

Groups, Ideas, System Boundary, & Use Case Diagram

Project: RFID Cloner Project

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Brief Description: An embedded device with RFID that clones RFID cards and sends the card ID/passcode to a web application over Bluetooth Low Energy (BLE). The web application UI presents the ID/passcode to the user.

ChatGPT Use Case Diagram and Descriptions:

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Create a Use Case Diagram for this project description, include a system boundary and actors and relationships:

A user controlled web app using Bluetooth low energy that connects to a RFID module on a microcontroller. The small module is able to read nearby RFID cards and write them to the microcontroller. The microcontroller will then send the RFID card data using BLE to the device hosting the web app. The web app will receive the data and store the RFID code in a list. The user can then select the RFID code from the list, and send a BLE signal to the microcontroller to flash the RFID code to a RFID card using the small module.

Sure! Here's a Use Case Diagram for the project description you provided:

```

graph TD
    User[User]
    subgraph WebApp [Web App]
        UC1[Receive RFID Data]
        UC2[Store RFID Data]
        UC3[Select RFID Code]
        UC4[Send BLE Signal]
    end
    subgraph Microcontroller [Microcontroller Module]
        UC5[Read RFID Cards]
        UC6[Write RFID Cards]
    end
    User --> UC1
    User --> UC2
    User --> UC3
    User --> UC4
    UC1 --> UC5
    UC2 --> UC6
    UC3 --> UC6
    UC4 --> UC5

```

Key:

- Actors are represented as rectangles.
- Use cases are represented as ovals.
- Arrows indicate the relationships between the actors and the use cases.

In this diagram, the "User" is the main actor who interacts with the "Web App." The "Web App" receives RFID data, stores it, allows the user to select a code, and sends a BLE signal. The "Microcontroller Module" is a separate component that interacts with the "Web App" via BLE. It reads RFID cards and writes RFID codes to them.

The use cases represented in the diagram are as follows:

- User:**
 - None explicitly defined in the description, but assumed to include actions such as interacting with the web app's interface and selecting RFID codes.
- Web App:**
 - Receive RFID Data:** Receives RFID data from the microcontroller via BLE.
 - Store RFID Data:** Stores the received RFID data in a list.
 - Select RFID Code:** Allows the user to select an RFID code from the stored list.
 - Send BLE Signal:** Sends a BLE signal to the microcontroller to flash the selected RFID code to a RFID card.
- Microcontroller Module:**
 - Read RFID Cards:** Reads nearby RFID cards using the RFID module.
 - Write RFID Cards:** Writes RFID codes to the RFID cards using the RFID module.

The diagram illustrates the system boundary between the user-controlled web app and the microcontroller module.

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Describe some requirements of the above use case diagram



Based on the provided use case diagram, here are some requirements that can be derived:

**1. User Interface Requirement:**

- The web app should provide an intuitive and user-friendly interface for the user to interact with.
- The interface should allow the user to view the received RFID data and select an RFID code from the list.
- The web app should have a mechanism to display status updates and feedback to the user during the interaction.

2. RFID Data Management Requirement:

- The web app should have the capability to receive RFID data from the microcontroller module via Bluetooth Low Energy (BLE).
- The received RFID data should be stored in a list within the web app for future reference.
- The web app should be able to handle multiple RFID codes and manage the list effectively.

3. BLE Communication Requirement:

- The web app should be able to establish a connection with the microcontroller module using BLE.
- The web app should be capable of sending BLE signals to the microcontroller module to trigger specific actions, such as flashing an RFID code to a card.

4. Microcontroller Module Requirement:

- The microcontroller module should be equipped with an RFID module capable of reading nearby RFID cards.
- The module should have the capability to write RFID codes to the cards.
- The module should be able to establish a BLE connection with the web app to facilitate communication.

5. Security Requirement:

- The web app should implement appropriate security measures, such as authentication and data encryption, to ensure the privacy and integrity of the RFID data.
- The microcontroller module should also implement security measures to protect the BLE connection and prevent unauthorized access or tampering.

6. Error Handling Requirement:

- The web app should handle exceptions and errors that may occur during BLE communication or data processing.
- The system should provide informative error messages or notifications to the user in case of failures or unexpected situations.

7. Compatibility Requirement:

- The web app and the microcontroller module should be compatible with Bluetooth Low Energy (BLE) technology to establish a reliable connection.
- The web app should be compatible with popular web browsers and operating systems to ensure broad accessibility.

It is important to note that these requirements provide a high-level overview and further analysis and refinement may be necessary to capture the full scope and details of the system.

Discussion:

Overall, ChatGPT's generated use case diagram gave a decent diagram for the scope of our project. That being said, there are some problems in the microcontroller module. There is no use case for saving/storing the RFID data. Also, ChatGPT did not describe the relationships between each use case with includes/extends labels, as well as describe the actors and pre-conditions.

System:

- Bluetooth Low Energy
- Small Module (RFID Reader)
- ESP32 (Microcontroller)
- Web App
- Web App UI

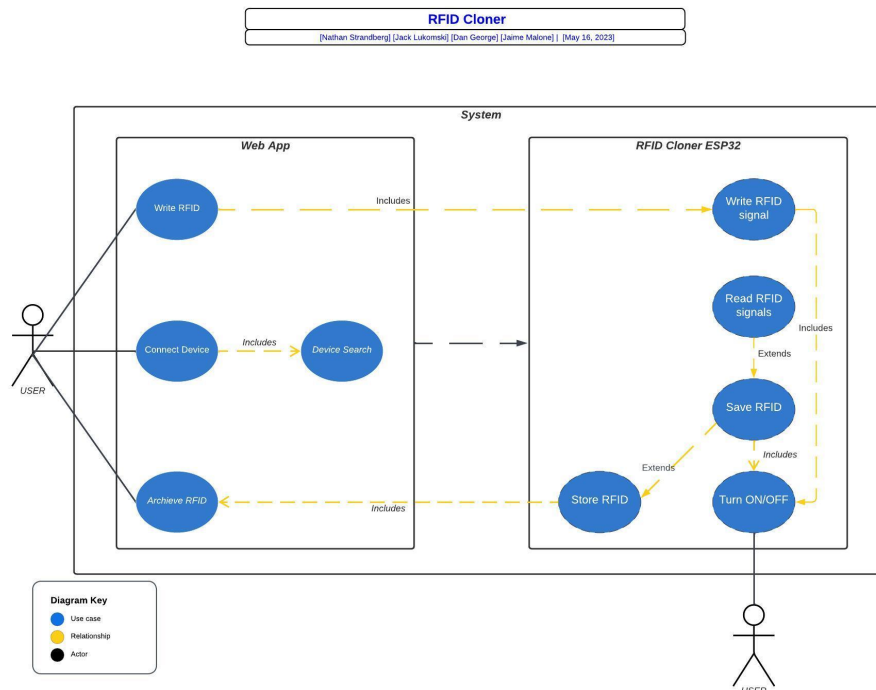
System Context:

- RFID Cards
- User
- Peripherals for Web App

Irrelevant Environment:

- External Interfaces:
 - Environmental noise
 - Other devices
 - Physical obstacles that affect BLE
- Network Infrastructure:
 - Routers, Switches, Internet connectivity
- Legal and Regulatory Requirements:
 - Data Privacy
 - Radio Frequency Usage

Use Case Diagram:



Use case Diagram Descriptions

Web Page

Use Case: Connect Device

Actors: User (initiator)

Description:

1. User presses the button to connect to the RFID device.
2. The button opens up a list of available devices.
3. The user selects a device which causes the web app to send a pairing signal to the cloner device.
4. The devices are paired.

Pre-Condition: Device Search

Use Case: Write RFID

Actors: User (Initiator)

Description:

1. User selects a badge from the web page to write to a blank card.
2. User hits the button and the website communicates with the RFID cloner, commanding it to write to a blank card.

Pre-Condition: User must have a badge number to write to the card.

Use Case: Archive RFID

Actors: User (initiator)

Description:

1. RFID cloner sends a signal to a website through bluetooth.
2. Website saves badge numbers for later use.

Pre-Condition: Cloner must have RFID badge numbers to send to the web app.

Use Case: Device Search

Actors: User (Initiator)

Description:

1. The web page uses Bluetooth Low Energy to search for nearby devices.
2. After obtaining all nearby devices, a list of devices would be displayed to the web app UI.
3. This list would be used during Connect Device.

Pre-Condition: Turn ON/OFF

RFID Cloner ESP32

Use Case: Write RFID Signal

Actors: User (Initiator)

Description:

- 1.) The microcontroller receives a command via bluetooth with the RFID data.
- 2.) The microcontroller writes the RFID signal to the RFID tag.

Pre-condition: The device must be turned on via the **Turn on/off** use case and the user must request an RFID signal to be flashed via the **Write RFID** use case.

Use Case: Read RFID Signal

Actors: User (Initiator)

Description:

- 1.) The microcontroller is turned on.
- 2.) The microcontroller reads the RFID signal present.

Pre-condition: The device must be turned on via the **Turn on/off** use case.

Use Case: Store RFID

Actors: User (Initiator)

Description:

- 1.) The microcontroller has received a command to send the stored RFID data.
- 2.) The RFID data gets sent to the web application via bluetooth.

Pre-condition: The RFID data must have been stored to the microcontroller via the **Save RFID** use case and the user must have requested data be sent via the **Archive RFID** use case.

Use Case: Save RFID

Actors: User (Initiator)

Description:

- 1.) The RFID device has detected a valid RFID signal.
- 2.) The RFID data gets sent to the microcontroller via SPI.
- 3.) The RFID data gets saved in flash memory on the microcontroller.

Pre-condition: The RFID must have found an RFID signal via the **Read RFID signals** use case. The device must have also been turned on via the **Turn on/off** use case.

Use Case: Turn ON/OFF

Actors: User (initiator)

Description:

- 1.) The device is toggled either on or off with a switch

Pre-condition: Needs Power