



Department of Computer  
Engineering

# IoT-Based Door Lock Security System

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# Executive Summary

## Rationale

In recent years, incidents of break-ins and unauthorized home or office access have been rising, especially in urban areas. According to the Social Weather Stations, the Social Weather Survey conducted between September 14-23, 2024 found a rising percentage of families victimized by common crimes including pickpocketing, break-ins, carjacking, and physical violence. Break-ins crime rose across the Philippines except for Mindanao wherein Metro Manila had an increase from 1.7% to 2.7%, Balance Luzon from 1.5% to 1.8%, and 1.3% to 4.7% [1]. Traditional lock-and-key systems are vulnerable to duplication, picking, or being left unlocked [2]. Burglars often target properties, such as homes and businesses, that have been burgled in the past due to the owner's failure of upgrading security/ This indicates that ensuring safety and security of properties is necessary [3].

An IoT-based door locking system can offer enhanced security, remote monitoring, and control via mobile devices. It alerts an owner if there is an attempted theft which can help him/her in mitigating the break-in.

This project proposes a smart door lock system using an embedded system that can be accessed through the internet. The system is equipped with a keypad for manual PIN input and a Wi-Fi module for remote control through a smartphone app or web interface.

## Problem

How can we enhance home or office security using an embedded system for local and remote access control?

## Goals and Objectives

The goal of this project is to design and implement a secure and reliable IoT-based door locking system controlled both locally and remotely. Furthermore, the following objectives are to be met:

- Implement a local access control using a keypad and display through an LCD.
- Establish Wi-Fi connectivity for remote access control using a web/app interface.
- Design and develop the embedded system that integrates the chosen access method(s).
- Display access logs and system status via LCD and web/app interface.
- Conduct testing and debugging to ensure basic and responsive functionality.

## Scope & Limitation

The project scope involves only the use of a keypad for local access, an LCD for a local display, a web dashboard for remote access and monitoring, a lock mechanism via servo motor or electromagnetic lock, and the logging of access attempts.

The proposed design has the following limitations:

- Remote control access would be dependent on internet connectivity.
- Power outages may disable the system if no backup is included.
- Limited to single-door control (for prototype).
- Security depends on the implementation of secure protocols.

## Conceptual Framework

The following is the conceptual framework of the proposed project.

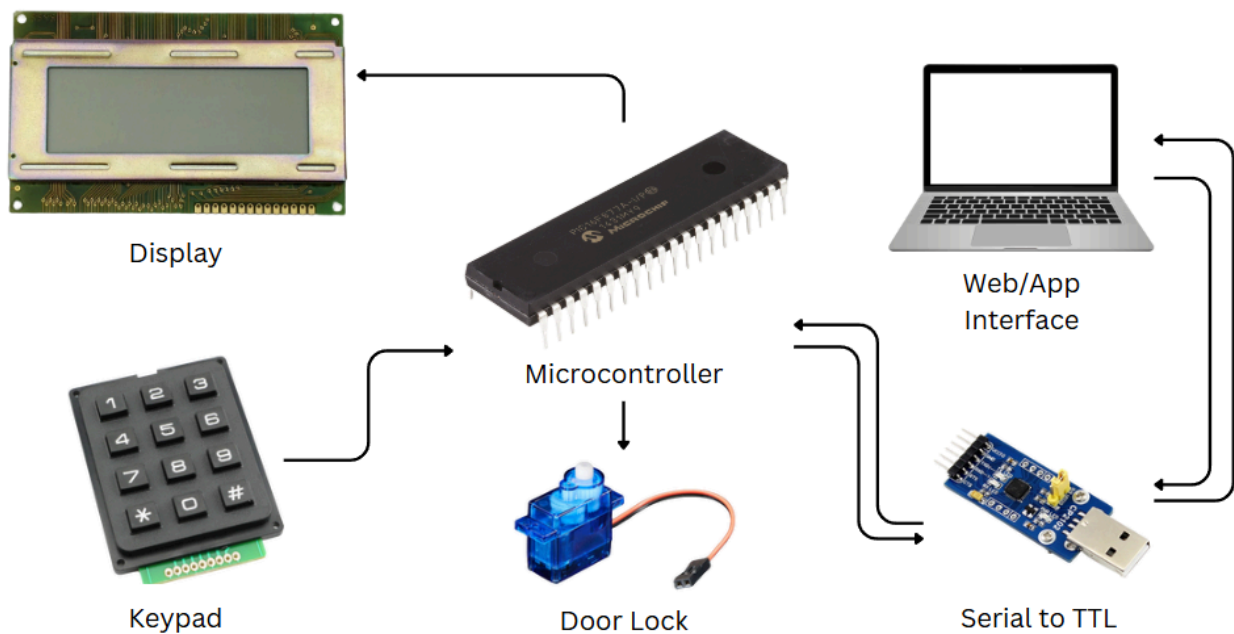


Figure 1. Conceptual Framework of the Proposed Door Lock Security System

The keypad and servo motor are directly interfaced to the microcontroller. The LCD is directly interfaced to the MCU through the assigned GPIO ports. As for the CP2102, it will be connected to the microcontroller via USART, which would allow communication between the two devices. It then allows our microcontroller to be controlled or monitored through a web/app interface.

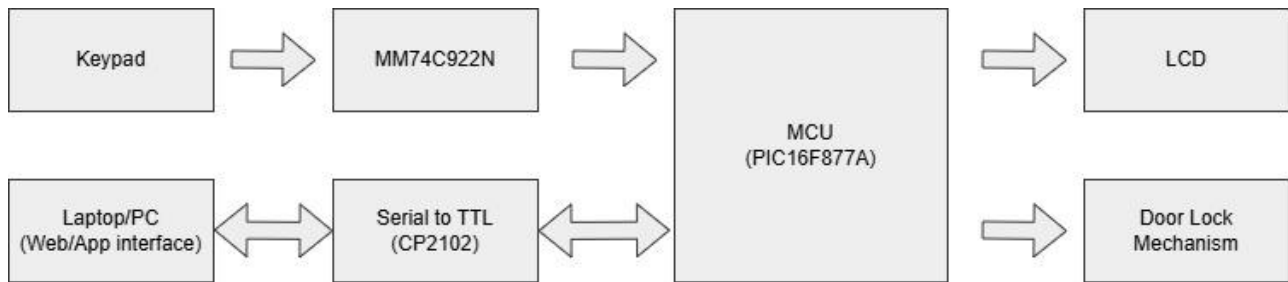


Figure 2. Door Lock Security System Block Diagram

## Hardware Design

The PIC16F877A microcontroller is the core of the IoT-based door lock system, controlling the servo motor, LCD display, keypad, and communication components. A serial-to-TTL converter allows the microcontroller to communicate with a web app on a laptop, allowing remote access and control. The LCD shows the lock status and tracks remaining PIN tries before entering lockdown mode to prevent further unauthorized access. A keypad with an encoder is attached to the microcontroller's GPIO ports, allowing users to input a PIN locally, while a servo motor serves as the physical door lock mechanism. Together, these components provide an access control, achieving the project's goals and objectives.

## Software Design

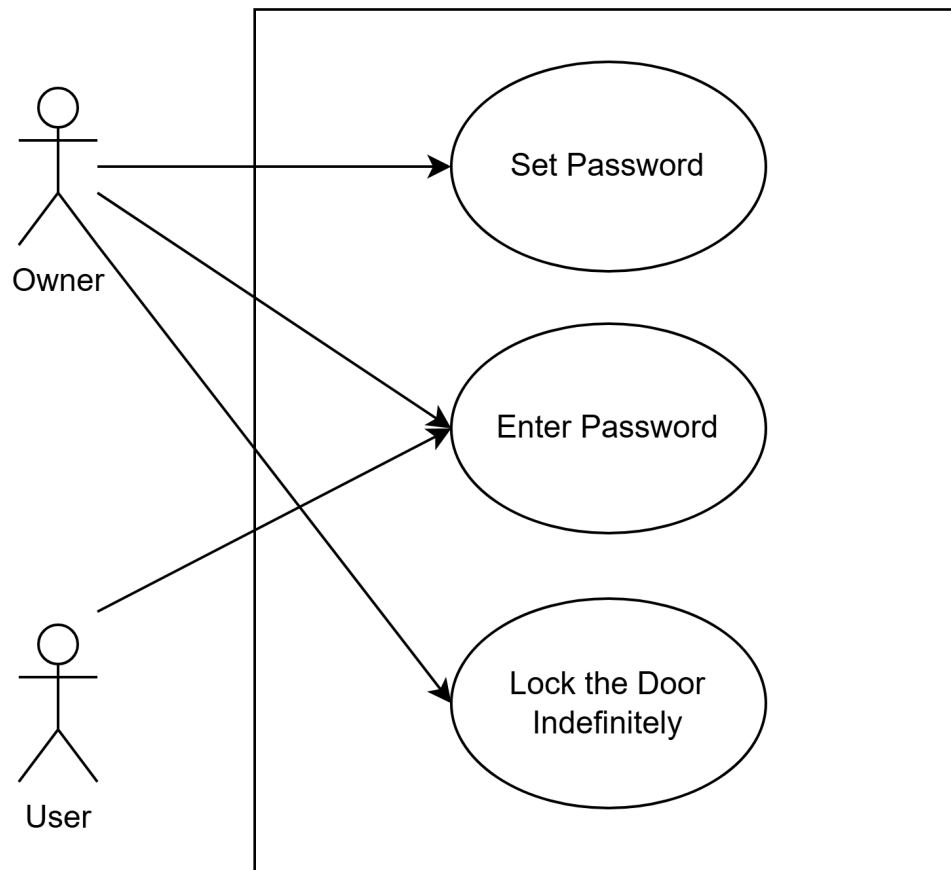


Figure 3. User Story for Door Lock System

The system enables the owner to set the password at first, can enter the password, and indefinitely lock the door via web application. For the user, he/she can only enter the password.

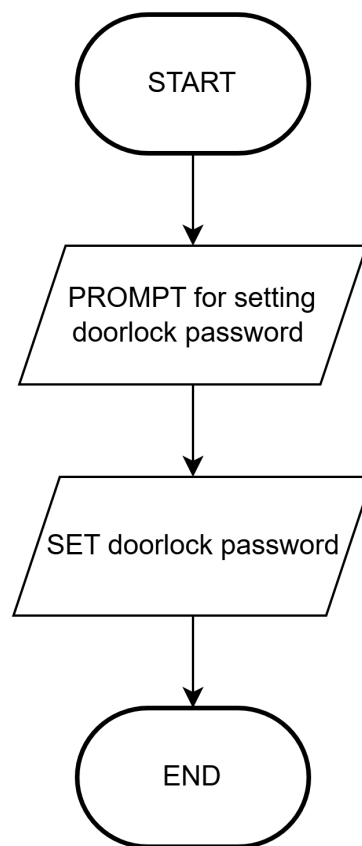


Figure 4. Flow Chart of Setting the Password

A password must be set to enable the doorlock system. A prompt will first show for the owner to set the password. Once the password is set, the servo motor, as the door lock, will lock. Attempts will be allowed to enter the correct password.

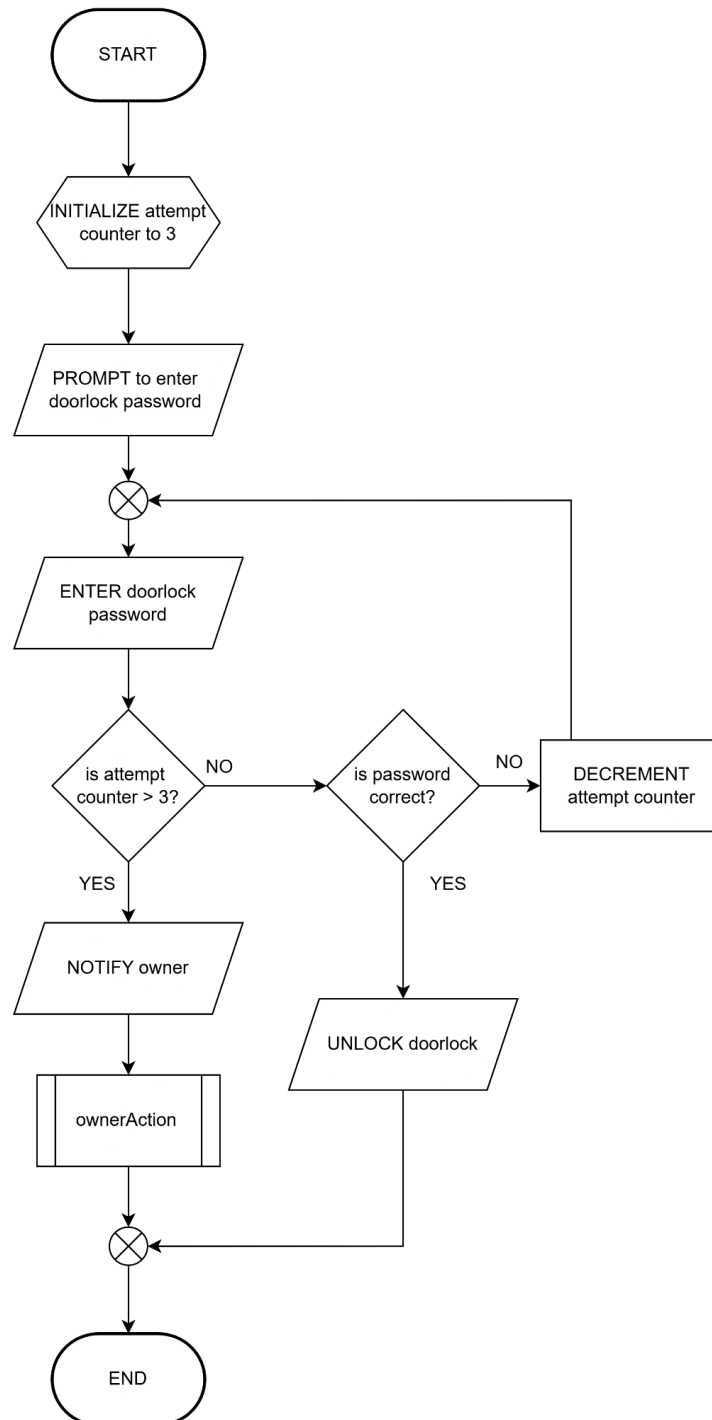


Figure 5. Flow Chart for Door Lock Password Attempt

The user can have at least three tries to enter the password. When the password is correct, it unlocks the door lock. If the user fails to enter the correct password three times, then it will notify the owner via a web application. An action from the owner will be requested via the ownerAction module.

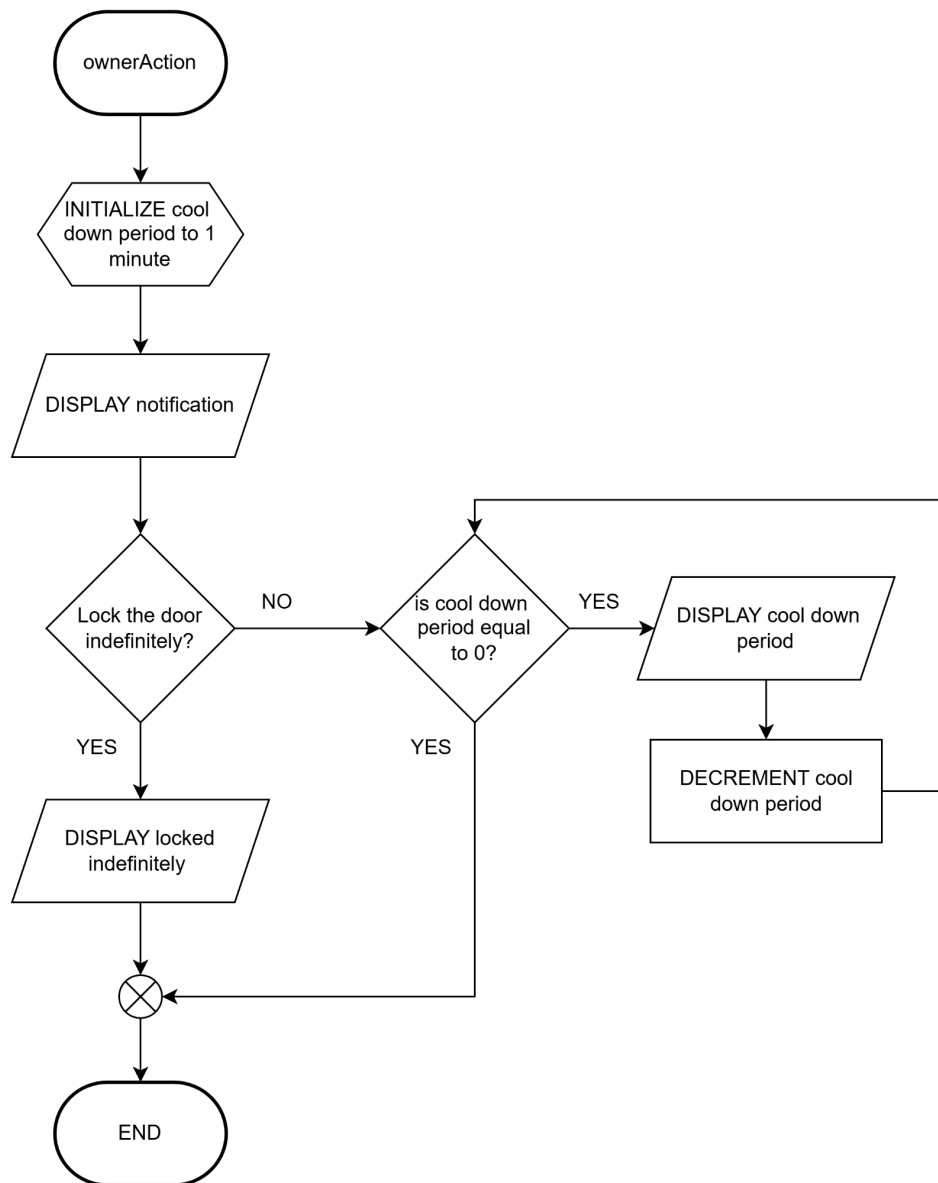


Figure 6. Flow Chart of Owner Action

In this module, it enables the owner to either lock the door indefinitely which means regardless of the number of attempts and correctness of the inputted password, the door lock will not open or a 1-minute cool down period will be given before allowing another attempt.





## Project Management

### Team Composition

**May Ochia** (Team Leader/Hardware Lead) - Is responsible for managing the project and developing the task scheduler. Represents the team to the instructor.

**Isaac Alotaya** (Member/Hardware) - Responsible for checking the functionality of the hardware components. Assists the hardware lead in the connection of the components in an organized manner.

**Kinshin Sorallo** (Member/Software Lead) - Creates the code foundation of the required functionalities of the system. Finalizes and tests the connection of the software and hardware components.

**Elisha Tepait** (Member/Software) - Assist the Software Lead and develop the WiFi connectivity features, and create the web/app interface for remote control.

### Task Assignment

1. Project Planning and Requirements Analysis - All Members
2. Hardware Component Selection and Architecture - May & Isaac
3. Circuit Design and Prototyping/Integration - May & Isaac
4. Development of Web/App interface for remote control - Elisha & Kinshin
5. System Testing - Elisha & Kinshin
6. Documentation - All Members

### Development Timeline

Task	April		May			
	3rd Week	4th Week	1st Week	2nd Week	3rd Week	4th Week
Project Proposal Approval						
Hardware Component Selection/Purchase						
Circuit Design and Prototyping						
Development of Web/App interface for remote control						
System Testing						
Documentation						



## References

- [1] Jairo Bolledo, "SWS: More families victimized by common crimes in Q3 2024," *RAPPLER*, Nov. 09, 2024. <https://www.rappler.com/philippines/sws-survey-families-victimized-common-crimes-q3-2024/>
- [2] Building Security Services and Systems, "Access Control Systems vs. Traditional Lock-and-Key Methods," *Building Security Services*. <https://www.buildingsecurity.com/blog/access-control-systems-vs-lock-and-key/>
- [3] Metropolitan Police, "Seven facts about residential burglary | Crime Prevention," *www.met.police.uk*, 2023. <https://www.met.police.uk/cp/crime-prevention/protect-home-crime/residential-burglary-facts/>