integrate camera, microphone and other peripherals

2.3.2. Software Requirement

- Real-time operating System (RTOS)
- C/C++ for Hardware interaction
- Waste separation algorithms implementation
- User identification and points allocation methods
- Bin monitoring and fullness alert system

2.3.3. Mobile App Software

- Native Android and iOS applications
- Point Tracking and Prize Management
- Secure Communication with smart bins and partner platforms

2.3.4. Technology Utilized

- Secure communication protocols
- Efficient data storage and retrieval mechanisms

2.3.5. Testing

- Hardware prototyping of real-world validation

2.4. Assumptions and Dependencies

2.4.1. Assumptions

- The trash cash system operates effectively in environments with standard waste disposal infrastructure.

- Users engage with the system responsibly and follow proper waste disposal guidelines, contributing to accurate trash classification and points allocation.
- The hardware components of the trash cash system function reliably without encountering frequent technical issues or malfunctions.
- The software algorithms and machine learning models employed by the Trash Cash system are properly trained and optimized to accurately classify various types of trash and allocate points accordingly.
- Users have access to stable internet connectivity and compatible devices for interacting with the Trash Cash Mobile App and accessing rewards and incentives.
- Local regulations and waste management policies support the deployment and operation of Trash Cash without significant legal or regulatory barriers.

2.4.2. Dependencies

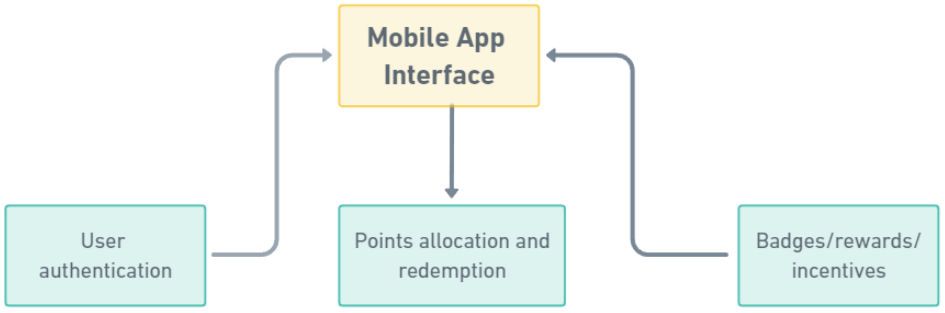
- The successful integration of hardware components, software algorithms and user interfaces are essential for the overall functionality and user experience of the Trash Cash system.
- Continuous availability of power supply is crucial to ensure uninterrupted operation of the Trash Cash hardware components and maintain system functionality.
- Timely updates and maintenance of the Trash Cash software are necessary for performance optimizations ensuring the long-term reliability and effectiveness of the system.
- The reliability and accuracy of trash classification and points allocation by the Trash Cash system depend on the quality of data inputs as well as the robustness of the underlying machine learning models.
- User engagement and participation in the Trash Cash reward program are essential for the sustainability and success of the system.

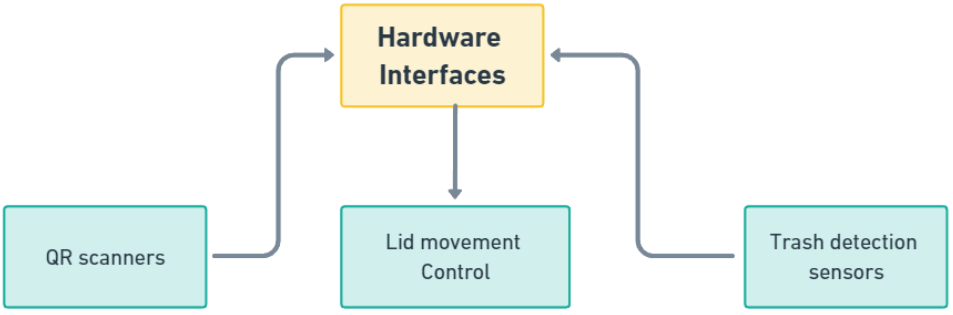
3. Requirement Specification

3.1. External Interface Requirements

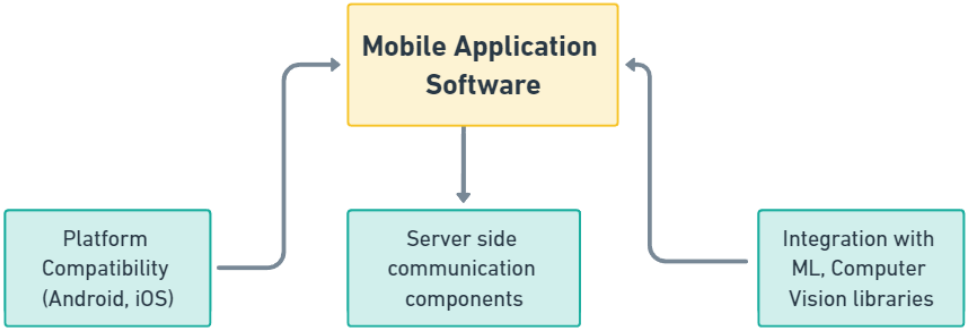
These requirements make sure that the system communicates correctly with the external components.

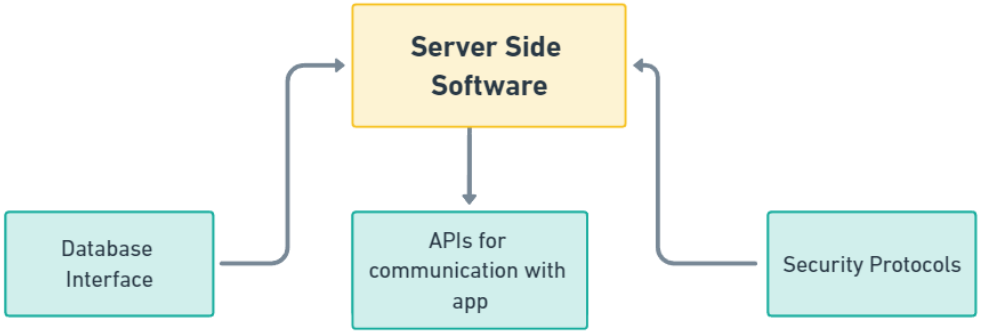
3.1.1. User Interfaces





3.1.2. Software Interfaces





3.2. Functional Requirements

TRASHCA$H Software	
Waste Separation (FR-1)	Achieve 98% accuracy in separating waste using X algorithm.
Data Tracking (FR-2):	Track and store waste type, quantity, and user ID for each interaction.
User Identification (FR-3):	Support identification methods with secure data encryption.
Point Allocation (FR-4):	Award points based on predefined criteria (e.g., waste type, quantity, consistency).
Point Redemption (FR-5):	Facilitate point redemption through partnerships or internal programs.
Bin Monitoring (FR-6)	Monitor fullness using sensor data and trigger alerts at 75% threshold.

Mobile App Software	
Point Display (FR-7)	Show accumulated points, categorized by source and redeemed/unredeemed status.
Point Breakdown (FR-8)	Provide clear breakdown of redeemed and unredeemed points with redemption options.
Leaderboard (FR-9)	Display real-time leaderboard based on points or other criteria.
Bin Traffic Data (FR-10)	Collect and store data on bin usage patterns (e.g., time, frequency, user ID).

3.3. Non Functional Requirements

TRASHCA$H Software	
Reusability (NFR-1)	Utilize object-oriented programming and modular design for code reusability.
Maintainability (NFR-2):	Implement well-documented code with clear explanations.
Reliability (NFR-3):	Ensure mobile app uptime of X% and implement error handling/recovery mechanisms.
Security (NFR-4):	Implement secure user authentication, authorization, and data encryption.
Performance (NFR-5):	Ensure acceptable response times and resource utilization for both app and bin software.