Smart Doorbell

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1 General overview

In today's rapidly evolving digital age, traditional doorbell systems provide limited functionality, merely alerting homeowners of a visitor's presence without offering insights into the visitor's identity. This lack of information can pose security risks, especially in scenarios where unauthorized or malicious individuals approach residences. To address this challenge, the proposed solution is to integrate facial recognition technology and user-activated camera systems. By pressing a push button, visitors activate the camera, allowing the system to capture their image and subsequently identify them using face recognition techniques. If the visitor is not recognized, the system sends the captured image to the homeowner's mobile app, giving them the opportunity to visually verify the visitor. The owner can then decide to grant or deny access based on the image received. For recognized visitors, homeowners receive real-time notifications detailing their identity.

2 Target clients

The Smart Doorbell system aims to revolutionize home and business security by integrating face recognition technology with IoT. Targeting urban homeowners, business establishments, and tech enthusiasts, this innovation promises not just enhanced security but also unparalleled convenience. With the ability to identify familiar faces and grant automated access, the system stands as a testament to the future of smart living.

3 Components

- Raspberry Pi: A compact, credit card-sized computer that is both affordable and powerful. The Raspberry Pi can run various software programs and interface with the outside world using its GPIO pins. It acts as the brain of the project, processing data, controlling the flow, and interfacing with other hardware components.
- Webcam: A digital camera that streams its feed directly to a computer system. For this project, it captures images of visitors, which are then processed for facial recognition. Given its compactness and ease of integration, it's ideal for embedding in the doorbell system.
- Servo Motor: A rotary or linear actuator that allows for precise control of angular or linear position. In this project, the servo motor drives the mock door mechanism, facilitating its opening and closing based on the facial recognition results or homeowner commands.

- Tactile Button: A simple push button that registers when it's pressed. For this project, it serves as an input device; when visitors press the button, it triggers the camera to capture their image and initiates the facial recognition process.

4 Technologies

To achieve the different parts of this project, multiple technologies and frameworks will be implemented:

• Backend:

– MQTT: MQTT is a lightweight messaging protocol for communication between the different Internet of Things components. This protocol requires a MQTT broker which will be the intermediary between the communication of two devices to ensure the decoupling of the two devices. In this case, we will be using Mosquitto as the MQTT broker.

– MongoDB: MongoDB is a NoSQL document-oriented database used to store all the data in this project such as data captured by the sensors and data of users of the application.

– Node-Red: Node-Red is an open source tool used in Internet of Things projects to manage the data flow of the sensors.

• Middleware:

– Jakarta Entreprise Edition: Jakarta Enterprise edition is a Java-based framework for developing API's for enabling communication between different and numerous applications. Jakarta's main selling point is the high level of security it provides that is not possible with other Java frameworks.

– WildFly: Wildfly is a Java Entreprise Edition lightweight application server designed by Red Hat providing all the necessary functionalities to run a Java web application.

• Frontend:

– PWA: Progressive Web Applications are web applications that leverage service workers, manifests, and other web-platform characteristics along with progressive enhancement to provide users with a native app-like experience.

5 Architecture

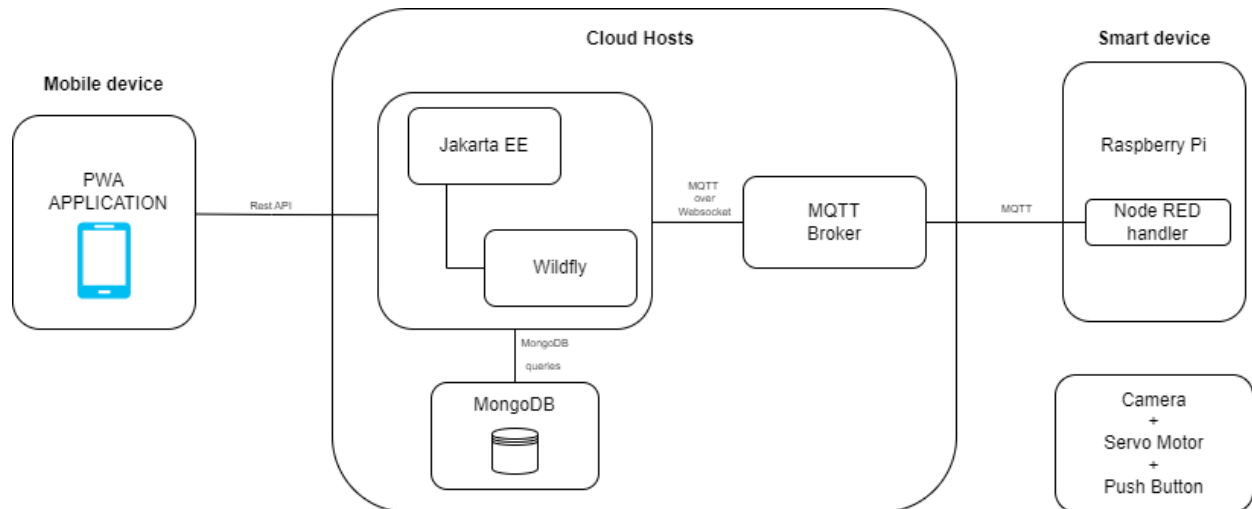Figure 1 demonstrates the architecture of the Smart Doorbell System.

Figure 1: Smart Doorbell system architecture

In this project, Cloud of Things technologies will be used. Therefore, the middleware server, the database and the MQTT Broker will all be hosted on cloud.

6 Project deliverables

By the end of this project, these requirements must be delivered:

• Source code: The source code for the different parts of the project will be stored and delivered using Github.

• Technical documentation: A README.md file in GitHub detailing all the needed steps to launch the application.

• Design document: A document that describes the architecture of the application and its functionalities through different diagrams.

• Demo: A video in mp4 format that contains a demonstration of the proposed solution.

7 Constraints

The realization of all parts of the Smart Doorbell system must be achieved no later than 8 January 2024.

8 Deployment diagram

A deployment diagram is an UML diagram for visualizing the hardware components and devices, the links of communication between these different components and and the software files on that hardware. Figure 2 shows the deployment diagram for the Smart Doorbell system.
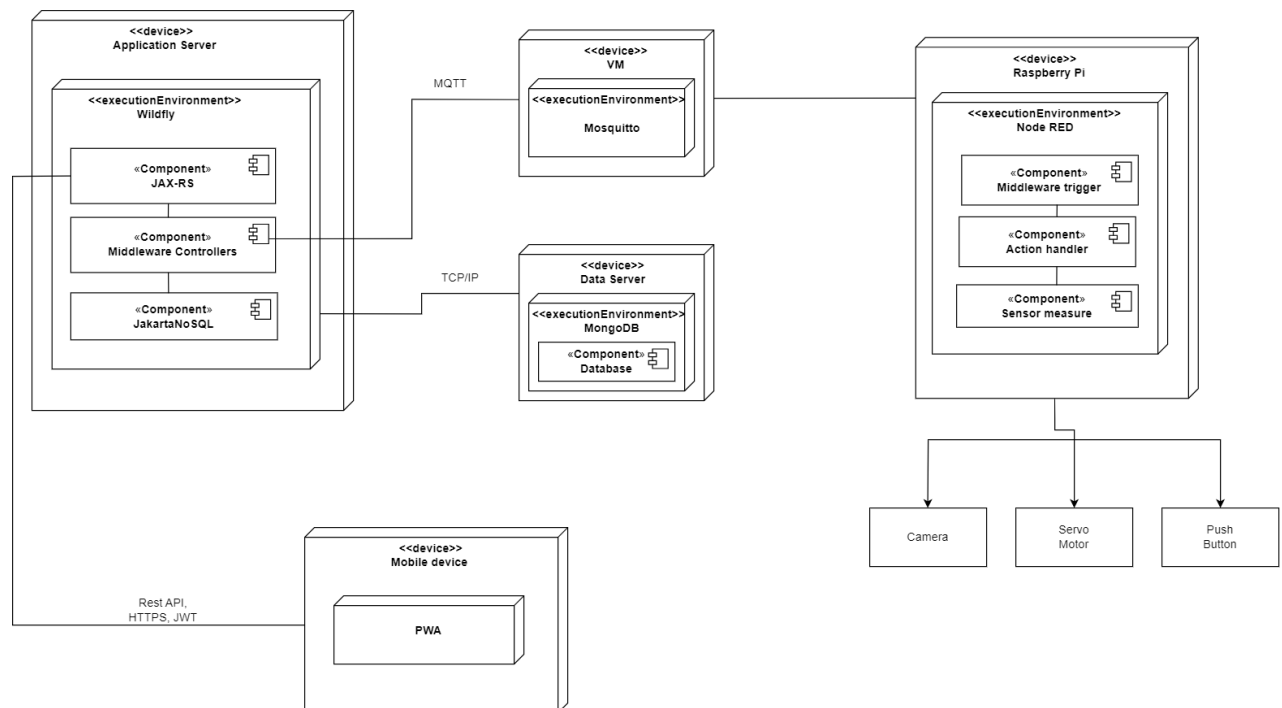

Figure 2: Smart Doorbell system deployment diagram

9 Marketing

9.1 Business Model Canvas

The figure below highlights the Business Model Canvas for the Smart Doorbell system.
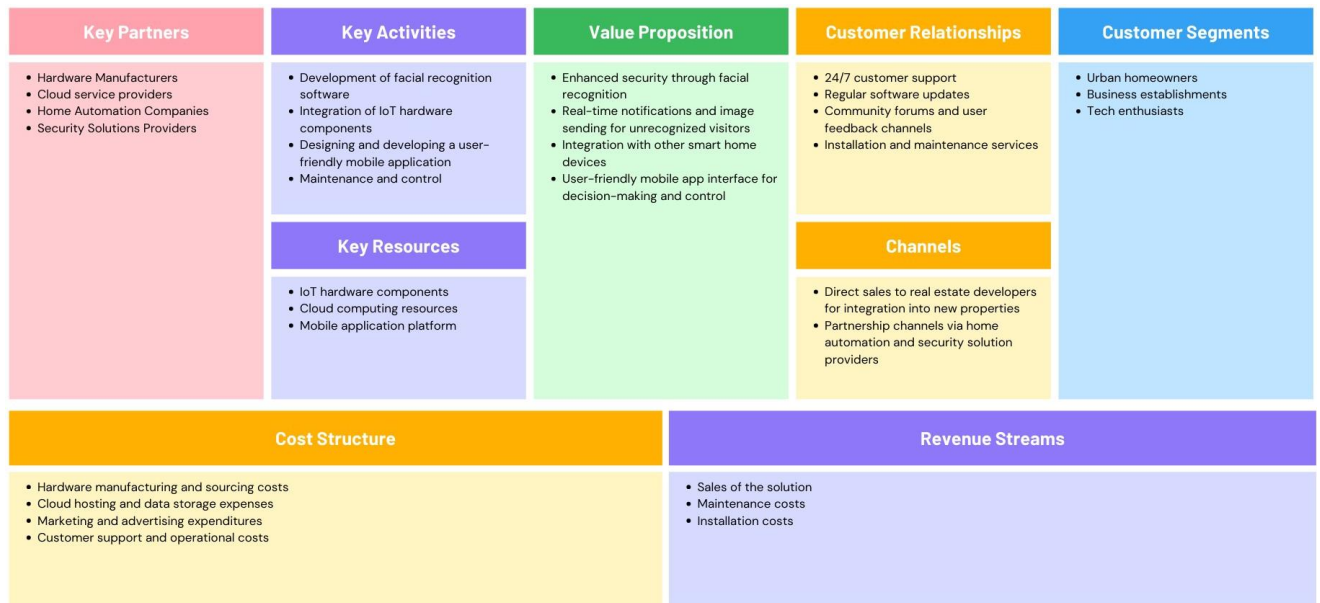
Figure 3: Smart Doorbell system business model canvas

9.1 SWOT analysis

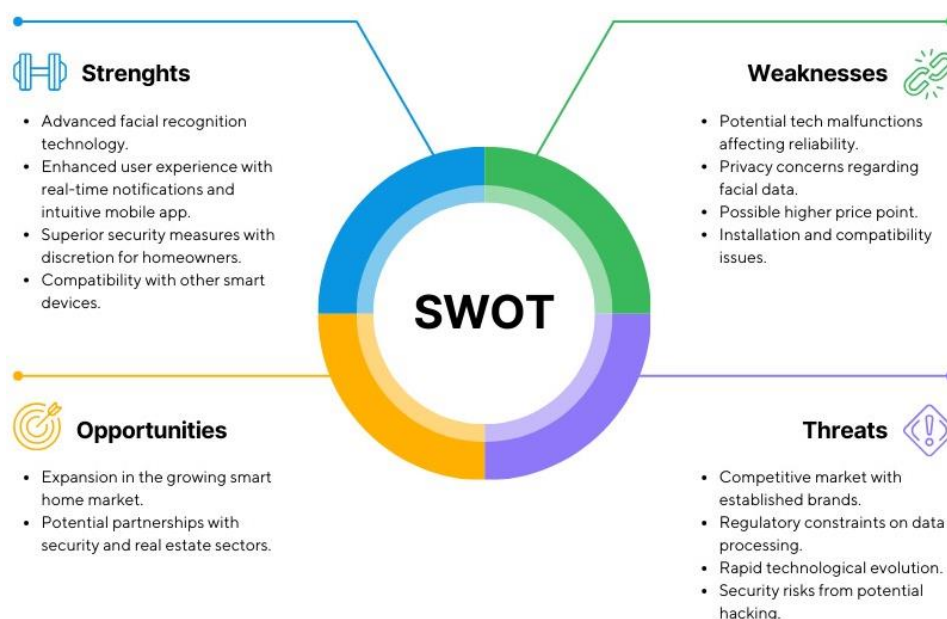The figure 4 shows the SWOT analysis for the Smart Doorbell system.

Figure 4: Smart Doorbell system SWOT analysis