SSN COLLEGE OF ENGINEERING
KALAVAKKAM-603110

INTERNALLY FUNDED STUDENT PROJECT REPORT (May 2022 - Oct 2023)

SYNCHRONIZED SECURITY SYSTEM

By

ARUN PRAKAASH C – 2110329 [3rd YEAR ECE Dept.]

AKHASH KARTHICK R – 2110552 [3rd YEAR EEE Dept.]

ARINI RSM – 2110633 [3rd YEAR EEE Dept.]

DHEERAJ J – 2110383 [3ST YEAR MECH Dept.]

Under the mentorship of,

Dr.J.Bhuvana, Associate Professor

Dr. T. T. Mirnalinee Professor & Head

Department of Computer Science and Engineering

Signature of the Project Students

Signature of the Project Guides

Signature of the Research Dean

1.PROJECT TITLE:

Synchronized Security System

2.BROAD SUBJECT:

To develop an integrated security system which consists of multiple electronic devices and a software application using machine learning to establish a security network using server-client interface (app development) to combine the data from the electronic devices and visual data from security camera to maximise the security of a premises.

3.PROJECT SUMMARY:

The goal of this project is to create and offer the general public an effective and reliable security solution since people's valuables and personal belongings need to be secured at home and at work. The creation of an electronic system that utilizes security camera footage from both inside and outside of buildings is one of the project's three primary objectives. In addition to being utilized as a surveillance video, the digital data is also used to analyse, interpret, and alter it using machine learning. The ultimate goal is to synchronize and integrate everything mentioned above to create a security network that includes an Android app to make it more efficient and user friendly.

4.KEYWORDS:

Security Network – Machine learning algorithms – Security and hidden Cameras – Motion detector – Door security module – Window security module – App development – Networking – Internet of Things

5.THE OBJECTIVES OF THE SYSTEM:

1. To develop a system composed of electronic components for security needs
2. To develop digital image processing software application using machine learning intelligence to use camera’s visual data for security needs.
3. To develop an android app for security needs.
4. Integrate the above to establish a modern security server-client network

6.INTRODUCTION:

Security can be defined as limiting others' freedom of action in order to protect oneself from potential harm inflicted by others. People, social groupings, things, organizations, ecosystems, and any other entity or phenomenon that is susceptible to unwelcome change can all benefit from security.

Security systems are networks of interconnected electronic devices that deter possible home invaders and criminals by cooperating with a central control panel. The first home security systems were created in the early 1900s. These devices were typically quite costly and challenging to keep an eye on. With the speed at which technology has advanced over the past century, it is now possible to create systems that are more dependable and efficient, which is essential in today's environment.

We are aiming to develop a network of security systems which is both efficient and cost effective so that security is offered to every individual.

7.DEFINITION OF THE PROBLEM:

There is always a high probability of a theft to happen in places like banks, homes, industries where valuables are stolen so there is a need for synchronised security system.

8.REVIEW OF STATUS ON RESEARCH AND DEVELOPMENT IN THE SUBJECT:

a) International status:

This research paper is about an inner sensor alarm system, which can send alarm messages as well as evidence material to outer media. [2]

This paper proposed a secure smart home architecture with cloud, secure fog with firewall, security analysis engine. The firewall system is in between of internet and fog layer to protect the unauthorized data access and internet threats. This security system will enhance the consumer trust to implement smart homes technology.[3]

Similar studies and projects are being done.[4]

b) National status:

This IoT project focuses on building a smart wireless home security system which sends alerts to the owner by using Internet in case of any trespass and raises an alarm optionally. Besides, the same can also be utilized for home automation by making use of the same set of sensors.[1]

9.NOVELTY OF THE PROJECT:

With the integration of multiple sensors, including a motion detector, a MQ2 smoke detector, 1080p cameras, and a fingerprint reader, all of which are managed by a Raspberry Pi 4, this security system was created as an Internet of Things system. The Android software "SSS," which was developed using the Microsoft PowerApps platform, allows users to view the data that has been gathered and is transmitted to a cloud server hosted by Amazon. A face recognition algorithm is applied to the live video feed to improve security and track unsuccessful attempts to access the building using the fingerprint reader.

10.WORK PLAN AND DETAILED TECHNICAL INFORMATION:

a) Methodology:

The project was divided into 3 phases.

Phase 1:

Planning and designing of electronic devices such as motion detectors, door security module and Window security module is aimed to be achieved.

Phase 2:

Making use of the camera footage and performing real time face recognition algorithm.

Phase 3:

We integrated all the above developed technologies using a hub dedicated for a particular premises and synchronize it using server to establish a security network which includes an android app to make it more efficient and user friendly.

b) Overview:

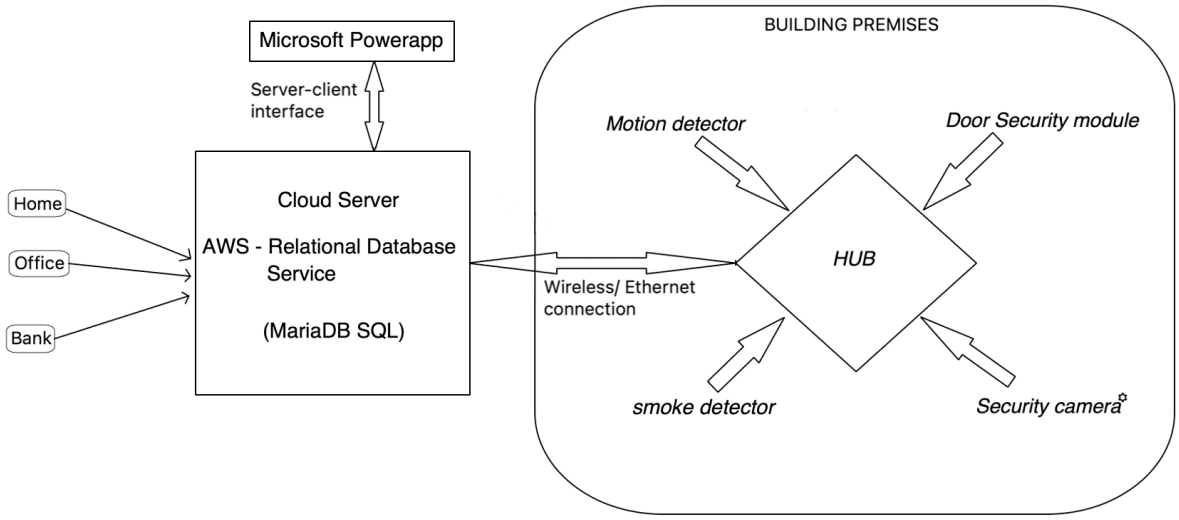

Figure 1

c) Electronic Systems developed:

a) Motion detector:

A motion detector (**PIR**) is an electrical device that utilizes a sensor to detect nearby motion in a particular range of area. Any motion detected and an alert is sent to the database.

b) Door Security module:

Door security module contains Camera and fingerprint sensor for ensuring security at entry level i.e., at gates or doors inside a premises. Fingerprint sensor (using **Adafruit packages**) authorizes the entry and any failed attempt is also recorded and an image is a taken by the camera installed and sent to the mail of the user.

c) Smoke detector:

A smoke detector (**MQ2**) is a device designed to detect the presence of smoke or other airborne particles associated with fires. It is a crucial component of fire safety and early

warning systems. When smoke is detected, it sends a message to the user via the android app and protects the building from potential fire.

d) Central Hub:

All of the previously created modules and sensors are linked to a central hub, in this case is the Raspberry Pi 4. This processor runs all of the sensor program codes (**Python**), which are then communicated via it to the RDS database. We had to install appropriate cooling (a fan) for the Pi with appropriate enclosure because this is a really powerful device. The various connectors and adapters for connecting the sensors with the raspberry pi are also a part of this hub.

e) Face recognition:

A Python program built on top of the OpenCV library processes the live video feed. We can avoid having to develop an algorithm from start because the **OpenCV** package includes pre-trained models for face detection. More precisely, the library uses a machine learning technique known as **Haar cascade** to recognize objects in visual input.

f) Android app:

An android app is developed using **Microsoft PowerApps** which is a platform and suite of tools that allows individuals and organizations to create custom business applications without the need for extensive coding or development expertise.

g) Main Server:

A cloud server for the proposed security system has been created in Amazon Web Services (**AWS**) used mainly for data storage as a relational database in **RDS-AWS** server.

h) Implementation:

Figure 2: 1080p camera

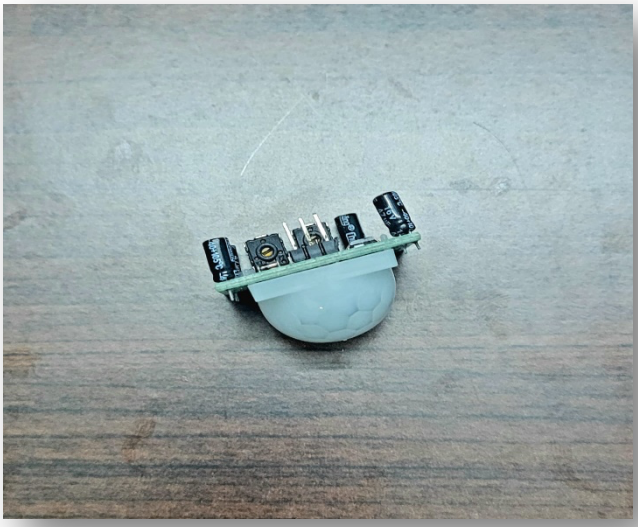

Figure 3: PIR motion sensor

Figure 4: MQ 2 smoke sensor

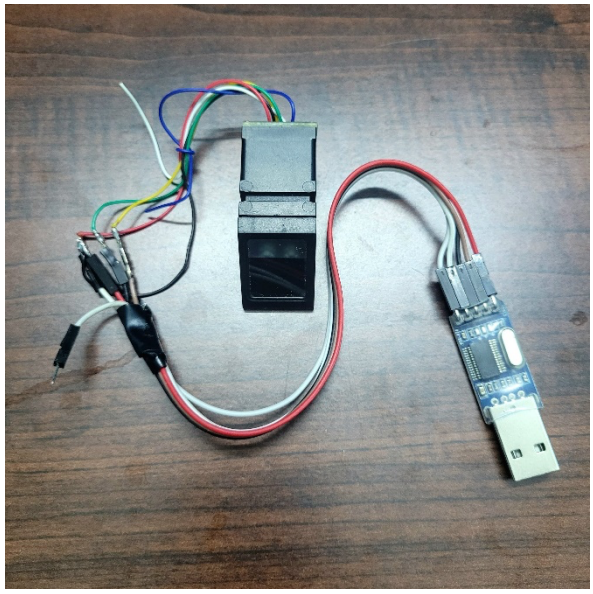

Figure 5: Fingerprint Scanner

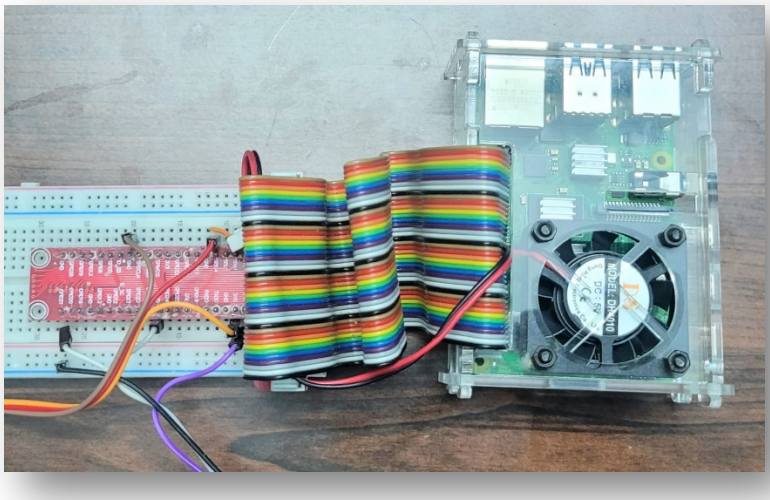

Figure 6: Raspberry Pi 4 (8GB ram)

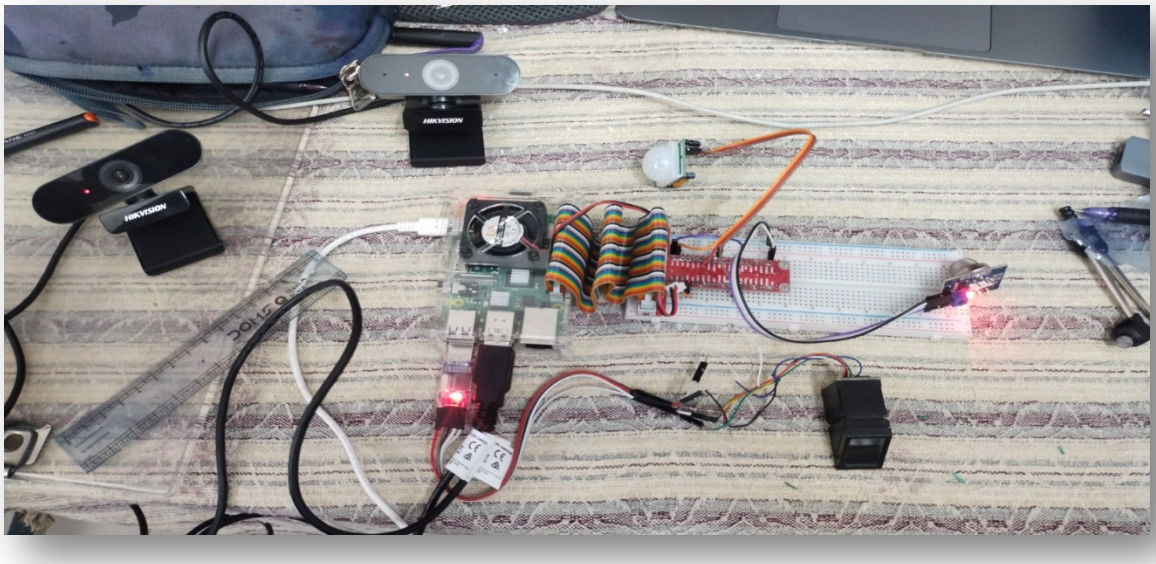

Figure 7: SETUP

The outputs of all the program codes are displayed on the central hub as well as sent to the cloud database.

Motion sensor output reads "**Motion detected** "when it senses a motion while remaining in the "**Sensor Ready** "state otherwise.

Fingerprint scanner has 3 options – '**enroll print**', '**find print'**, '**delete print'**. It can store up to 127 unique fingerprints with each of them given an id. Whenever a fingerprint is not recognised in the '**find print'** section, a camera placed near the scanner synchronously takes an image of the person and sends a mail from "**sssmailservice@gmail.com**" to the user with the image taken. The last failed attempt image is stored in the hub.

Smoke detector sends the output "**Smoke detected**" while triggered.

Facial recognition creates a new window with the live camera feed and whenever a face is detected there is a **box** surrounding the face with the **name** of the person if their images are already trained in the model else displays **unknown**.

The RDS **MariaDB** database named "**SSS**" can be accessed via the terminal in the raspberry pi or directly through the AWS website. To access this database on the phone, an android app based on Microsoft PowerApps named "**SSS**" was created.

11.Results:

a) Output on the central hub display:

Fingerprint scanner – Motion sensor – Smoke detector

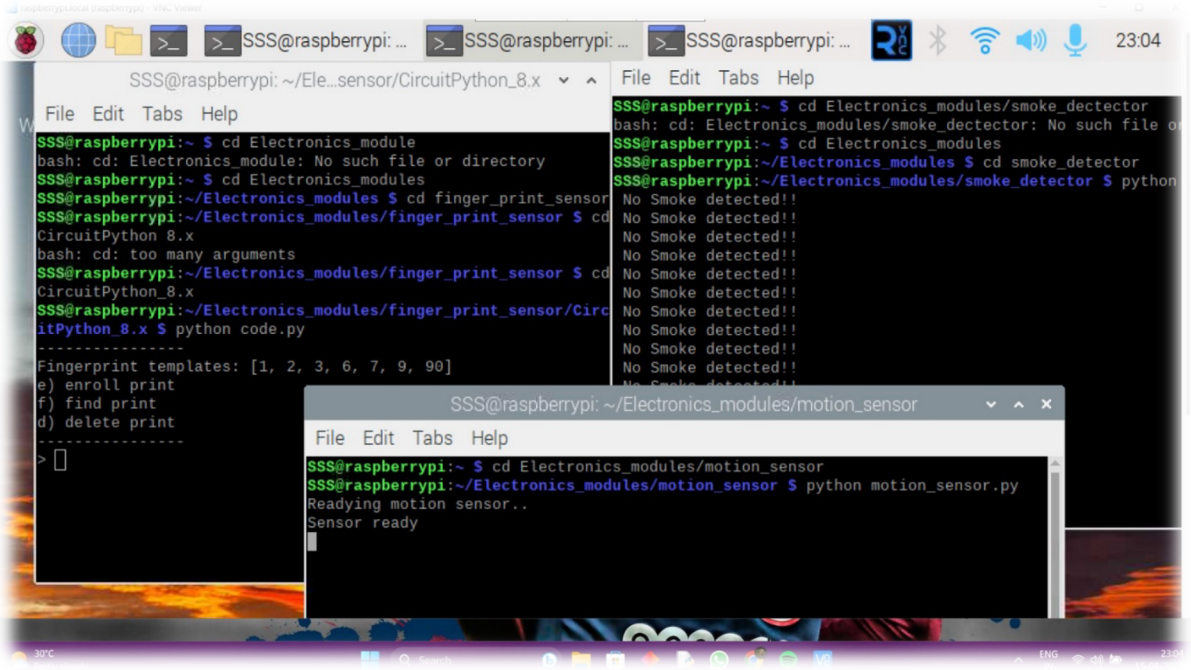

Figure 8: Face recognition

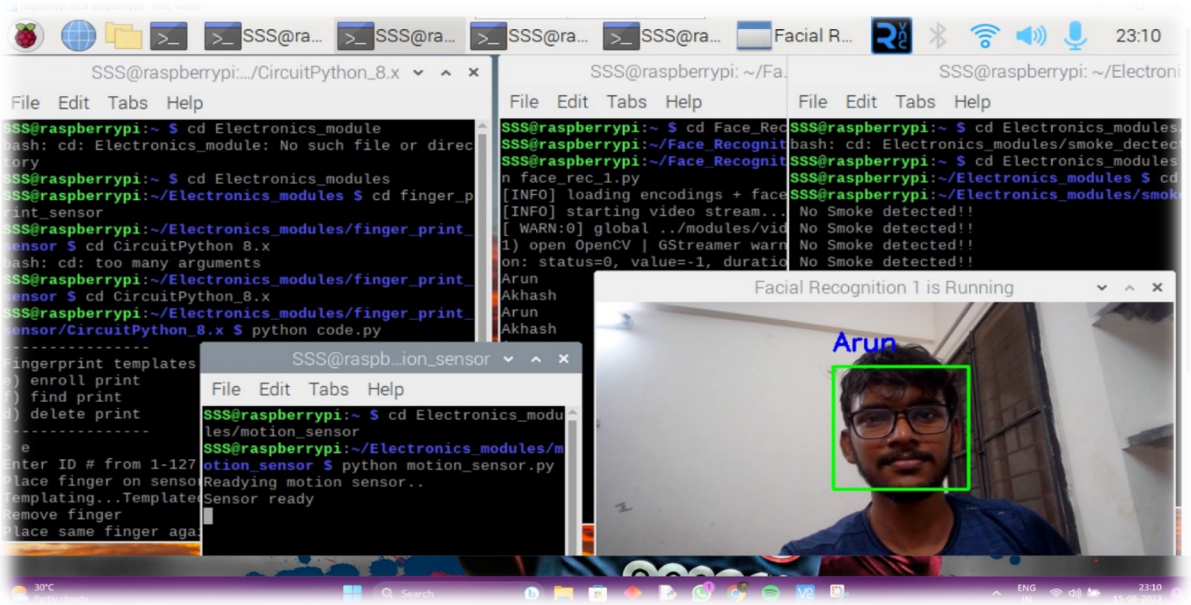

Figure 9: Face recognition

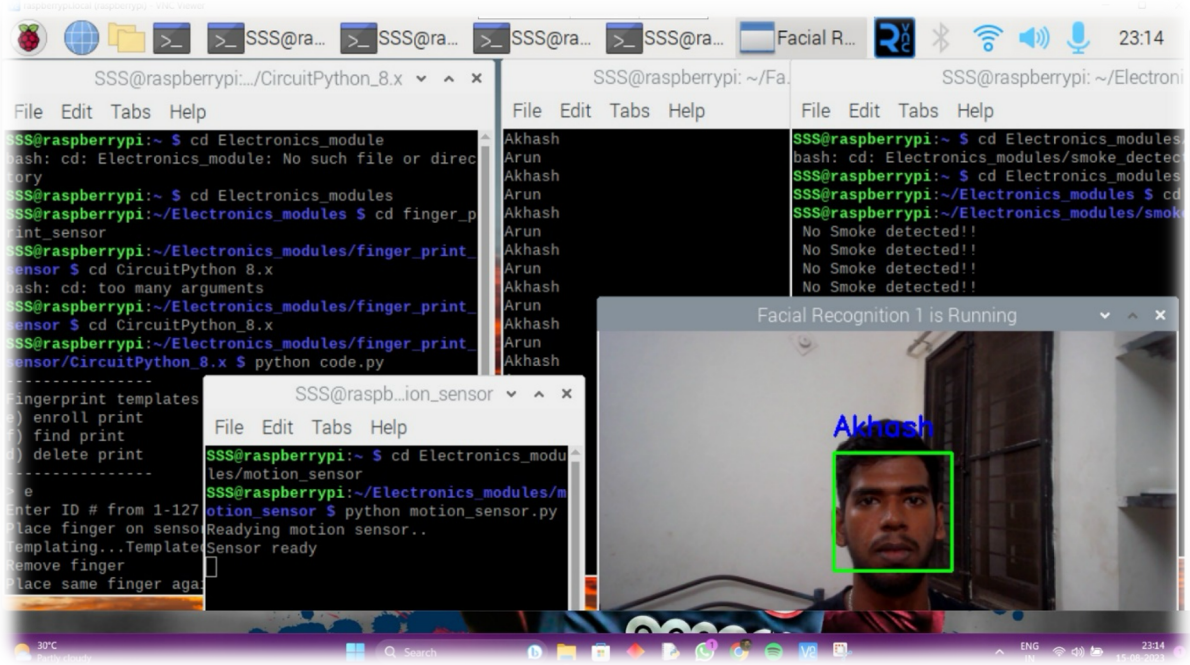

Figure 10: Face recognition

b) Output on the database:

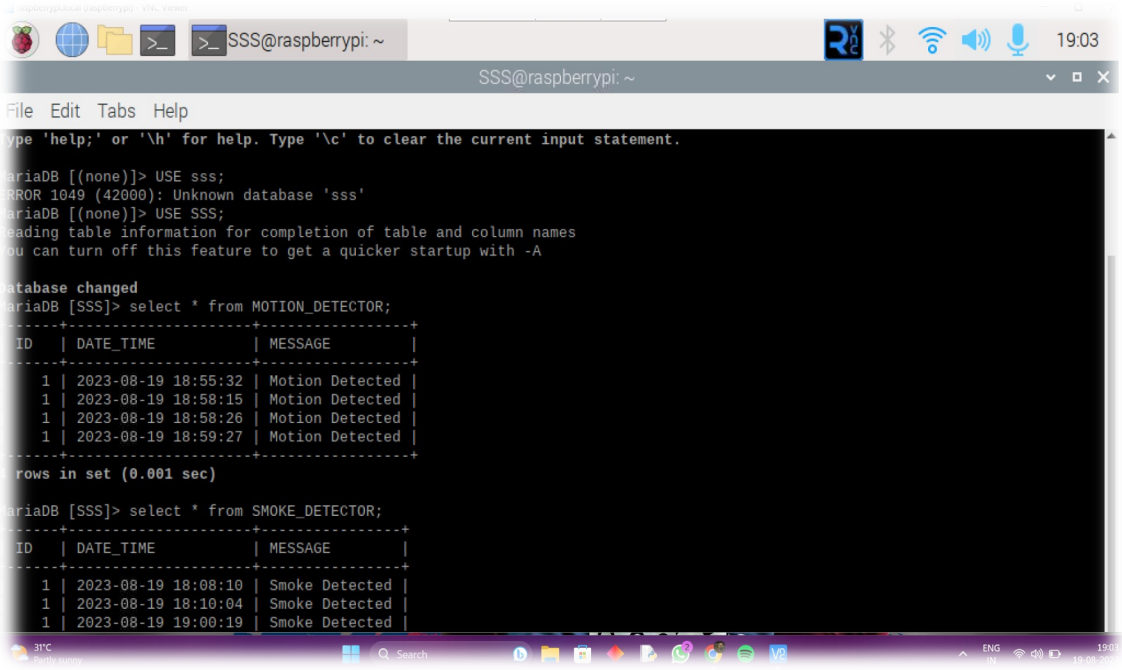

Figure 11

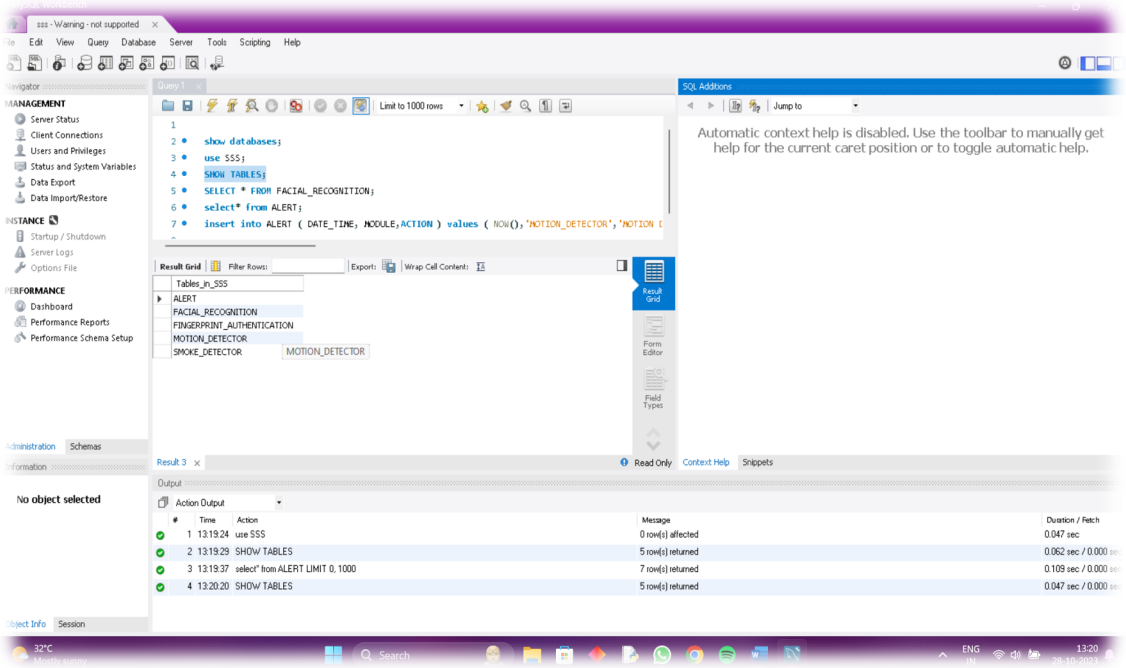

Figure 12

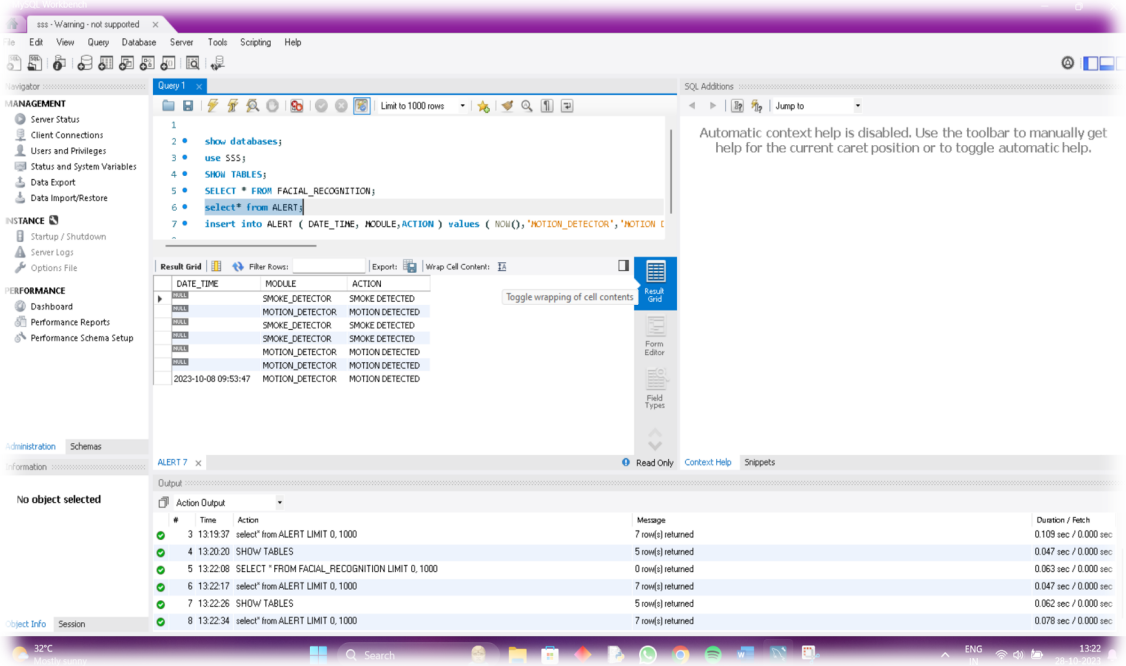

Figure 13

c) Output on the app” SSS”:

For accessing the app, Download Microsoft PowerApps on your device and “SSS” app is shown if you are given access.

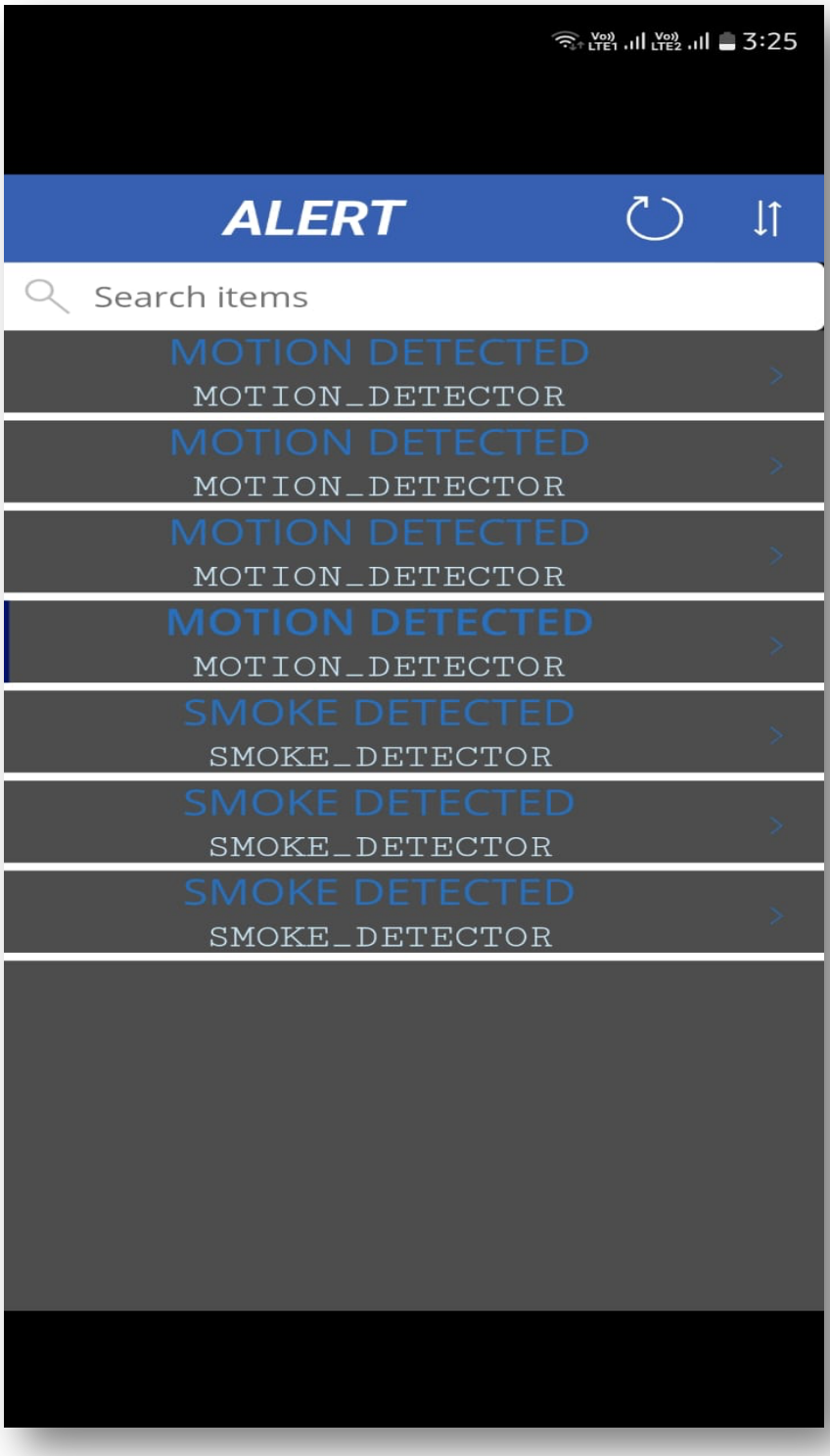

Figure 14


3:25
DETAILS
ACTION
MOTION DETECTED
DATE_TIME
08/10/2023 15:23
MODULE
MOTION_DETECTOR

Figure 15

d) Email output:

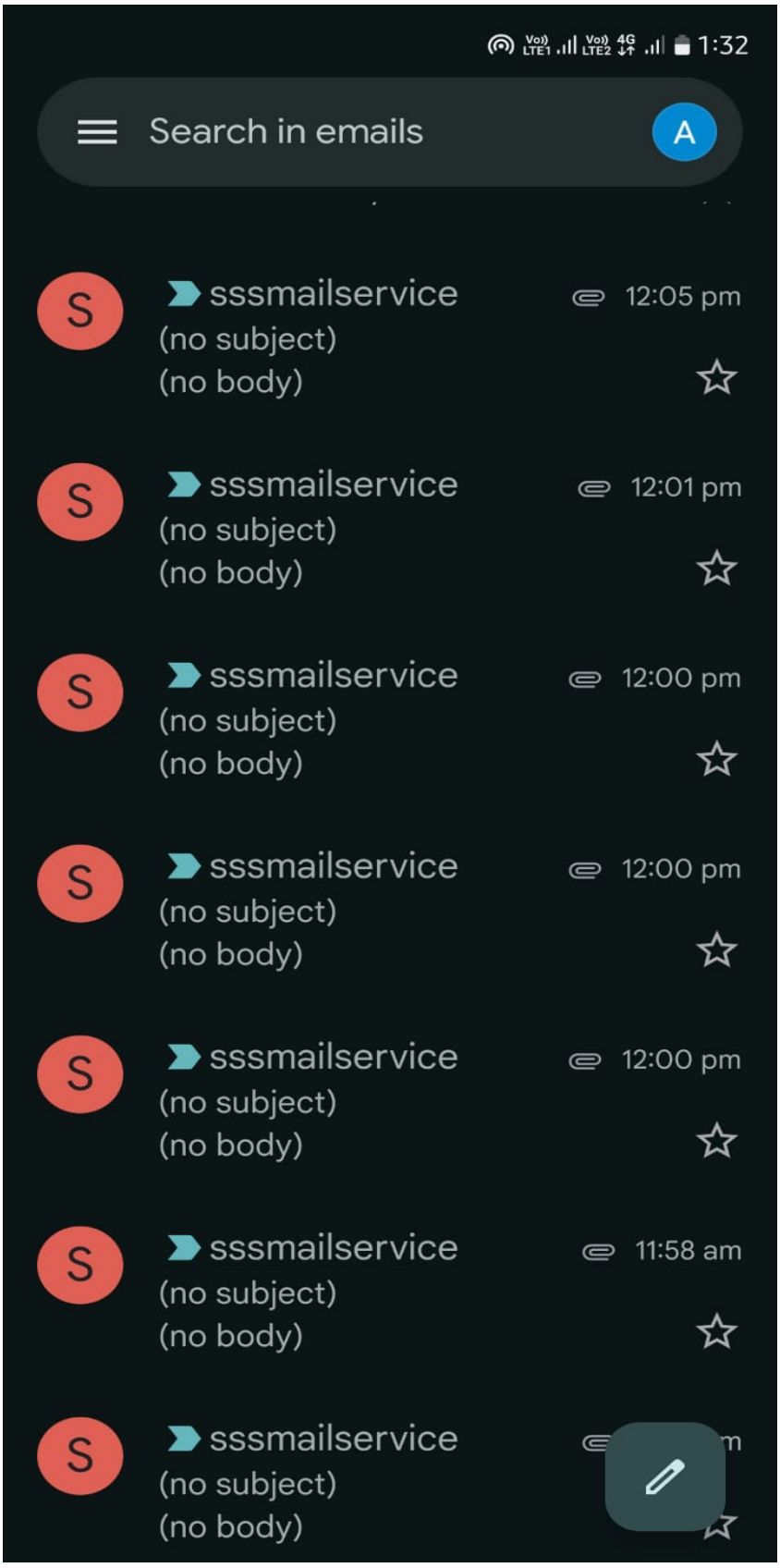

Figure 16

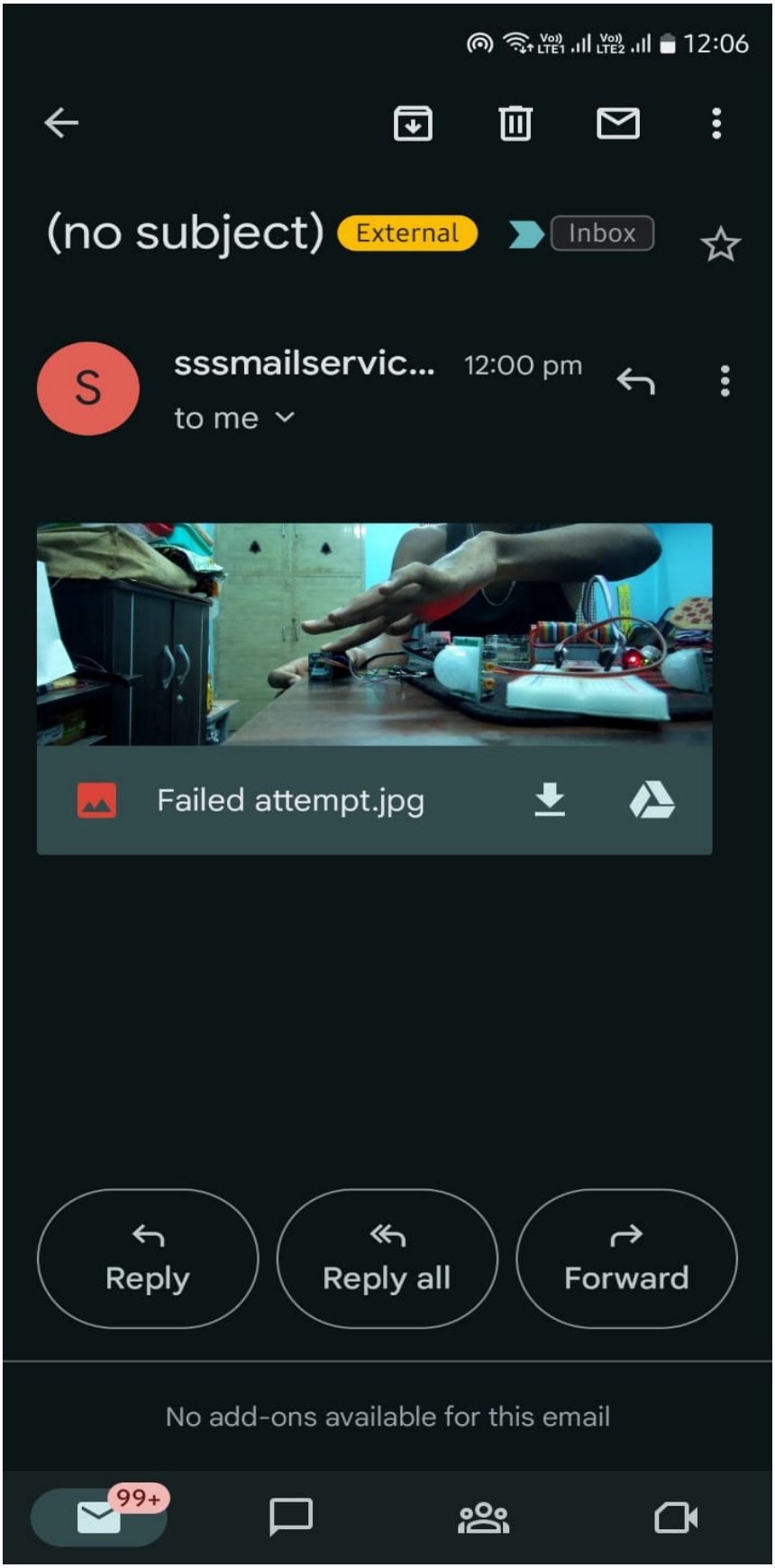
12:06
(no subject)
External
Inbox
S
sssmailservic...
12:00 pm
to me
Failed attempt.jpg
Reply
Reply all
Forward
No add-ons available for this email
99+

Figure 17

12.Conclusion:

In conclusion, this project has successfully developed a comprehensive and efficient security solution for both home and workplace environments. By combining an electronic system with security cameras, machine learning, and various sensors, the project has created an Internet of Things security system. The Android app "SSS" enhances user-friendliness by providing access to data via the cloud server hosted by Amazon. The integration of a face recognition algorithm further enhances security measures. This project not only achieves its objectives but also demonstrates the potential for advanced security technology in safeguarding people's valuables and personal belongings.

13.Recommendations:

Better sensitivity and resolution can be achieved by enhancing the quality of all the used sensors. More hubs can be made in order to add more cameras for face recognition. It is possible to permanently install a display with a respectable level of display quality on the central hub. In offices or educational facilities, this facial recognition technology can be used to track attendance. To store the live camera stream, a different database might be made. With the help of Flutter and Android Studio, the Android app may be developed to include new functionality and be improved aesthetically to our satisfaction. That app can also include the ability to stream live content. Every time an alarm is sent, users can manage additional hub actions through the app.

14. References:

1. Ravi Kishore, Vishal Jain, Suvadeep Bose, and Lakshmi Boppana. "IoT based smart security and home automation system." In 2016 international conference on computing, communication and automation *(ICCCA)*, pp. 1286-1289. IEEE, 2016.

2. X. Hong, C. Yang and C. Rong, "Smart Home Security Monitor System," 2016 15th International Symposium on Parallel and Distributed Computing (ISPDC), 2016, pp. 247-251, doi: 10.1109/ISPDC.2016.42.

3. A. K. Ray and A. Bagwari, "IoT based Smart home: Security Aspects and security architecture," 2020 IEEE 9th International Conference on Communication Systems and Network Technologies (CSNT), 2020, pp. 218-222, doi: 10.1109/CSNT48778.2020.9115737.

4. S. Sotoudeh, S. Hashemi and H. G. Garakani, "Security Framework of IoT-Based Smart Home," 2020 10th International Symposium on Telecommunications (IST), 2020, pp. 251-256, Doi: 10.1109/IST50524.2020.9345886.

5. https://www.cytron.io/tutorial/face-recognition-using-opencv-on-raspberry-pi-400