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Document Version

No	Update	Name	Date	Version
1.	Initial version		05/01/2025	1.0

1. Purpose

1.1. Intended Audience

This SRS document describes the System Requirements and Software Design for a Smart Drink Vending Machine.
This document is intended for:

- **System Engineers**: For understanding the integration of hardware and software components.
- **Software Developers**: To guide the coding and implementation process.
- **Test Engineers**: For creating and executing test cases.
- **Stakeholders**: To provide an overview of the project goals and deliverables.

1.2. Intended Use

The SRS defines the overall System Architecture and Requirements as well as the Software Architecture and Design. This document is also contains the definition of the System Requirements which shall be used as the input for System Test cases and Software Unit Test cases.

1.3. Scope

The **Smart Drinks Vending Machine** is an automated system that allows users to:

- Interact with an intuitive LCD and keypad interface.
- Order drinks remotely using a Telegram bot.
- Monitor environmental conditions for optimal storage.
- Ensure security with theft prevention mechanisms.
- Perform maintenance and diagnostics efficiently.

This system enhances the user experience by offering intelligent, reliable, and energy-efficient vending operations.

1.4. Definitions and Acronyms

Acronym	Description
IR	Infra-Red
LED	Light Emitting Diode
NFC	Near Field Communication
SW	Software
HW	Hardware
HMI	Human Machine Interface
USonic	Ultra Sonic

ADC	Analog to Digital Converter
picam	Camera Module of Raspberry Pi
AES-256	Advanced Encryption Standard 256-bit

2. Overall System Description

2.1. Use Case Diagrams

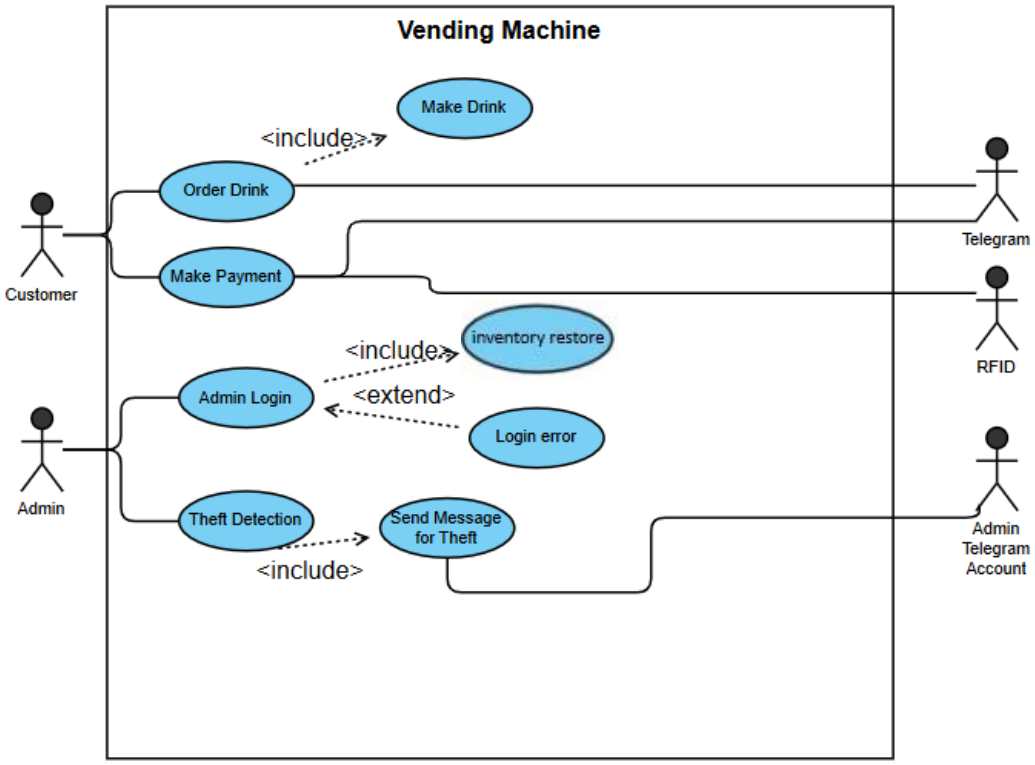


Figure 1

2.2. System Architecture

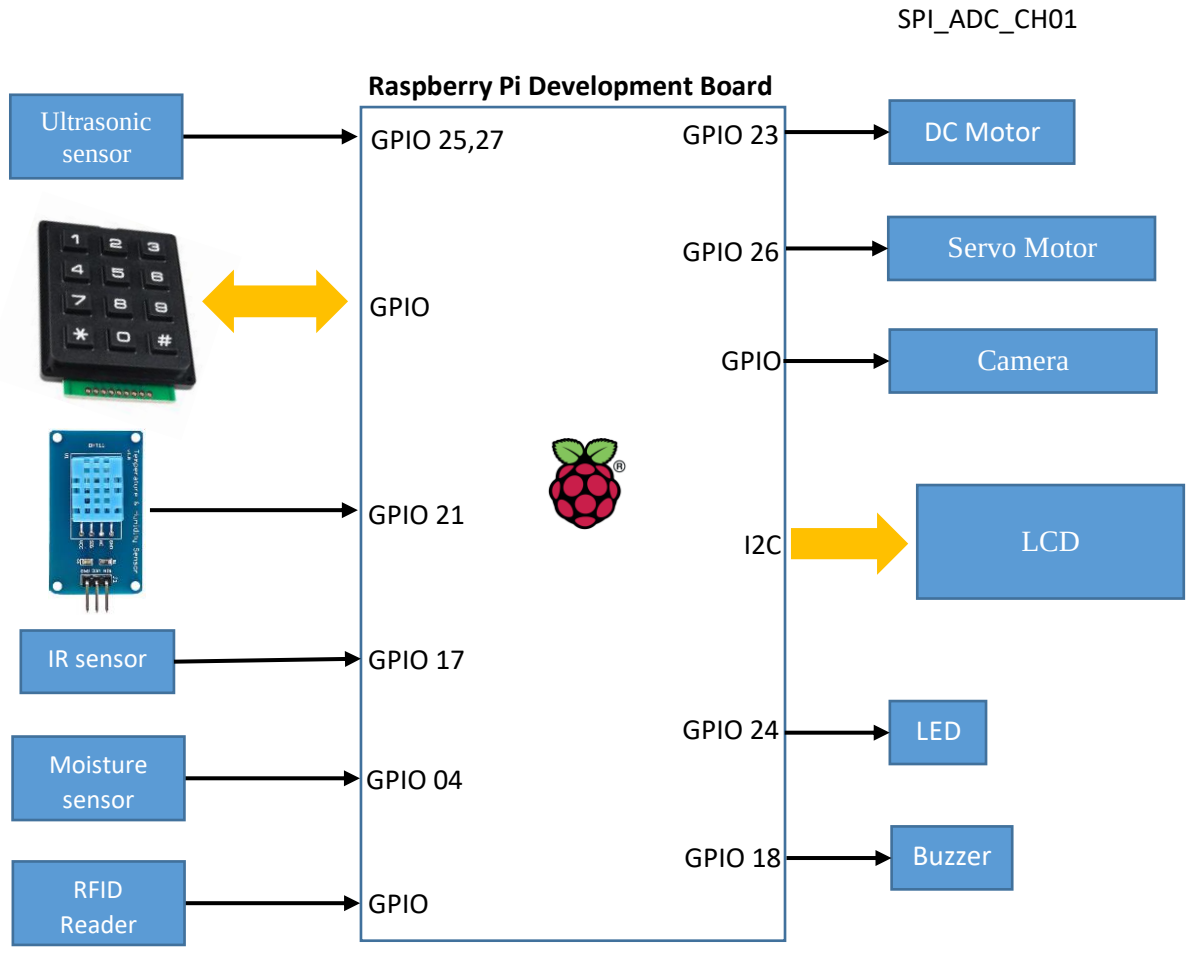


Figure 2

2.3. Functional Requirements

2.3.1. Start Up, Main Menu & Function Drink Selection

REQ_ID	Requirement
REQ-01	When the vending machine is operating, the LCD will display the main menu below for customer and admin access. Line 1 = “1. Customer” Line 2 = “2. Admin”
REQ-02	If the option 1 defined in REQ-01 is selected on main menu, the following text will display. Line 1 = “1. Order drinks” Line 2 = “2. Collect drinks”
REQ-03	If option 1 defined in REQ-02, is selected, the vending machine shall allow customers to key in their drinks using a numeric keypad and display options on an LCD screen. Line 1 = “Enter Item #”
REQ-04	The customer will be able to see selected drink and will need to be confirmed to proceed. Line 1 = “1. Yes” Line 2 = “2. No”

2.3.2. Function Payment Options & Purchase Methods

If the customer selected a drink from one of the options from REQ-04, the following flowchart from figure 3 (next page) will be implemented.

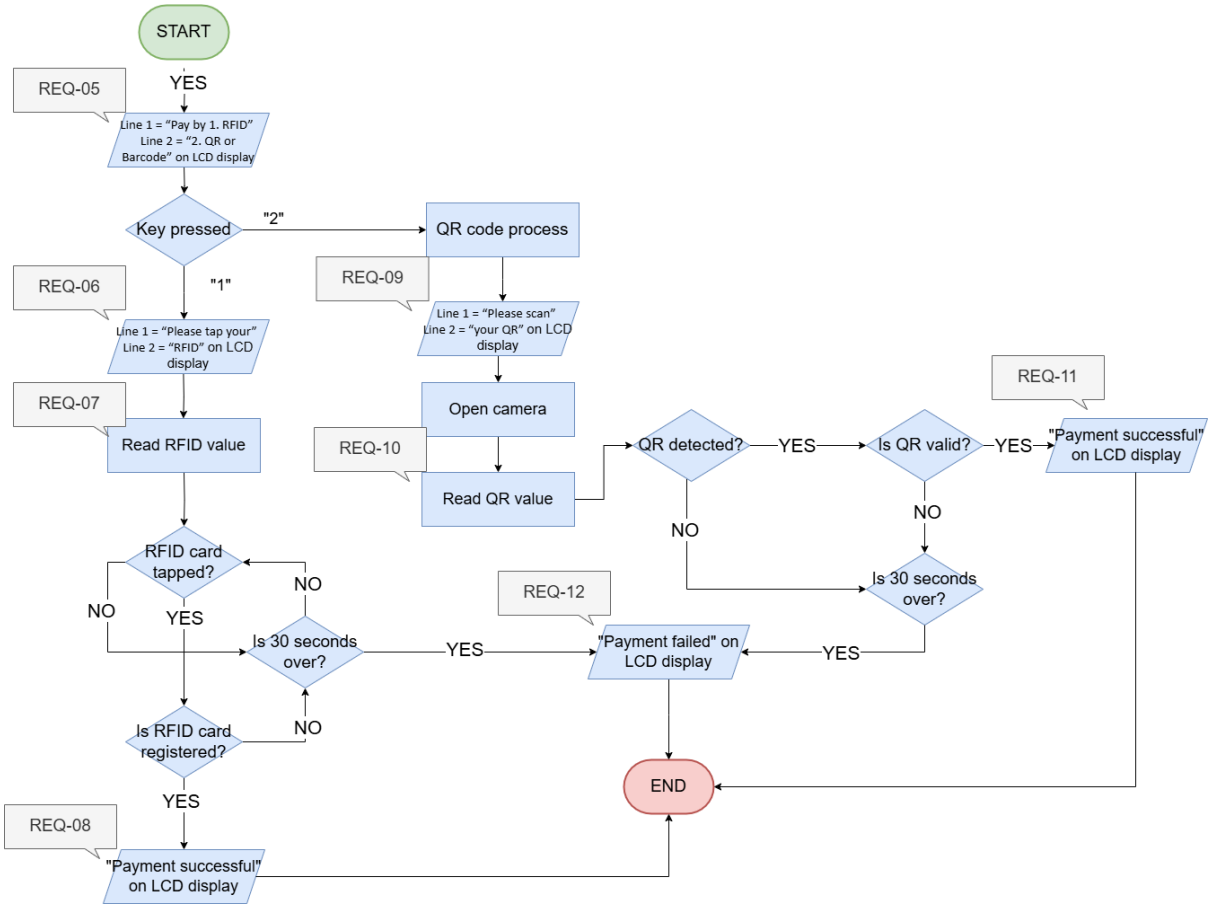


Figure 3

REQ_ID	Requirement
REQ-13	After the payment has been done, the following text will be displayed on LCD and a countdown will start Line1 = "Preparing Drink!"

2.3.3. Remote/Online Order System

The vending machine supports a unique “Remote/Online Order System” to enable remote drink purchases via .

REQ_ID	Requirement
REQ-14	The customer will be able to access online order system via website. The customer will need to key in the phone number first.
REQ-15	After the customer enter their phone number, they will be able to see the drink menu which are available. After selecting the drink. The customer will need to key in the card to proceed with the payment.
REQ-16	After confirming the payment, the QR code will be sent to the customer via telegram via telegram with the phone number they entered in the REQ-14.
REQ-17	With the QR code they received from the telegram, they will be able to collect the drinks.

2.3.4. Inventory Checking system

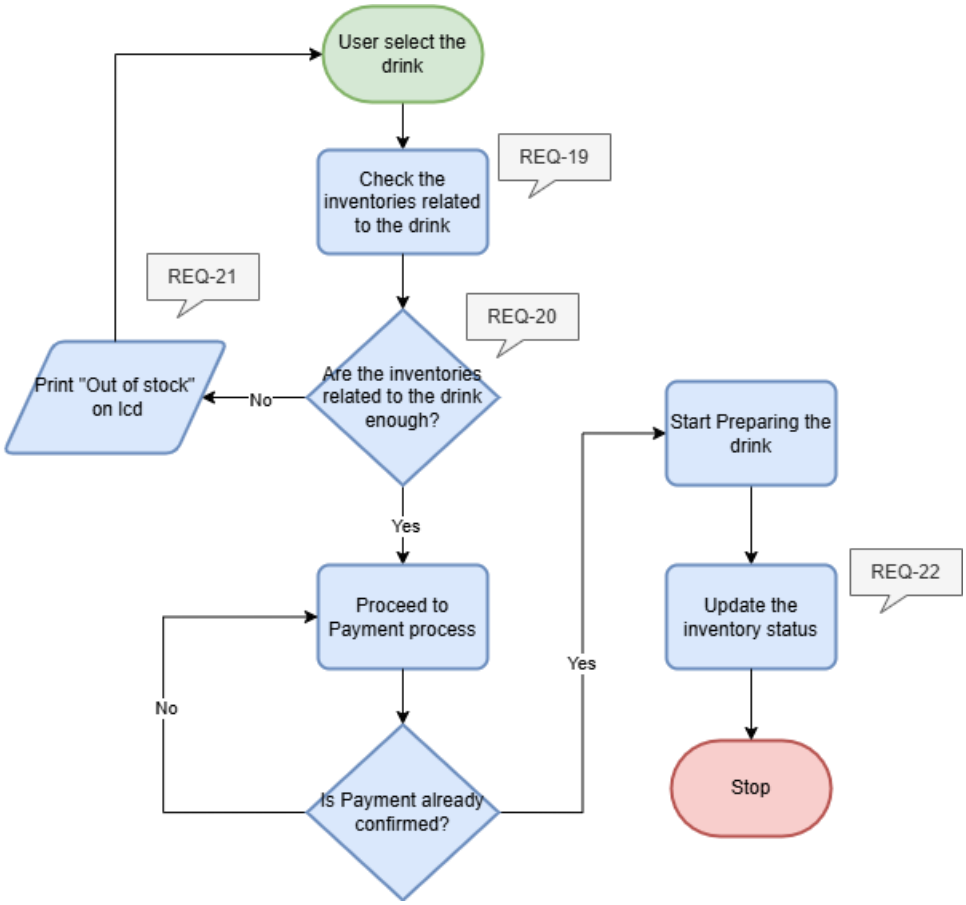


Figure 4

2.3.5. Drink Preparation System

Drink Preparation System

REQ_ID	Requirement
REQ-23	The vending machine start preparing the drinks upon receiving the signal from REQ-13 or REQ-17. The following flowchart will be implemented for drinks preparation system

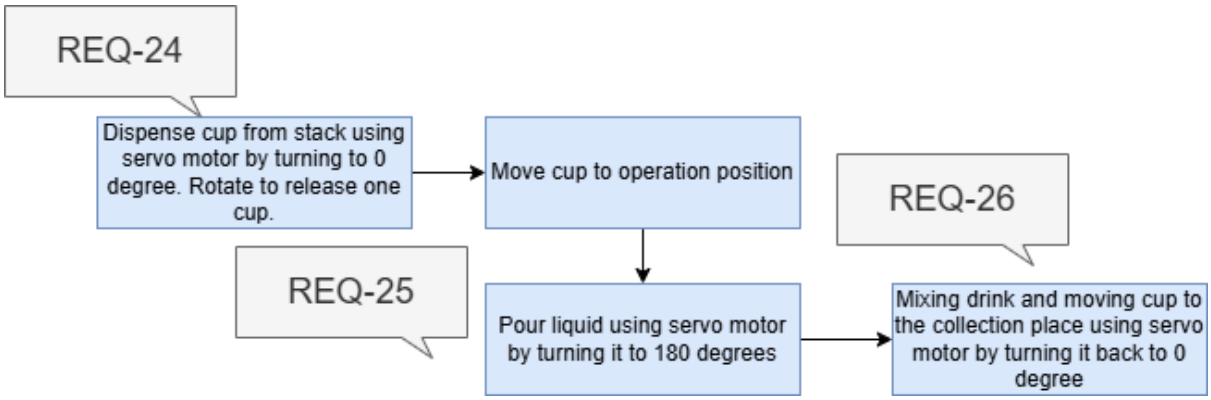


Figure 5

2.3.6. Drinks Collection System

REQ_ID	Requirement
REQ-27	When the drink is ready the door attached to servo motor will open and allow the customer to collect the drink.
REQ-28	For remote collection system, when the customer select option 2 from REQ-02, the following text will be displayed on LCD. Line 1 = “1. QR code scanning”g Depends on the user selection, the authentication process will begin, and the door will open for collection.

2.3.7. Function Theft Prevention & Security Features

REQ_ID	Requirement
REQ-29	The vending machine shall implement a burglar detection system that detects if the machine’s door is forcefully opened. There will be IR sensor placed near the door handle to check whether the door handle is being touched. The door handle will be implemented with potentiometer and servomotor. The following flowchart from figure 5 will be used to implement for the security features of the vending machine.

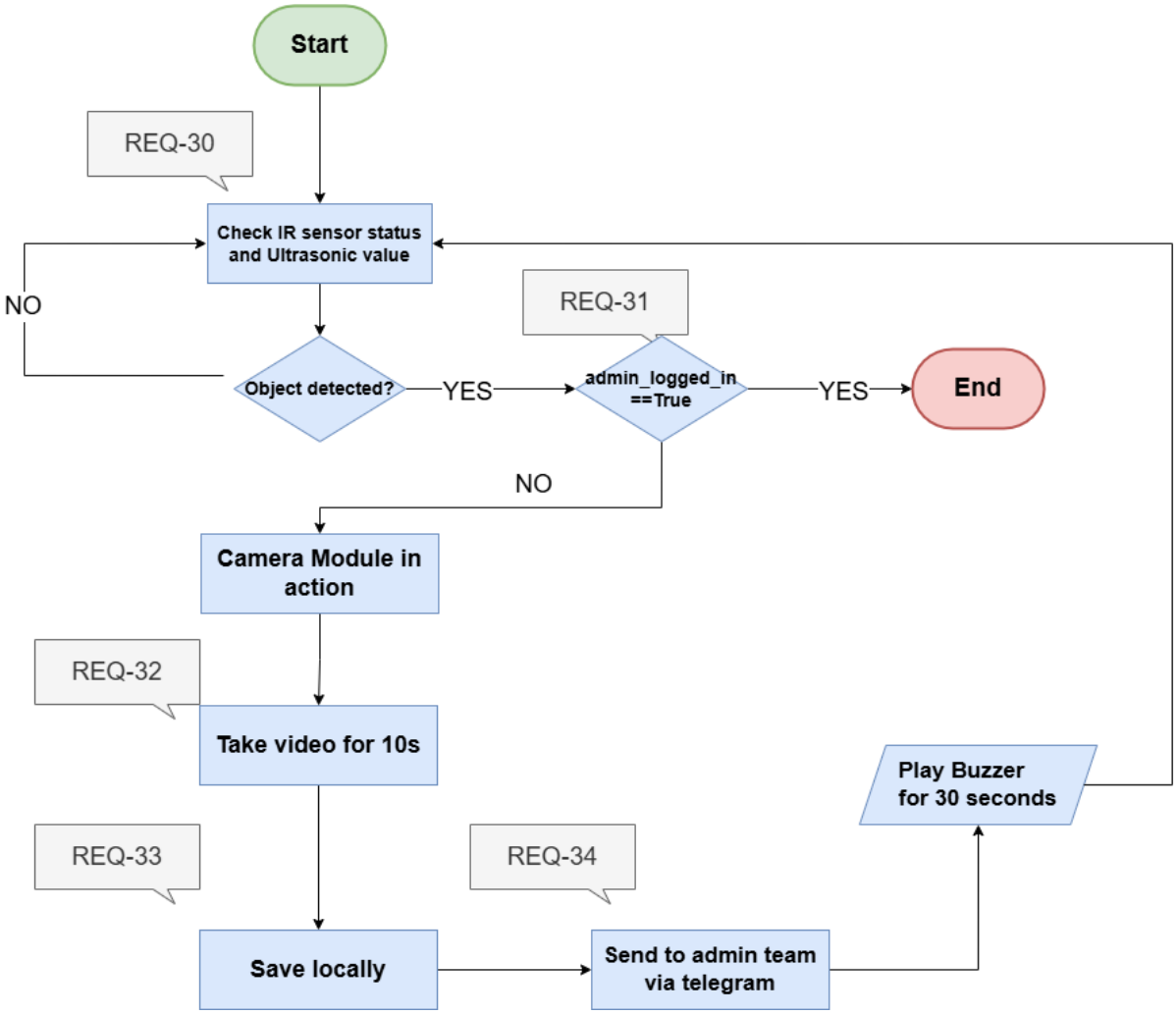


Figure 6

2.3.8. Function Environment Monitoring & Technician Access

REQ_ID	Requirement
REQ-35	The vending machine shall maintain optimal storage conditions for drinks. ▪ Storage Temperature using temperature sensor ▪ Humidity level using the humidity sensor ▪ Water Leakage using moisture sensor If environment controls fail, then the flowchart defined in figure 6 will be implemented.

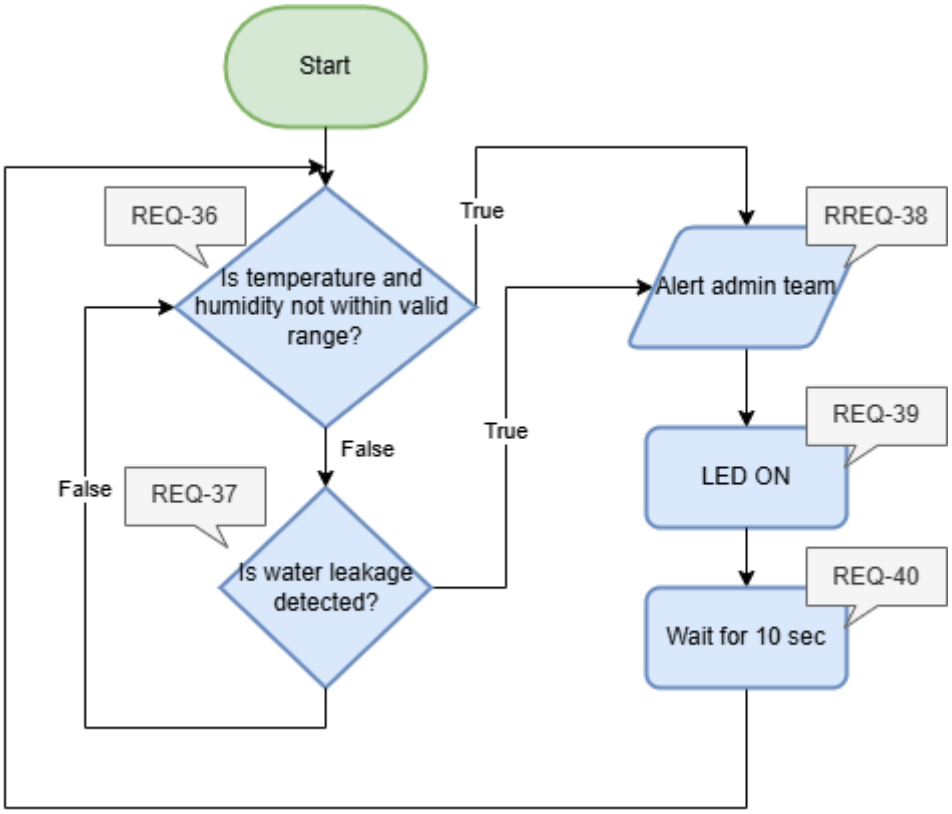


Figure 7

REQ_ID	**Requirement**
REQ-41	The vending machine also allow the technicians and admin to access inventory. To access the system, the user can select option 2 from REQ-01 and the following flowchart from the figure will be deployed.

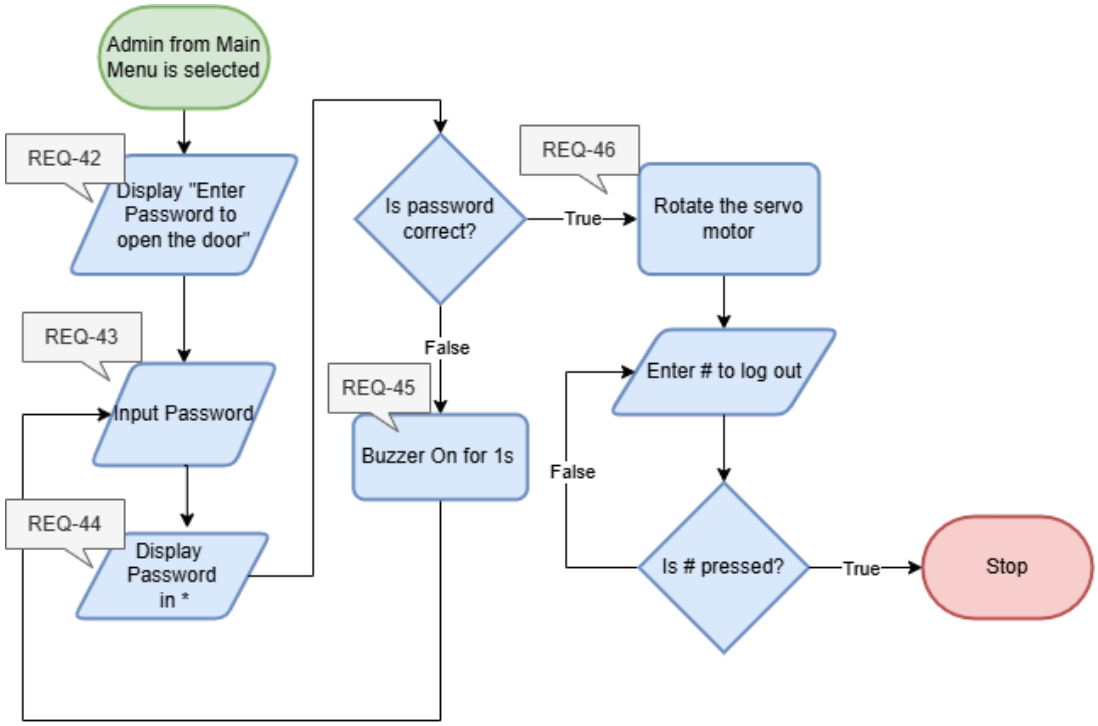


Figure 8

2.4. Non-Functional Requirements

2.4.1. Performance

REQ_ID	Requirement
NFR-01	The vending machine shall process drink selection and payment transactions within **5 seconds**.
NFR-02	The machine shall detect environmental parameter changes (e.g., temperature or humidity) and respond within **2 seconds**.
NFR-03	The RFID reader shall authenticate a user within **1 second** after scanning

2.4.2. Security

REQ_ID	Requirement
NFR-05	Unauthorized attempts to access the machine shall trigger the **buzzer** and log the incident with a timestamp and captured image from the **camera module**.
NFR-06	Technicians shall be automatically logged out after **5 minutes** of inactivity.

2.4.3. Reliability

REQ_ID	Requirement
NFR-07	The vending machine shall achieve an uptime of **99.9%**, including during Docker container updates.
NFR-08	All sensors (e.g., **moisture**, **temperature**, **IR**) and actuators (e.g., **servo**, **DC motor**) shall operate reliably for at least **10,000 cycles** without maintenance.
NFR-09	Alerts generated due to failures or security breaches shall reach the technician within **10 seconds**.

NFR-10	The system shall include a battery backup to support critical functions during power outages.

2.4.4. Usability

REQ_ID	Requirement
NFR-11	The machine shall use the **LED** and **buzzer** for visual and auditory feedback during the interaction process.

2.4.5. Energy Efficiency

REQ_ID	Requirement
NFR-12	The vending machine shall enter a **low-power mode** if idle for more than **2 minutes**, using only essential sensors (e.g., **IR sensor** for object detection).
NFR-13	The **LDR** module shall adjust the LCD brightness based on ambient light to reduce power consumption.

2.4.6. Maintainability

REQ_ID	Requirement
NFR-14	The system shall generate detailed logs (e.g., drink dispensing, environmental data, security incidents) that are retained for at least **30 days**.
NFR-15	The machine shall allow remote diagnostics and software updates to minimize on-site maintenance.

2.4.7. Monitoring and Environmental Control

REQ_ID	Requirement
NFR-16	The system shall allow technicians to test individual components (e.g., **buzzer**, **servo motor**) through a diagnostic mode accessed via the keypad.
NFR-17	The system shall continuously monitor internal temperature and humidity to ensure optimal operating conditions.

2.4.8. Safety

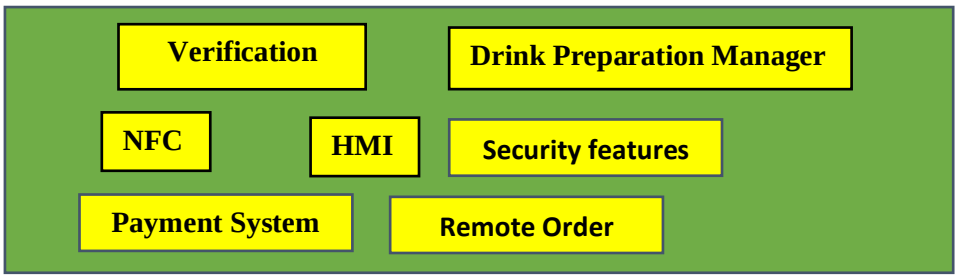
REQ_ID	Requirement
NFR-18	The vending machine shall detect vibrations or tilting using the **accelerometer**, triggering an alert for potential tampering.
NFR-19	The **slide switch** shall act as an emergency power cutoff for technicians during maintenance

3. Software Architecture

3.1. Static Software Architecture

The Software Architecture defines the various Software Components that are developed to realize the implementation of the system requirements.

Application Layer



Hardware Abstraction Layer (HAL)