

## Burglar Alarm System Details

### Authors:

Oluwaseun Adewola  
Nahala Noreen  
Lara Abouelnour  
Usman Tahir

### Organization:

Automatic Control and Systems Engineering Dept. - The University of Sheffield

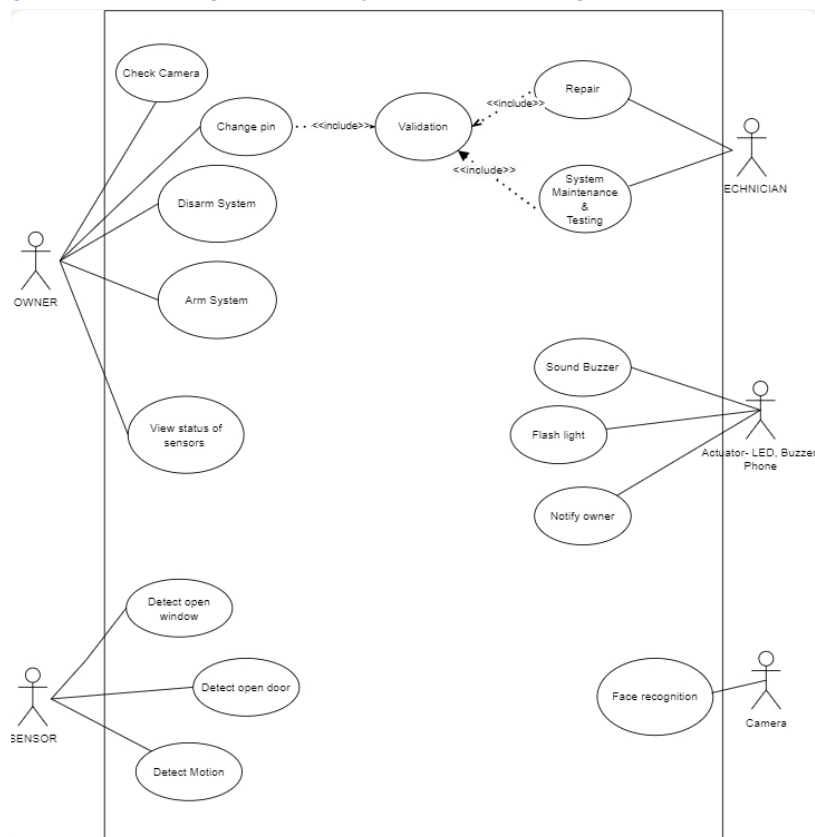
The purpose of the following document is to outline the details of a burglar alarm system that is activated when the owner exits the premises and therefore detects unauthorized activities within the premises. The system is coded on both Arduino IDE and Matlab.

This document consists of the following:

- UML Use-case diagram
- UML State diagram
- UML Activity diagram
- UML Class diagram (OOP Implementation)
- User Requirements
- System Requirements
- List of Components
- Circuit Diagram

### **UML Use-Case Diagram:**

[https://drive.google.com/file/d/1gAwq9Ju\\_ZyoZ\\_2Fkk-U2ISfgX2pGeFDT/view?usp=share\\_link](https://drive.google.com/file/d/1gAwq9Ju_ZyoZ_2Fkk-U2ISfgX2pGeFDT/view?usp=share_link)

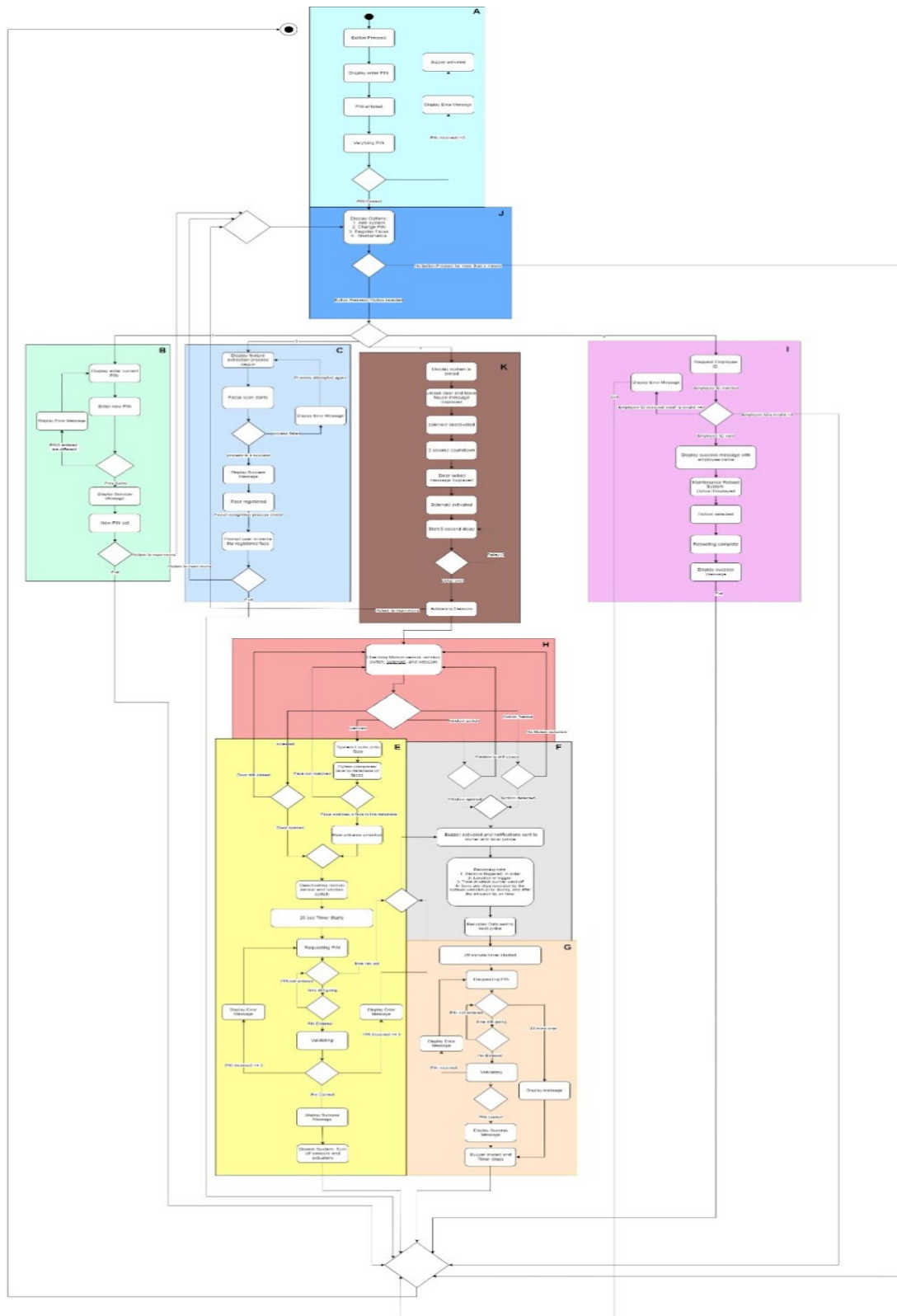


## UML State Diagram

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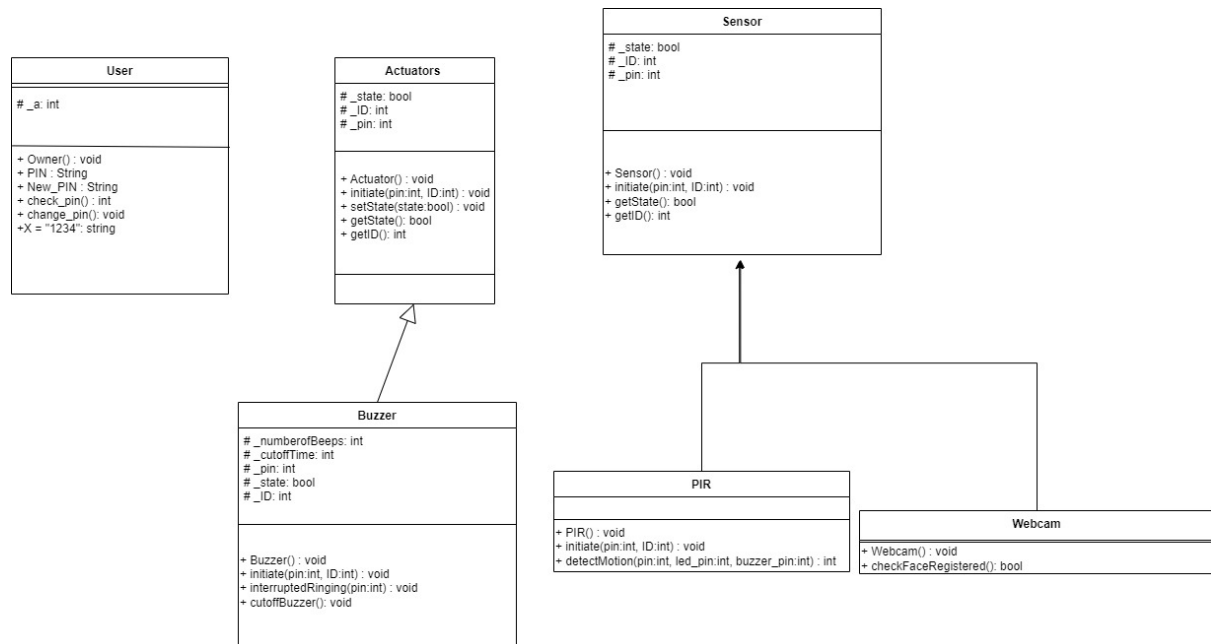
## UML Activity Diagram

[https://drive.google.com/file/d/1JpnN5Te1UF9\\_kFRiYFADdBbr0KP\\_b9I1/view?usp=share\\_link](https://drive.google.com/file/d/1JpnN5Te1UF9_kFRiYFADdBbr0KP_b9I1/view?usp=share_link)



## UML Class Diagram

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## User Requirements:

1. The owner should be able to identify the specific area where the intrusion has occurred via the system interface.
2. The user shall be able to select from a list of services through a monitor
3. The owner shall be able to input a PIN into the system to access it
4. The owner shall be able to change the PIN
5. The user shall have a limit on the number of attempts of entering the pin to access the system
6. The user shall be able to arm or disarm the alarm through entering a PIN.
7. The user should be able to arm or disarm the system through face scan
8. The user shall be able to view the status of the system any time.
9. The maintenance team shall require the presence of the owner to access the system.
10. The maintenance team shall be able to arm or disarm the alarm for maintenance purposes.

11. Maintenance personnel shall have permission to access the system via unique maintenance employee ID
12. The owner shall be notified of any intrusions from any remote location.
13. The local police shall receive notifications including time and location of the intrusion.
14. The local police should be notified of genuine intrusions only whenever possible; the number of false alarms should be kept to a minimum.
15. If the alarm goes off accidentally, the user should be able to register, after the alarm buzzer is disabled, whether the threat was genuine or false.
16. The user should be able to access the CCTV footage
17. The user shall be able to register multiple faces to the facial recognition system.
18. The user should be able to view a log of all the times the alarm went off, the reason for it going off, and the status of genuineness of threat declared.
19. The user should be given a set time limit between opening the door and the alarm going off, in order to input the pin.
20. The user should be notified if any windows or doors are open, from the system interface, during system activation
21. The user should be able to get visual confirmations when the system is armed and disarmed through display.

## **Definitions**

The relevant meanings of the acronyms used in this agreement are explained below:

- “The system”: an abbreviation for “The Burglar alarm system”, which is all the components of the Burglar Alarm Network
- “The system is armed”: the system is activated, the sensors are turned on, and actuators are prepared to receive commands
- “The system is disarmed”: The system is activated, the sensors are turned off, the actuators are not receiving commands

- “Webcam” : refers to a 2 in 1 component which can act as a CCTV and facial recognition device.

## System Requirements

1. The system shall be able to communicate with all standard intrusion detection sensors to detect potential threats.
  - 1.1. PIR Motion sensors shall detect movement
  - 1.2. Window mount switch shall detect windows' status (open or shut)
  - 1.3. Solenoid which shall signal the system and report the doors' status (open or shut)
2. All system components shall be mounted in appropriate locations
  - 2.1. The system interface panel shall be mounted on the wall, inside the building, next to the main entrance, along with the keypad  
*(Non-Functional Requirement)*
  - 2.2. Window switches and solenoid on the door shall be mounted on the inside, to avoid being tampered with.
  - 2.3. Buzzers shall be placed in secure overhead vents, in different spots, to avoid intentional damage of buzzers and to provide clear unmuffled rings.
  - 2.4. Motion detection sensors shall be placed in blind spots around the space and on different levels to ensure best coverage
  - 2.5. Webcam shall be mounted outside above the main entrance door frame to scan the user's face as they go in.
3. The systems should have particular specifications for distinct components
  - 3.1. The motion detection sensors shall have a detection range of up to seven metres and no less than five metres
  - 3.2. the system shall have a buzzer that sounds differently to the fire alarm system as to not confuse them with each other
4. Sensors shall be tested annually to ensure they are in perfect working condition.
5. The system shall monitor and display the status of its components and the system as a whole
  - 5.1. The system shall display its activation status: armed or disarmed
  - 5.2. The system shall be able to communicate and display the status of all integrated standard intrusion detection sensors
  - 5.3. The system shall display error messages for any failed actions
  - 5.4. The system shall display success messages for any successful actions  
*(Non-Functional Requirement)*
6. The system shall manage the transition between user session, alert state, and idle state
  - 6.1. The display panel shall be a screen in the idle state. In an idle state, no user session will be active.
  - 6.2. The user session shall be active when the user presses a button on the keypad and verifies themselves

- 6.2.1. User verification shall be through entering the correct 4-digit PIN number
    - 6.2.1.1 The process undergone due to entering an incorrect 4-digit PIN shall be handled by requirement 12
  - 6.3. The system shall be in alert mode when an intruder is detected and the buzzer goes off
    - 6.3.1. To exit alert mode, user verification shall be done through requirement 6.2.1
- 7. The system, when armed, shall prepare for validation when the webcam detects a presence.
  - 7.1. The webcam shall lock onto an individuals face as they are approaching the door
  - 7.2. The webcam shall compare the detected face to the registered face profiles
- 8. The webcam and facial recognition system shall accept up to five profiles to be registered in the system
- 9. When a face is successfully verified against a pre-registered face profile by the webcam, or if someone unlocks the door, the armed system shall change the status of its sensors and actuators and request further user verification
  - 9.1. The solenoid shall retract to allow the door to be opened
  - 9.2. The motion detector sensors and window switches shall be deactivated
  - 9.3. A 25 second timer shall be activated
  - 9.4. The interface panel shall switch from idle state to user session and request a PIN to be entered
    - i. If an incorrect PIN is entered, refer to requirement 12
  - 9.5. The buzzer shall be in ready-mode to react when the timer runs out and the correct PIN is not entered
- 10. The system shall be armed or disarmed using a pre-registered 4-digit PIN  
(Non-Functional Requirement)
- 11. The system shall provide the option of changing the 4-digit PIN.  
(Non-functional Requirement)
- 12. The system shall allow up to three attempts to input the 4-digit PIN at a time
  - 12.1. The user shall be allowed to access the system when the four digit pin has been inputted correctly
  - 12.2. The system shall display 'INCORRECT PIN' to the monitor and allow the user another attempt, if the user inputs an incorrect PIN.
  - 12.3. After inputting the incorrect PIN for the third attempt, the buzzer shall be activated  
(Non-Functional Requirement)
- 13. System shall provide monitored high level access to the maintenance team
  - 13.1. They shall have access to reboot the system.

14. When the system is accessed by the maintenance team it shall be recorded.
  - 14.1. The system shall record the employee ID used to access the system
15. For systems installed in the UK, any cameras placed outside shall adhere to United Kingdom law, including privacy laws and CCTV legal requirements, and the government's Guidance on the use of domestic CCTV
  - 15.1. Cameras should be placed in a way that minimises the intrusion to other people's privacy
    - 15.1.1. Cameras should only capture private property whenever possible
    - 15.1.2. The use of privacy filters should be considered, if cameras are to capture public property,
  - 15.2. Cameras shall be signposted if they are to capture any public spaces
    - 15.2.1. Signs should be placed where they are clearly visible.
    - 15.2.2. Signs should clearly state the reason for recording.
  - 15.3. Regular actions shall be undertaken to ensure that public space cameras comply with the law
    - 15.3.1. Regular review shall be done to ensure that they comply with the General Data Protection Regulation (GDPR) and the Data Protection Act (DPA).
    - 15.3.2. Recordings shall be regularly deleted when no longer needed
    - 15.3.3. Regular checks of camera position shall be done to ensure that privacy intrusion is minimised.
16. The system shall log and report details regarding events that trigger the buzzer and notify the local Police.
  - 16.1. The system shall record the suspected point of intrusion and all the sensors triggered in order
  - 16.2. The system shall record the time the buzzer went off
  - 16.3. The system shall save any clips recorded by the outdoor webcam prior, during, and after the intrusion by an hour, that is if the recording option on the webcam was activated
  - 16.4. The details shall be available to view on the interface panel and must be sent to the local police responsible for responding to the call
  - 16.5. The owner shall also be notified through their cell phone when the buzzer goes off
17. Alarm system installed in the United Kingdom shall meet basic standards and conform to PD6662: 2017 in order to be accepted by insurance companies.
  - 17.1. The remotely monitored alarm system shall adhere to BS EN 50131-1 and BS 8243, for Installation and configuration to generate admissible alarm conditions, in order to attain police response. This includes methods for minimising false alarms and hold up alarm systems; for more information visit <https://www.bsia.co.uk/zappfiles/bsia-front/pdfs/172-basic-guide-bs8418-2015-ctv-installers.pdf>
18. The system shall be configured to diminish the number of false alarms to the police

- 18.1. CCTV System shall adhere to BS8418 for the correct design & installation of CCTV systems; for more information visit <https://www.nsi.org.uk/wp-content/uploads/2012/10/Tech-Bulletin-0018-BS-8418-2010.pdf>
- 18.2. the system shall adhere to BS 8243 as mentioned in 23.1
19. Adhering to UK Law, the system shall have a 20 minute cut-off protocol in place for the buzzer, when it is rung, as to reduce noise pollution.
20. The system shall implement basic data protection principles
- 20.1. Pre registered PIN shall not be viewed or altered without entering the PIN first
- 20.2. No new face profiles shall be registered without first entering the PIN

### List of Components

- Solenoid
- [BJT Transistor BD909/911 BD910/912](#)
- [PIR Motion Module HC-SR505](#)
- Buzzer
- Magnetic Switch
- LED
- Resistor
- Wires
- Arduino Uno Board
- Camera
- Computer (to run the programs on)

### Circuit Diagram

[https://drive.google.com/file/d/1N-uOUpS3YAf0l2H1kM5Zp96sNvACvJVR/view?usp=share\\_link](https://drive.google.com/file/d/1N-uOUpS3YAf0l2H1kM5Zp96sNvACvJVR/view?usp=share_link)

