
Project [20 marks] Release Date: 25/8/2022 Submission Date:14/10/2022

Group Number:

Group Members (Name and ID):

- 1.
 - 2.
 - 3.
 - 4.
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Overview

This project aims to design a smart door system that can be used to detect presence and authenticate the personnel that want to enter the protected premise. The system should have several key features which are elaborated below. Take note that only the basic functionalities of these features are described, and additional modifications must be implemented according to the marking rubric to obtain higher grades.

Activity 1: IoT Sensor and Network System

The system should be capable of detecting objects that are near to the physical door. Whenever a presence is detected, the system should notify the owner of the presence's movements. Using ultrasonic sensors and camera, design a smart door system that is capable of the following:

- a) A user should gain access by entering a username into the system. If the username is in the system's database, a password will be generated and sent to the user's Telegram. The user should then enter this password to successfully access the protected premise.
- b) An ultrasonic sensor is used to detect presence near the smart door. When a signal is detected, send a video that is shorter than 1 minute to the user's Telegram (to avoid theft/breaking in/monitor situation).
- c) The design should consider minimal usage of sensors with high functionality or data interpretation.

Activity 2: Machine Learning System

Artificial Intelligence should be integrated into the system to help the system make more accurate and effective decisions. Design a machine learning algorithm/code based on the existing machine learning methods that can classify movements of the person/object/hand in front of the door with the highest accuracy. This feature can be used to either classify the movement of the object or as an authentication procedure (e.g. specific hand movement to unlock the smart door).

- a) Display the person/object movement accurately and send this information to the user using Telegram. (it does not need to be a live update, the information can be sent after manual processing, or within 24 hours)

b) The system/machine learning algorithm/codes should respond fast and accurately during the inference process. Computational efficiency should be analyzed thoroughly with efficient information.

Activity 3: Temperature and Humidity

The system should be capable of measuring the temperature and humidity of the surroundings using the given sensor. Use the temperature and humidity sensor to tell users more information about the current environment that could help users understand the presence's movements better. (For example: temperature low, humidity high, it could be raining, hence the user is standing still in front of the door, assuming this door refers to the main door of your house or the temperature is high, there could be a fire. Be creative and ensure feasible functionality). This information can be sent alongside the presence's movements to users in Activity 2.

Activity 4: Security Door Lock

If the person requesting access to the protected premise authenticates him/herself successfully, the door should unlock and allow him/her to enter. The door should then lock itself appropriately afterwards. This is done using the relay and solenoid door lock.

Activity 5: Security – Encryption and Decryption

Create a simple and reliable security algorithm for your door system. Before running your program, the user should login to the system with a username and password (e.g. a simple login page, focus on the code, not the GUI). Data encryption and decryption should be utilized whenever necessary to ensure that the security provided by the smart door system is not compromised (e.g. an encrypted password should be sent to the user to prevent hackers from obtaining the actual password by intercepting transmission packets).

Activity 6: Additional Features

Additional features should be introduced and integrated into the system with appropriate justifications. The implementations of these features should make the system more user-friendly and more practical. Try to imagine what happens in the real world if a smart door is installed in your house and when or how it should be locked or unlocked. Propose any extra and useful features/methods to make your system outstanding from other teams based on the items provided to you.

Activity 7: Report

Write a report consisting of all the above activities with feasibility evaluation on the implementation and cost – benefit analysis. Your report should consist of the following: 1.0 Introduction (with Problem Statement and Objectives), 2.0 Literature Review, 3.0 Methodology (with flow charts for activities plus a section for additional features), 4.0 Results and Analysis, 5.0 Feasibility Evaluation with Cost Benefit Analysis, 6.0 Conclusion, Future Work and References. The report should be limited to maximum 15 pages with approximately 6000 words, the number of words is not inclusive of appendices, references, and

diagrams. Marks will only be given to the report excluding appendices. Anything more than 15 pages will not be given marks.

Activity 8: Demonstration

Present the demonstration of your work/prototype, methodology, results, and feasibility evaluation with cost benefit analysis as a group in week 11 to pitch your prototype/idea/project. You will be given 7 minutes each group (approximately 2 minutes on overall report summary presentation and 5 minutes for demonstration of the working prototype). There will be a 3 mins of Q&A session.

Activity 9: Reflective Summary – Contribution and Commitment

Each member should prepare a reflective summary, 1 page each member and submit together with the report as a single pdf file. The reflective summary should include contribution of each member, communication during the participation of team discussion and commitment by each team member to the project. Each member should list down how they have contributed.