

CAPSTONE PROJECT REPORT

(Project Term January-May 2021)

EYE-ON ATM SECURITY SYSTEM

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Course Code: CSE445

Under the Guidance of

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L OVELY
P ROFESSIONAL
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PAC Form



TOPIC APPROVAL PERFORMA

School of Computer Science and Engineering (SCSE)

Program : P132-H::B.Tech. (Computer Science & Engineering) (Hons.)

COURSE CODE : CSE445

REGULAR/BACKLOG : Regular

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PROPOSED TOPIC : Eye-On ATM Security

Qualitative Assessment of Proposed Topic by PAC		
Sr.No.	Parameter	Rating (out of 10)
1	Project Novelty: Potential of the project to create new knowledge	7.00
2	Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students.	6.69
3	Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program.	7.00
4	Project Supervision: Project supervisor's is technically competent to guide students, resolve any issues, and impart necessary skills.	7.31
5	Social Applicability: Project work intends to solve a practical problem.	7.38
6	Future Scope: Project has potential to become basis of future research work, publication or patent.	7.69

PAC Committee Members		
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Final Topic Approved by PAC: Eye-On ATM Security

Overall Remarks: Approved

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Approval Date: 08 Mar 2021

DECLARATION

We hereby declare that the project work entitled “**Eye-on ATM Security**” is an authentic record of our own work carried out as requirements of Capstone Project for the award of **B.Tech** degree in Computer Science and Engineering (Hons.) from **Lovely Professional University**, Phagwara, under the guidance of **Ms. Sakshi**, during January to May 2021. All the information furnished in this capstone project report is based on our own intensive work and is genuine.

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CERTIFICATE

This is to certify that the declaration statement made by this group of students is correct to the best of my knowledge and belief. They have completed this Capstone Project under my guidance and supervision. The present work is the result of their original investigation, effort and study. No part of the work has ever been submitted for any other degree at any University. The Capstone Project is fit for the submission and partial fulfillment of the conditions for the award of **B.Tech** degree in Computer Science and Engineering (Hons.) from **Lovely Professional University**, Phagwara.

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ACKNOWLEDGEMENT

We would like to express the deepest appreciation to our Capstone Mentor **Asst. Prof. Ms. Sakshi** who has the attitude and the substance of a genius. She continually and convincingly conveyed a spirit of adventure with regard to the completion of project.

We are thankful to all those, particularly our friends, who have been instrumental in creating proper, healthy and conducive environment and including new and fresh innovative ideas for us during the project, without their help, it would have been extremely difficult for us to prepare the project in a time bound framework. Last but not the least we would like to thank and appreciate the constant support and guidance put in by our parents and other members of the college without which the completion would not have been possible.

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1. INTRODUCTION

The Automated Teller Machine (ATM) has become one of the preferred bank services nowadays, which allows banking customers to do various works such as cash withdrawal, deposit, transfer money, etc. On November 8 2016, when Government of India announced demonetization, ATM became integral part of people's lives. With the technology taking control over and providing ease to human beings, with the era of digitization knocking, security must be one the most important areas which should be taken care equally. Traditional ATM system uses PIN (personal identification number) for the authentication purpose and nowadays smart card with magnetic stripes and PIN is in use. Thereby taking care of security from user's front. However, securing ATMs from bank's front needs a lot of work to be done. Merely deploying security personnel at the ATM is not enough. This project comprises an advanced security system that can monitor and activate various security measure in case of robbery and theft. This security system detects malicious activities inside the ATM booth. The security system check different parameters of the security and keep the concerned authorities updated. It use sensors like Reed Switch, Ultrasonic Sensor, and Cameras to do so. If any unauthorized person is trying to move or open the ATM machine, due to reed switch, the circuit gets open. The ultrasonic sensor is used to sense to presence of intruder. If there is any change in these two parameters, the surveillance camera takes the picture and concerned authority is inform via SMS.

1.1 OBJECTIVE

- To prevent the ATM Machines from robbery, theft, and capture the culprits red-handed.
- To secure the ATM Machine even if there is no responsible personal.
- To intimate the authorities about any suspicious activity and provide live updates.
- To better maintain the database by saving the database by saving the images to admin's Telegram app.

- To help the organization analyze and predict future actions needed for providing better services.

2. PROFILE OF THE PROBLEM

The problem with ATMs security is common in India, and the rising rates of burglary and thefts are disturbing too, through the proposed project we have tried to minimize this problem by putting some security alarms in the ATM booths, So that any malicious intent can be detected in early stage and proper actions can be taken against the intruder. The use of Reed switch sensor will be the main part in our system to alert the authorities when the burglar tries to pull the machine's door. It is an Arduino based project to simulate how our system will detect and work under such situations.

2.1 SCOPE OF THE STUDY

The thefts in ATM has been increasing at an alarming rate and made it very difficult for the authorities to control it; there are currently no existing systems present that could provide a proper overview reflecting the problem and measures to resolve it. The proposed system contains a detailed structure and ways to control thefts in an innovative manner at a cheaper price.

The proposed system makes it able to identify and minimize the robbery conditions at ATMs by providing end-to-end monitoring and security alerts. The system is made safe for the authorities to enter and make changes according to their needs.

- Monitoring through telegram bot
- Details of person entering the ATM
- Security alerts through SMS
- Motion sensing in ATM
- Automatic door open/close through ultrasonic sensor

3. EXISTING SYSTEM

3.1 INTRODUCTION

The proposed project is implemented in order to provide security to ATMs at very cost-effective price. There are number of different security system in the past years, however this system is cost-effective and user friendly too as it provides the surveillance and alert in mobile phone. Other ATM security systems are:

In Unusual Events Detection For Enhancing ATM Security proposed by S.Swathi, H.R. Shashidhar. With the help of this technique they are able to identify the presence of unusual events like covering of face, camera masking, and low resolution videos by methods for standard deviation, statistical methods for moving targeted objects. All the work is done in MATLAB [1]. It does not send the unusual images of the events. The approach used in this doesn't detect the useless events and the system doesn't send the unnecessary message's to concerned authorities [2].

In ATM Security System Using Arduino proposed by B. Saranraj, N. Sri Priya Dharshini R. Suvetha, K. Uma Bharathi. To offer safe and secure support to the clients and to do exchanges without going to the bank [3]. They used ARDUINO NANO, Fingerprint sensor are used for enhancing security and authentication purposes. Hence fingerprint for every person is individual. The proposed system consists of fingerprint sensor, smart tags and reader, LCD and NODE MCU [4].

In Enhancing ATM Security Using Fingerprint proposed by S. Jathumithran, V. Thamilarasan, A. Piratheepan, P. Rushanthini, J. Mercy veniancy, P. Nirupa and K. Thiruthanigesan. Fingerprint technology is exceptionally accepted and matured biometric technology and is the easiest to develop and for an advanced level of security at the fingertips. Hence, no misuse of the system is possible [5]. The biometric identification technology checks the client's identity better and achieve the purpose that use of ATM Machines improve the safety effectively [6]. This research paper discusses a minutiae detection algorithm to showed key parameters of fingerprint image for identification [8]. Biometric data separated and distinct from personal information. For image enhancement,

the direction filter algorithms and the Gabor filter algorithms are used [9]. Fingerprint and voice systems have the smallest comparative sizes with eye systems currently are the largest [10]. It is important to evaluate the validity and the quality of the captured fingerprint images by fingerprint management system. If Authentication fails then it send the alert message to the Account holder and Bank [11].

In Design and Implementation of ATM Security System Using Vibration Sensor and GSM Modem proposed by Miss. K.C.Hanchinal, Miss. Savita.C.Kundargi. In this project, when a criminal enters and attempted to harm the machine, the vibration sensor which is attached to the machine get vibrated and sends the signal to the ARDUINO. GSM is Global System For Mobile communications [12]. The proposed project consists of an idea of implementing Vibration Detection sensors. These sensors will generate a signal whenever someone tries to forcefully open or damage the ATM machine[13].

3.2 EXISTING SOFTWARE

There is an industry level, security software developed by BS/2 U.S Company. ATMeye.iQ is an ATM security, dispute handling, and anti-fraud solution developed by BS/2, a software ATM security company, for banks and financial institutions.

3.3 DFD FOR PRESENT SYSTEM

3.3.1 Level 0 DFD

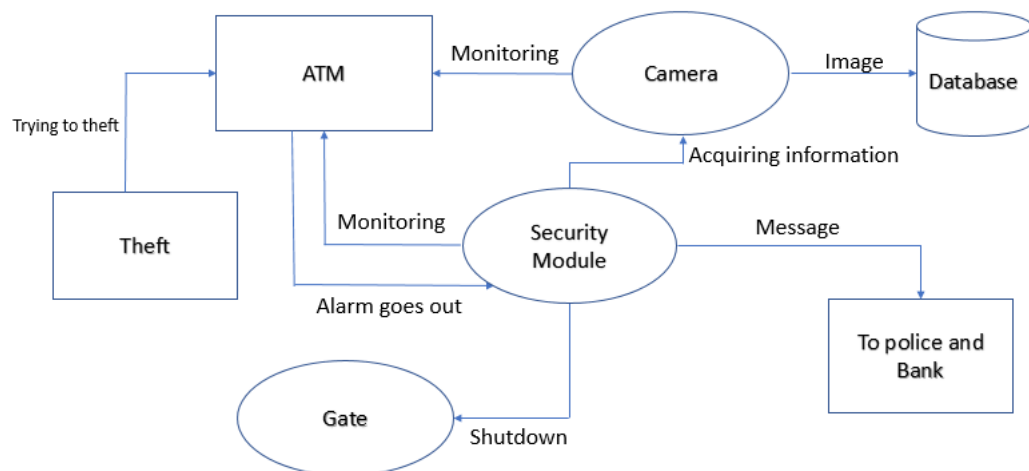


Fig.1. Level 0 DFD

3.3.2 Level 1 DFD FOR USER

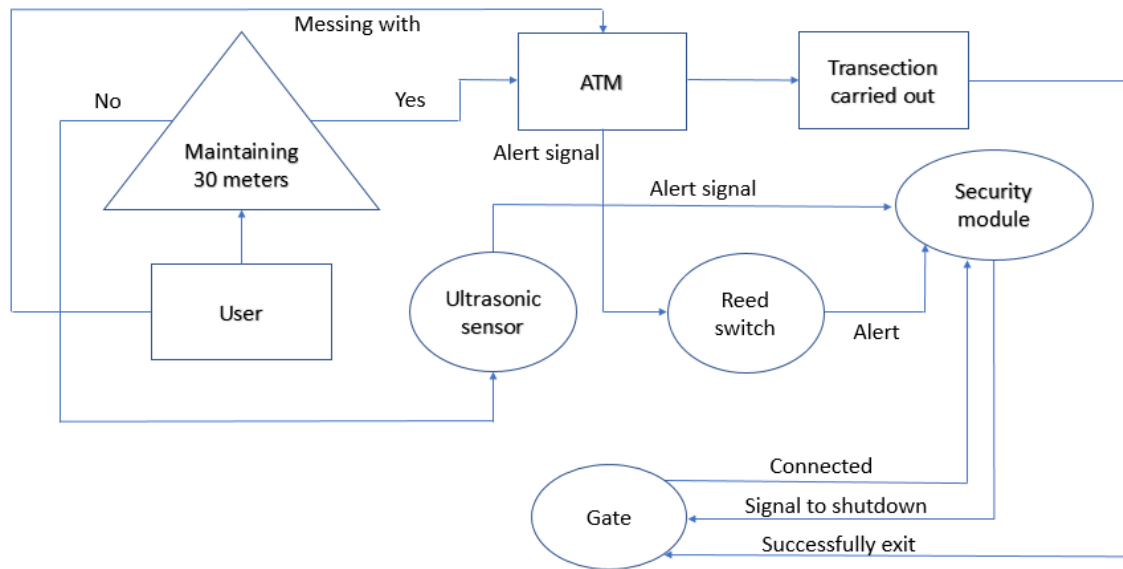


Fig. 2. Level 1 DFD For user

3.3.3 Level 1 DFD FOR ADMIN

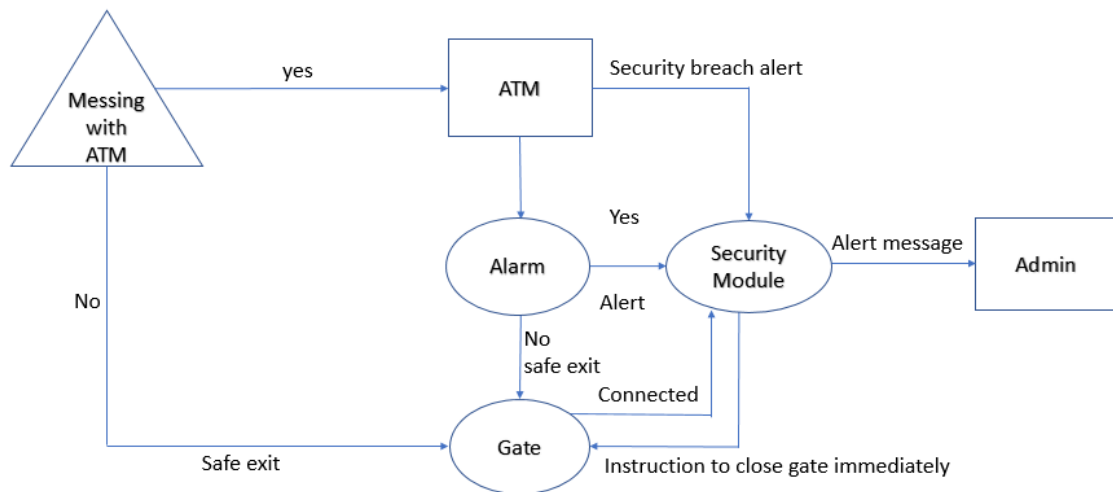


Fig.3. Level 1 DFD for admin

3.3.4 Level 2 DFD

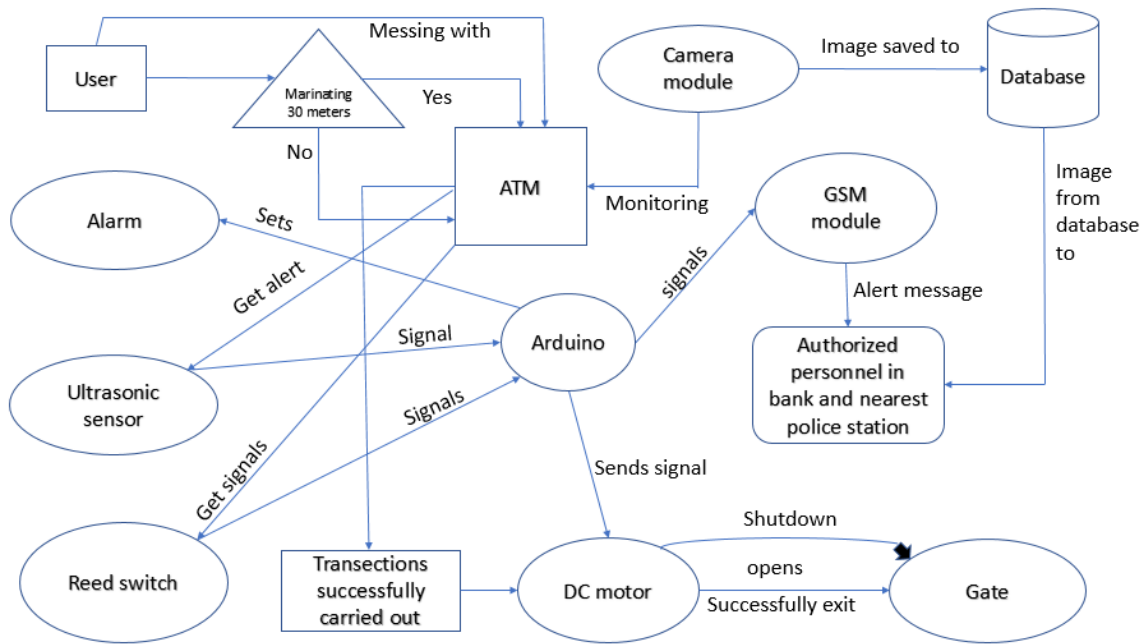


Fig. 4 Level 2 DFD

3.4 WHAT'S NEW IN THE SYSTEM TO BE DEVELOPED

The proposed projects aims at solving problems of theft and robbery from the bank's front. It uses minimal resources to give maximum output. Banks have been facing loses due to theft and robbery. The system uses Arduino Uno to controlling sensors and motors. The project provides automatic opening and closing of main door of the ATM booth. It allows admin via a user-friendly telegram app to continuous monitor the environment around ATM. If theft and robbery about to take place, admin can access the image of the robber via telegram and alert message is also sent to admin, and the main door closes automatically and remains closed. Therefore, intruder will not be able to escape. It is very cost-effective system to be implemented.

4. PROBLEM ANALYSIS

4.1 PRODUCT DEFINITION

ATM machine project comprises an advanced security system that can monitor and activate various security measure in case of robbery and theft. This security system detects malicious activities inside the ATM booth. The security system checks different parameters of the security and update it to the server in real-time. It uses sensors like Reed Switch, Ultrasonic Sensor, and Cameras to do so. If any unauthorized person is trying to move or open the ATM machine, due to reed switch, the circuit gets open. The ultrasonic sensor is used to sense to presence of intruder. If there is any change in these two parameters, the surveillance camera takes the picture and concerned authority will be informed via SMS. The main thing of this project is it focuses on security.

4.2 FEASIBILITY ANALYSIS

4.2.1 TECHNICAL FEASIBILITY

As far as the technical feasibility is concerned, securing the system becomes the primary objective. This system includes electronic components such as Arduino Uno, some sensors, ESP32 camera module, servo motor and GSM Module, which is easily available in any electronic shop or can order it online. With the help of this system, security aspect can be checked that were once leading to loses to banks.

4.2.1 ECONOMIC FEASIBILITY

This project is very cost-effective, as we do not need explicit server or cloud as of now to store images, it gets stored in mobile storage. However, as the number of user increases with time, we would need to upgrade the system accordingly.

4.2.1 OPERATIONAL FEASIBILITY

Through the proposed project, we have tried to minimize this problem by putting some security alarms in the ATM booths, So that any malicious intent can be detected in early stage and proper actions can be taken against the intruder. The use of Reed switch sensor

will be the main part in our system to alert the authorities when the burglar tries to pull the machine's door. It is an Arduino based project to simulate how our system will detect and work under such situations. Therefore, we have tried to solve the problem of ATM theft.

4.3 PROJECT PLAN

Planning plays a crucial role in development of any system. It is the first and the foremost step to take. Whenever a project or a system is to be develop, it follows a series of lifecycle activities and planning is the first. Planning is done in order to emphasize on how to take up a systematic approach before proceeding further to develop a system. Planning drives the project flow and control and its execution simultaneously. It checks for the plans, which must be formulated to carry out the project plan. The project plan for this application commits the following steps:

- Scope planning
- Preparation of the work breakdown structure
- Project schedule development
- Resource planning
- Budget Planning
- Procurement planning
- Risk management
- Quality planning
- Communication planning

5. SOFTWARE REQUIREMENT ANALYSIS

5.1 INTRODUCTION

In the analysis of the software specification, functionality of the proposed project, which is to be implemented, is fully specified. The Software design specification document contains all the necessary requirements of the proposed project. The proposed project

takes care of the security measures from the bank's front. The project is implemented to reduce the number of thefts and robberies occurring in ATMs.

The project includes:

- a. Automatic door open/close.
- b. Motion detection
- c. Continuous monitoring
- d. SMS alert
- e. ATM's protection through reed switch

5.2 GENERAL DESCRIPTION

The requirements analysis phase talks about the general operations rather than specific areas of concern. This phase also includes three prime activities, which form the center of this phase. These fundamental areas can be illustrated as: Eliciting Requirements:

This involves following acts:

- Project Documentation
- Information gathering
- Communications Interfaces

Eye-on ATM security system is an intelligent system project and therefore has some programming requirement. Arduino integrated development environment (IDE) is used for programming Arduino Uno. Based on the signal received from peripheral sensors Arduino provides with the output/action to perform such as if a person is in the range of 0 to 30 in-front of the main door only then the servo motor will receive a command from Arduino to open the door.

5.3 SPECIFIC REQUIREMENTS

5.3.1 FUNCTIONAL REQUIREMENTS

5.3.1.1 AUTOMATIC DOOR OPEN/CLOSE

Description: The proposed project provides a contact-less door opening and closing. Initially, the main door of the ATMs is closed. With the help of ultrasonic sensor, which detects the presence, door opens for 10 seconds. It senses the same by transmitting ultrasonic waves. The waves, when encounter any disturbance in the path, travels back and received by the receiver that helps in measuring the distance between sensor and person. Then the signal is sent to Arduino, which controls the movement of mini servomotor, based on distance measurement the servomotor opens the door and closes it. An Arduino code is used for the same. When a person is in the range of 0 to 30cms from the main door, the door will open automatically. Once the person is inside the ATM booth, he can use the service.

5.3.1.1.1 Stand in the range of 0 to 30cms in front of ultrasonic

Input: The user has to come in the range of 0 to 30cms in front of ultrasonic.

Output: The door will open automatically.

Processing: The door will open for a few seconds and thereafter closes automatically.

5.3.1.2 CONTINUOUS MONITORING THROUGH TELEGRAM

Description: PIR sensor inside the ATM machine starts detecting motion and ESP32 camera module monitors it and send images to telegram. Therefor ESP32 camera module helps in continuous monitoring of the system.

5.3.1.2.1 Motion Detection through PIR sensor

Input: User has to be make a move, he/she will be in motion so that PIR sensor can detect the motion

Output: Images will be send to Telegram.

Processing: As soon as the PIR sensor detects motion it sends the image to admin's Telegram application through ESP32 camera module.

5.3.1.3 SMS ALERT

Description: A reed sensor is attach to the door of ATM machine. If any person tries to open, lift or break the door of the machine, the magnetic field fluctuation is detected with the help of reed switch sensor, and the circuit gets open. Once the circuit is open, the main door closes so that the intruder cannot escape the booth, buzzer will get activated and produce an alert sound, and the concerned authority will be informed immediately via SMS through GSM. An immediate action will be taken against intruder.

5.3.1.3.1 Theft alert

Input: The intruder will try to open the door of ATM thereby opens the circuit.

Output: SMS alert sent to concerned authority.

Processing: As soon as the circuit opens, GSM module will send the SMS alert to concerned authority.

5.3.2 NON-FUNCTIONAL REQUIREMENTS

The proposed project allows admin/bank to continue monitor the respective ATM. It also has an alarming system, which will let the people around know that a theft is occurring though a buzzer sound. This system is easy to implement and use.

5.3.2.1 Availability Requirement

If the required components are available and well connected to each other, the proposed system can work for 24*7 and the 24*7 the ATM can be monitored and secured.

5.3.2.2 Efficiency Requirement

Given the connections are correct and soldered; the proposed system can monitor and send alert whenever theft occurs and any fault can be corrected easily.

5.3.2.3 Reliability

The proposed system is checked and tested and therefore is reliable. Any happening can be monitored via images sent to admin in telegram app. SMS alert is also sent to the concerned authority for taking immediate action if any theft occurs.

5.3.2.4 Accuracy

The proposed project sends the images to the telegram only when motion is detected, which means no unnecessary image will be sent. It also sends the SMS alert only when somebody is trying to harm the ATM machine. It is tried and tested. Therefore, the proposed project is very accurate to its functionality.

5.3.2.5 Performance Requirement

The proposed project performs to the best of its functionality. The connections need to be protected from any damage. The motion-detected images takes less than 10 seconds to reach the admin via telegram app. The SMS is sent in less than 10 seconds, whenever theft is occurring, to concerned authority so that he/she can take further action.

5.3.2.6 Maintainability Requirement

The system must be checked in the morning to make sure it is working fine. Fault detection is very easy as every sensor has different functionality to perform. The system provides ATM with security and therefore reducing loses which banks bear due to theft and robbery.

6. DESIGN

6.1 SYSTEM DESIGN

The process of showing and describing various components and their features through visual representation, E-R diagrams, Use case diagrams, pseudo codes and design notations comes under system design. The purpose of system design is to provide a clear and crisp idea of our project and its features. Every module's functionality is clearly explained through design notations and respective diagrams.

6.2 DESIGN NOTATIONS

6.2.1 Use case diagram

A use case diagram shows system requirements, consider use cases for defining different case to check the system performance, and expected behavior of what will happen, if the system has to do that proposed task. It summarizes the relationship between use cases, systems and actors. It helps in system validation.

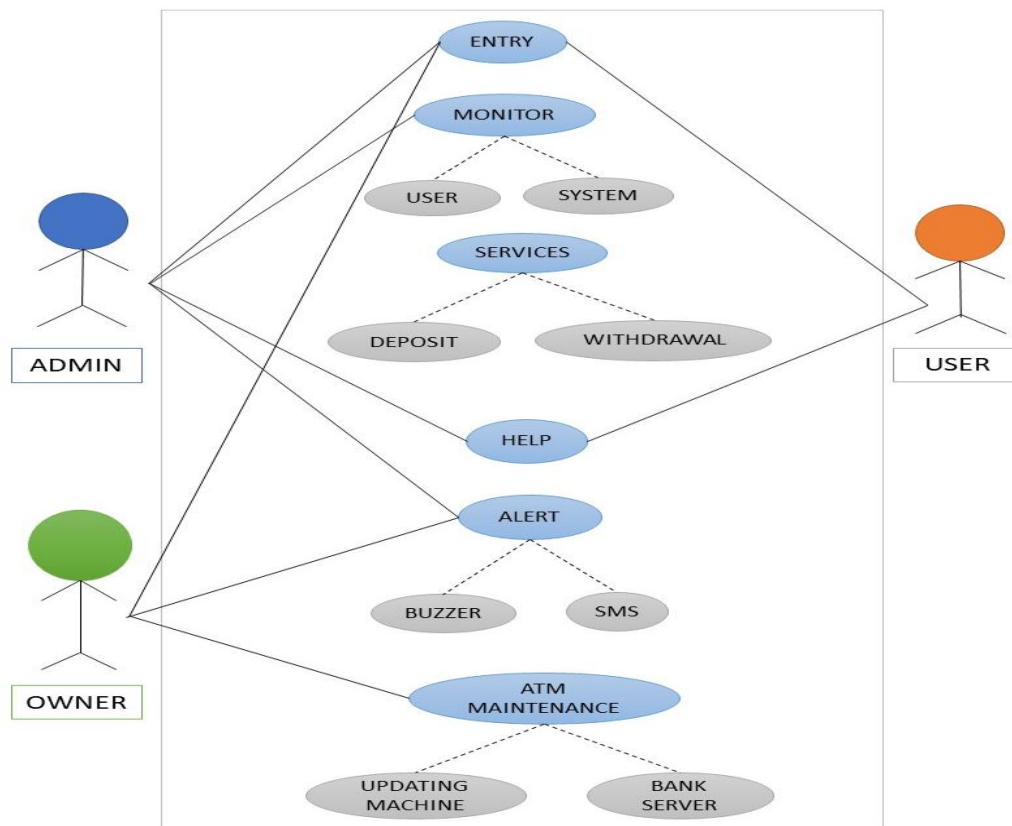


Fig.5 Use-Case Diagram

1. Actors- user, admin, owner
2. Use cases – blue colored attributes
3. Functionalities- grey colored identities
4. Communication link- black bold lines
5. Extends – dotted black lines
6. Boundary of system- grey rectangular box

6.2.2 ER Diagram

An Entity Relationship diagram is a blueprint of database that is to be implemented in the project. It contains two main components: entity set and relationship set, where each entity i.e. an object of data has a relationship with the attributes, which contains the property of that entity. They helps us to create a logical structure of the system.

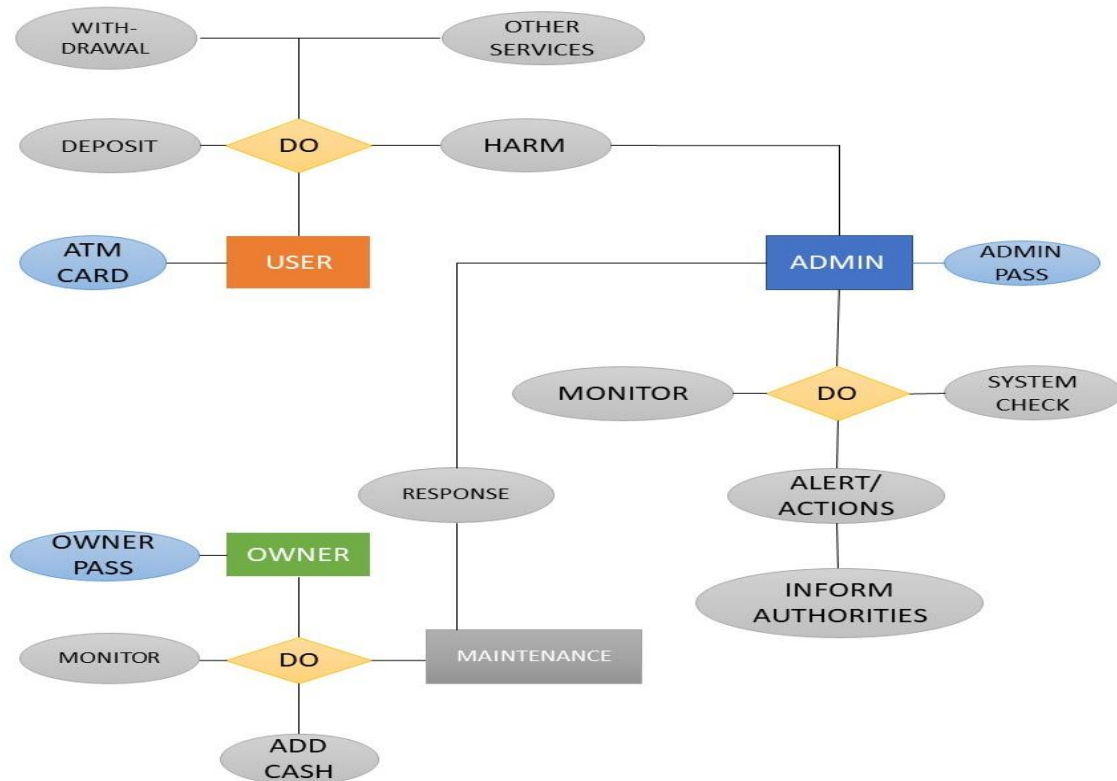


Fig.6 ER Diagram

1. Rectangle- user, admin, owner.
2. Ellipses- attributes, key attributes (blue colored ellipse), multivalued attributes (grey colored ellipses).
3. Diamonds- relationship set (yellow diamonds).
4. Lines- link for entity set to their attributes.

6.3 DETAILED DESIGN

The design of the circuit is performed on Tinker cad platform. GND and VCC from Arduino is attached to the breadboard. Then rest connection are made according to the pin assigned to each component inside the code.

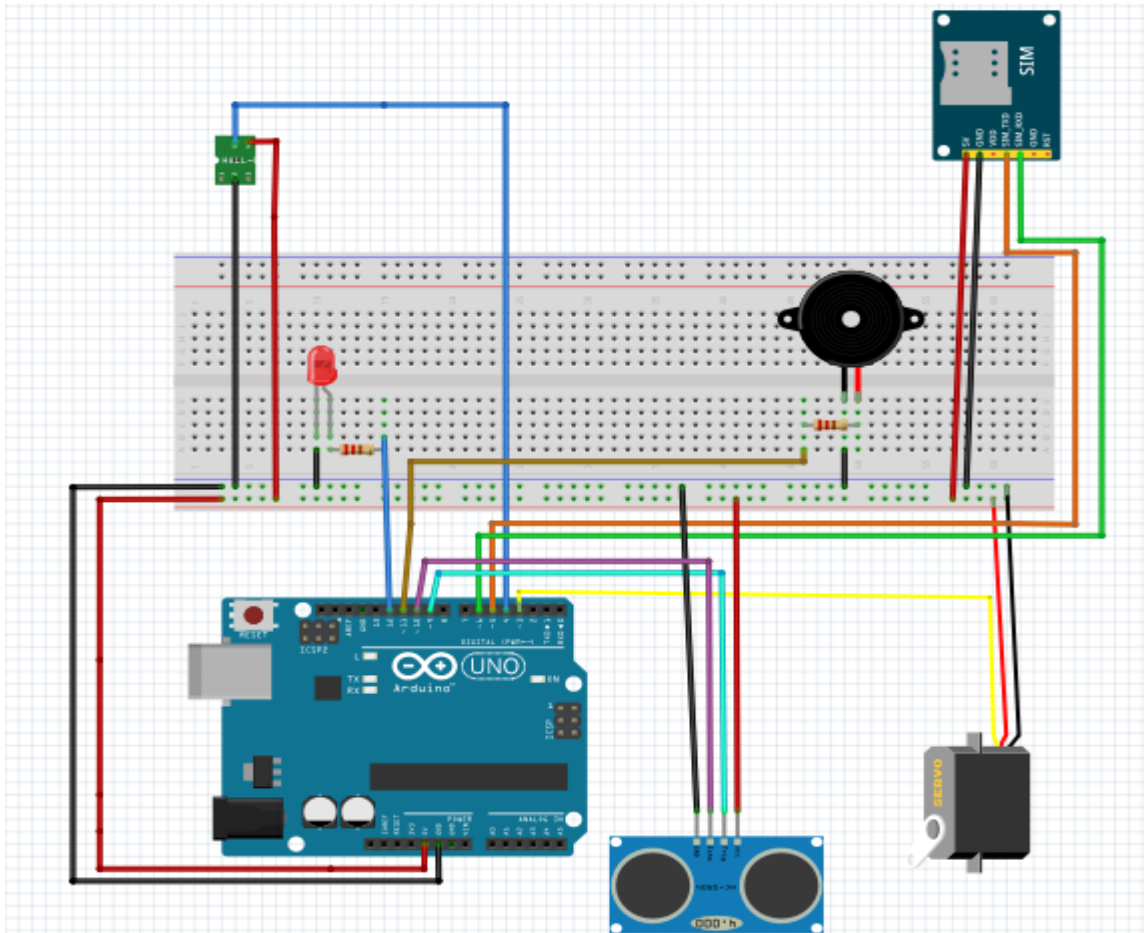


Fig.7 Arduino Uno and other sensor connections

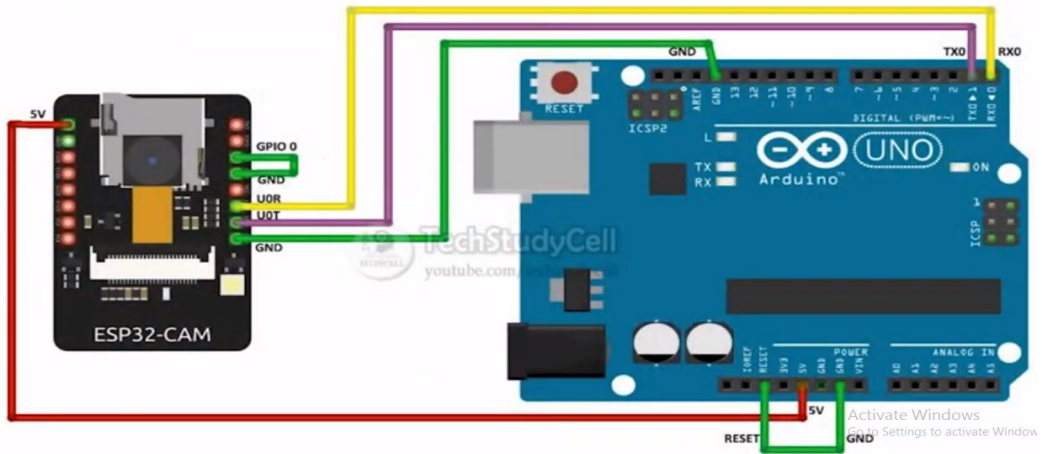


Fig.8 ESP32-CAM connection with Arduino for uploading code

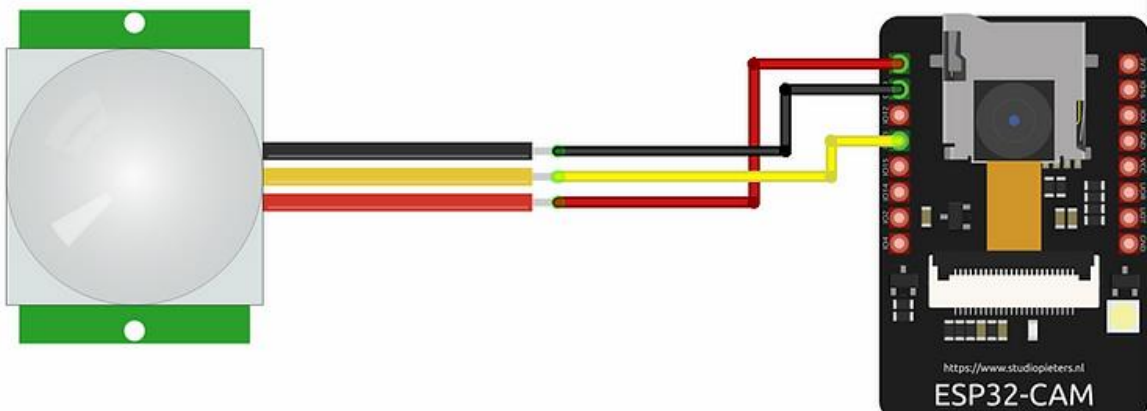


Fig.9 ESP32-CAM connection with PIR sensor

6.4 FLOWCHART

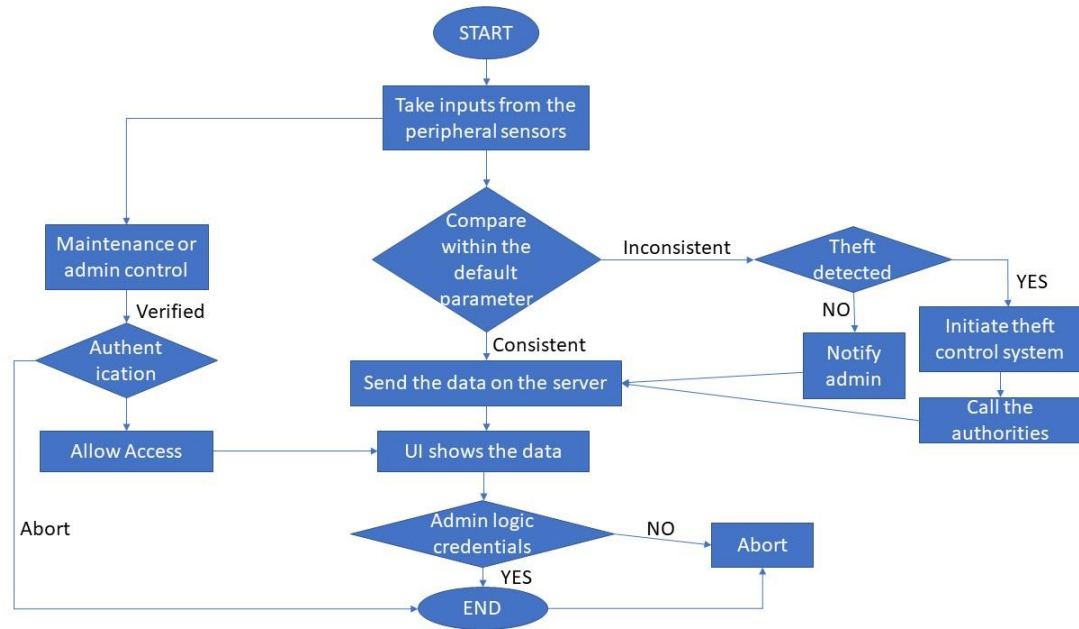
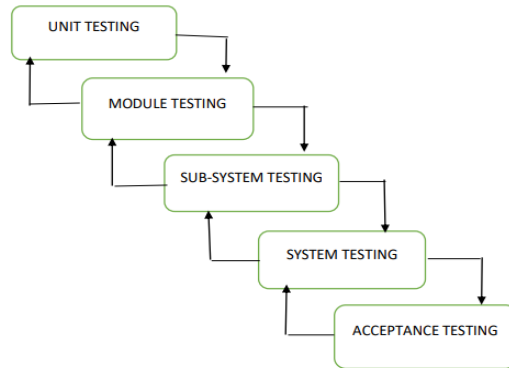


Fig.10 Flowchart for the proposed project

7. TESTING

In our project, we have used spiral model approach for the testing purpose. As we keep moving insides along the spiral model, we are having designing and finally coding. In our case we are using Arduino IDE to upload and edit the code in the Arduino. No other software is developed for this purpose. So, after uploading the code in the Arduino while other connections are already there, we were able to test the modules under different conditions whether it is working accordingly or not. So, if there is any error then we can make changes from IDE and re-upload it and then output of the system is observed. Unit testing begins at the spiral vertex and focuses on implementing source code on each unit of the program. We use Arduino IDE for code development and editing purpose. Monitoring growth by going outside of the integration spiral model monitoring, where emphasis is on computer architecture construct and design. We use online available circuit design platform for the circuit design i.e., Circuit Lab for prototype circuit design purpose. On another turn of the spiral model, we find validity tests against the built code. Her in the Arduino IDE we input different boundary value to test the code under different

conditions and after that is it uploaded in the Arduino board to test its compatibility with the other module. If the component was able to function normally under the boundary conditions, then changes are made otherwise mid-range values are applied. Eventually, we come to a system check where the code and other system components as a whole are tested. For this testing purpose, all the connections are made with the Arduino and whole environment is set up like that and test samples are carried out at different conditions.



7.1 FUNCTIONAL TESTING

Functional test is a test technique in which all the vital important component of the project gets stress test. The main aim of the functional testing is to make sure all the vital components are working at its peak without any hiccups. In our project all the components used are the most vital part i.e., the ultrasonic sensor, reed switch, dc motor are all the vital parts of the system. So functional testing is carried in this entire module to make sure none of the modules is having any sort of fault. Typically, three steps are involved in functional testing:

1. The vital task of the program are identified.
2. Range of value is applied so to know at which range of values it is working properly.
3. Connection are checked very carefully during each testing phase.

Black box testing is a software testing approach that tests an application's features without evaluating its internal structure or functions. This test is adopted to test each

module to its peak level. This test makes sure that all the components in the project is working normally and having robust performance. This black box test includes many of higher standard's tests. Black box testing having more advantage over white box testing. Those are -

- Failed to deliver desired output
- Stability of modules issues during different conditions.
- How robust the modules are performing all together
- Fetching of errors during initializing and ending.

7.2 STRUCTURAL TESTING

White box testing is an approach where it identifies and measures core structures of the project and features to its usability. Internal system analysis and programming skills of the programmer plays an important role in white box testing methodology. So, during the testing of our project, we input different values to obtain the desired and appropriate outputs. This is known as checking nodes in a loop. The reason behind for opting this testing strategy so that we can check every single path within a unit that means checking each component with different value, integration testing between the paths and during system level testing between subsystems. This test case design method may result in showing many different errors and problems, parts of the specification which are still not implemented or the requirements that are missing may not be noticed. White-box testing techniques include:

- Control flow testing
- Data flow testing
- Branch testing
- Statement coverage
- Decision coverage
- Modified condition/decision coverage

- Prime path testing
- Path testing

7.3 LEVELS OF TESTING

7.3.1 Unit Testing:

It is a type of testing where individual units or components of a particular project are tested. The purpose is to validate that each unit of the code performs as expected. Unit Testing is done during the development (coding phase) of an application by the developers. Unit Tests isolate a section of code and verify its correctness. A unit may be an individual function, method, procedure, module, or object. So, during our code development we follow this technique to verify the correctness of the code

7.3.2 Integration Testing:

It is defined as a type of testing where modules are integrated logically and tested as a group. A typical project consists of multiple modules, coded by different programmers. The purpose of this level of testing is to expose defects in the interaction between these modules when they are integrated. So, after completing the coding part we uploaded the code in the Arduino tested each and component behavior at their own field.

7.4 TESTING THE PROJECT

We have checked our project through thick and thin for every possible error we can find. The modules that have been added and integration testing method that includes all the error detection and correction method. All the errors identified during the testing phase have been rectified to the best of our knowledge.

8. Implementation

8.1 Implementation of the project

We have implemented this project keeping in mind about creating more security to bank's assets as well as public safety. While we are implementing this project, we faced many difficulties in the designing phase, coding phase and in the process of maintaining a tight security for the ATM machine. Therefore, to get over this problem we tried to developed number of prototypes and tried to test them under different harsh conditions. This testing methodology helped us to overcome different issues with that we were facing during development phases. We also did some survey on people like what sort of security problems are they facing during use ATM, what sort of idea, if they have any, are they having that can be implemented, what type of security they are expecting from the bank end.

We also tried to have some conversation with the bank authority about the security issues and shared the idea if implementing this type of security systems for the betterment of both the customer and the bank. Therefore, after doing all these researches we tried to put all the things together and tried to put solution of each problems in this project.

8.2 Conversion Plan

There had been few times where we need to change our plans, as we were not getting our desired results. The reasons for making such changes are -

- Unavailability of the proper resources
- Not having proper knowledge on components
- Difficulty faced during module integration
- Some error in the module is not correctable
- Module behaviour in different environment keeps changing
- As the module was not functioning accordingly, so some changes were made in the code.
- Lastly, we completed our project by just keeping those functionalities, which are most vital and important.

8.3. Post-Implementation and Maintenance

Before final implementation of the project, we designed different circuits in the available online platform. After going through different trial and error method, we were able to come up with the correct circuit diagram that were working correctly and accordingly. Before designing of the circuits, we also took feedback from the bank and we designed the circuits accordingly. We also adopted different testing methods during development procedures. For the maintenance, we adopt different strategy and tactics to maintain our system working under different conditions.

9. PROJECT LEGACY

9.1 CURRENT STATUS OF THE PROJECT

The project is completed and so does its implementation. The project is working fine and up to its functionality. It is tested and verified for all its functionalities such as automatic door open, images sending and SMS alert. All the possible errors have been removed. The next step wis to expand its functionality even more so that it become a full-fledged security system.

9.2 REMAINING AREAS OF CONCERN

As it is based on electronic equipment, it needs sufficient 5volt power for turning on Arduino and same for GSM module to send alert messages. The images can only accessed by admin's telegram, to make it available for police and other concerned authority over internet cloud can be used. The door gets locked once someone try to harm the ATM machine so in order to make the robber unconscious a spray system can be added so that he/she cannot escape from ATM booth. Currently, the system send alert message to just one-person i.e. admin, one more functionality can be added that the system inform the nearest police station via message. System cannot be controlled from outside, so Arduino code can be modified in order to make it controllable via authorities phone.

9.3 TECHNICAL AND MANAGERIAL LESSONS LEARNT

One of the most important lessons that we learnt is how to understand the real world problem and make use of available technology to solve it. As we are aware that covid-19 is here to stay and therefore the remote learning is going to take a toll in coming years, this project helped us to learn that how can we make a system while staying at home, it helped in remote learning. We are studying in the CSE/IT department. This project helped us learn some new skills such as Arduino coding and connections. It was a great experience while working with module of project, performing test cases and at the end integrating all the required modules and getting the desired result. We did learn teamwork and team management.

9. USER MANUAL: A HELP GUIDE

Initially, the main door of the ATMs is closed. With the help of ultrasonic sensor, which detects the presence, door opens for 10 seconds. It senses the same by transmitting ultrasonic waves. The waves, when encounter any disturbance in the path, travels back and received by the receiver that helps in measuring the distance between sensor and person. Then the signal is sent to Arduino, which controls the movement of mini servo motor, based on distance measurement the servo motor opens the door and closes it. An Arduino code is used for the same.

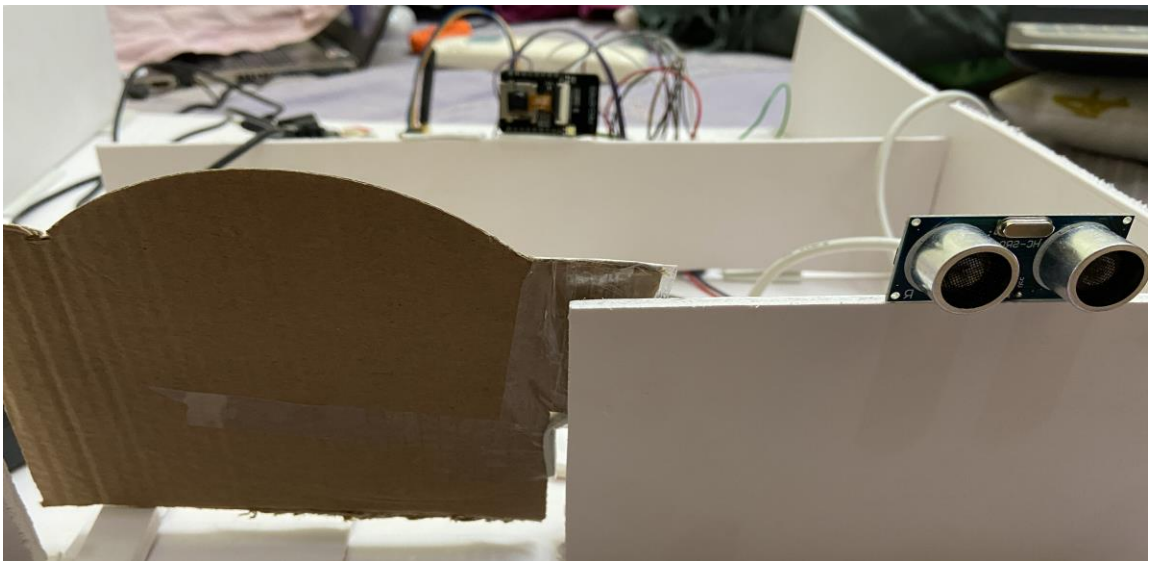


Fig. 11 Automatic Entrance door with Ultrasonic sensor

When the distance is in the range of 0 to 30cms the mini servo opens the door for a few seconds and closes it again.

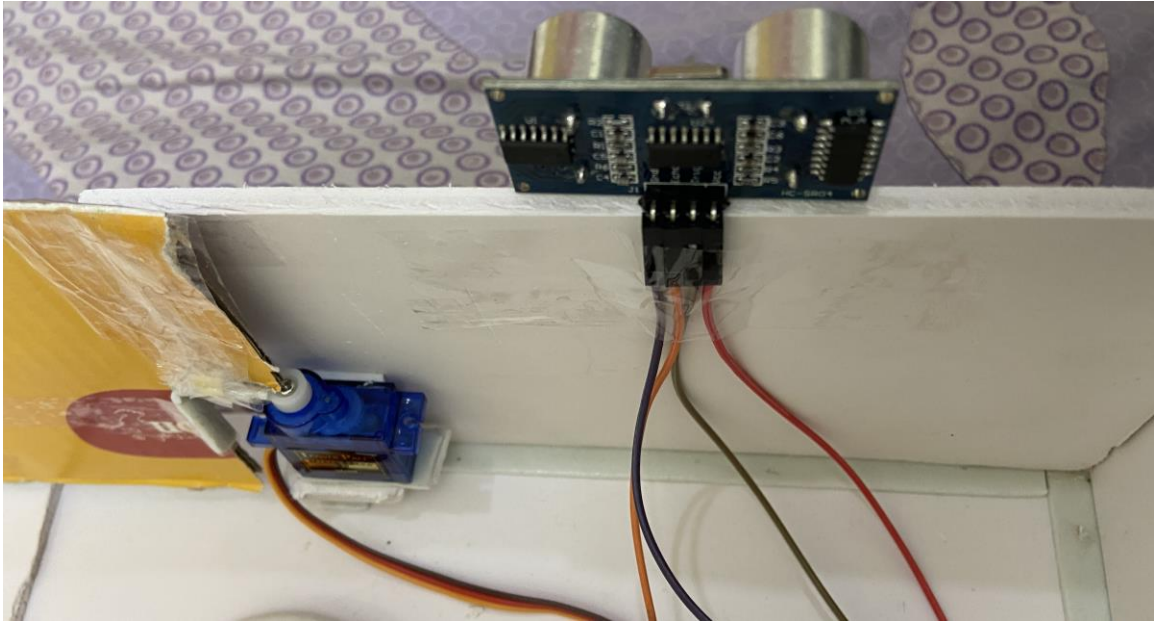


Fig.12 Back view of Entrance

Once the person is inside the ATM booth he can use the service. PIR sensor inside the ATM machine starts detecting motion and ESP32 camera module monitors it and send images to telegram. Therefor ESP32 camera module helps in continuous monitoring of the system.

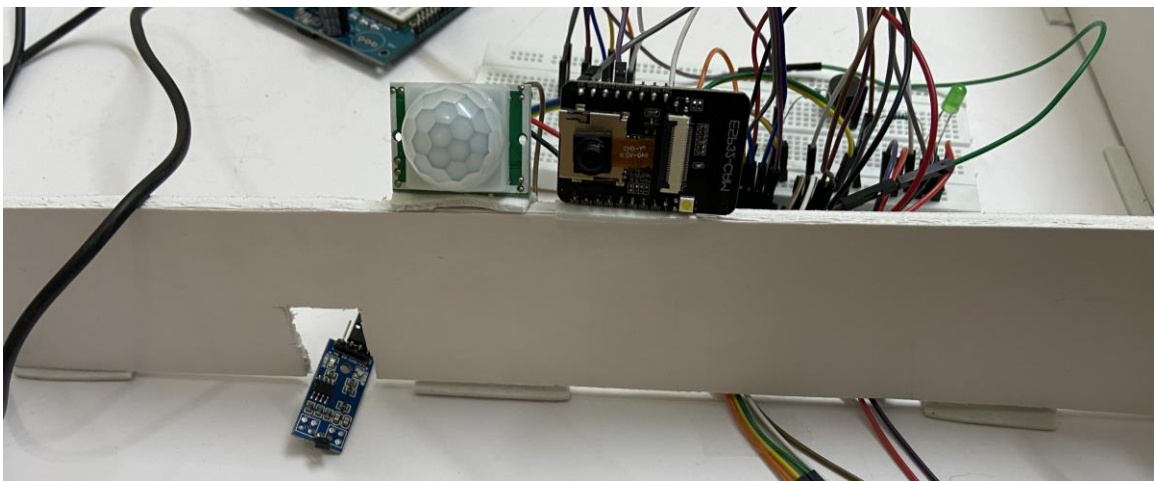


Fig. 13 ESP32 Camera module with PIR sensor

A reed sensor is attach to the door of ATM machine. If any person tries to open, lift or break the door of the machine, the magnetic field fluctuation is detected with the help of reed switch sensor, and the circuit gets open. Once the circuit is open, the main door closes so that the intruder cannot escape the booth, buzzer will get activated and produce an alert sound, and the concerned authority will be informed immediately via SMS through GSM.

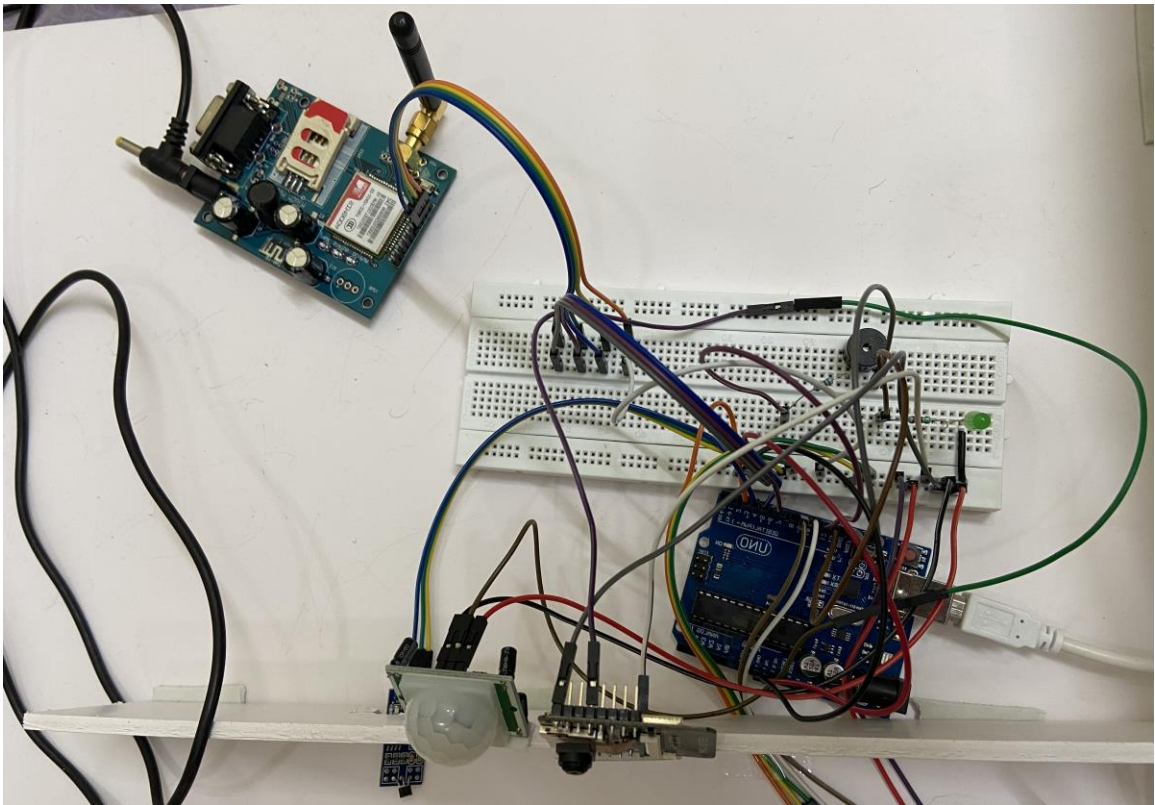


Fig.14 GSM module and Arduino Uno

The authority can access images via telegram. An immediate action will be taken against the intruder. The project connections are:

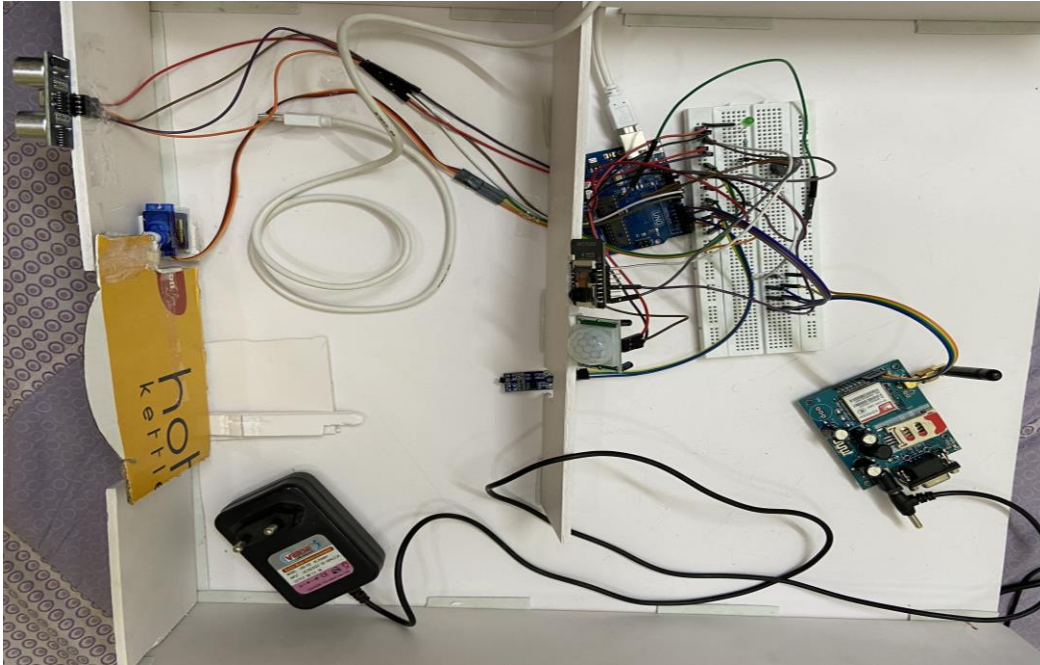


Fig. 15 The proposed system

11. SOURCE CODE AND SYSTEM SNAPSHOT

For Arduino Uno:

```
sketch_apr22a
#include <Servo.h>
#include <SoftwareSerial.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);

SoftwareSerial mySerial(3,2);//5→tx and 6→rx
char msg; //Text message content to be send
const int servoPin = 4;
Servo servoMotor;
float distance;
float duration;
int reedSwitchPin = 8;
int ledPin = 13;
int state = 0;
int pos;
void setup()
{
  pinMode(6, OUTPUT);//trigger of ultrasonic
  pinMode(7, INPUT);//Echo of ultrasonic
  pinMode(11, OUTPUT);//buzzer +ve
  mySerial.begin(9600);
  Serial.begin(9600);
  servoMotor.attach(servoPin);
}
```

```

void loop()
{
  digitalWrite(9,0);
  delayMicroseconds(2);
  digitalWrite(9,1);
  delayMicroseconds(10);
  digitalWrite(9,0);
  duration = pulseIn(10,1);
  distance = duration *(float) 0.034 / 2;//calculation distance for the main door
  Serial.print("Distance = ");
  Serial.print(distance);
  Serial.println(" cms");
  state = digitalRead(reedSwitchPin);
  if (state == LOW)//circuit is closed→ machine's door is closed
  {
    digitalWrite(ledPin, HIGH);
  }
  else //machine's door open i.e., theft occurring
    digitalWrite(ledPin, LOW);
  }
  if(distance>50)
  {
    servoMotor.write(0);
  }

  else if(distance<30 && state==LOW)//checks for user's presence in order to open the //main door
  {
    tone(11, 100);//buzzer start making sound
    servoMotor.write(0);//main door gets closed
    SendMessage();//sms sent to admin
    displaymsg();
    delay(10000);
    noTone(11);//buzzer stops
  }
  else if(state==LOW)
  {
    tone(11, 100); //buzzer start making sound
    SendMessage();//sms sent to admin
    displaymsg();
    servoMotor.write(0); //main door gets closed
    delay(10000);
    noTone(11); //buzzer stops
  }
  else if(distance<30)//main door opens
  {
    for(pos=0;pos<=90;pos++)
    {
      servoMotor.write(pos);
      delay(15);
    }
    delay(1000);

    for(pos=90;pos>=0;pos--)//main door closes
    {
      servoMotor.write(pos);
      delay(15);
    }
  }
  else
  {
    servoMotor.write(0);//main door in normally closed
  }
}

```

```

void SendMessage()// function for sending SMS
{
    //Begin serial communication with Arduino and Arduino IDE (Serial Monitor)
    Serial.begin(9600);

    //Begin serial communication with Arduino and A6
    mySerial.begin(9600);

    Serial.println("Initializing...");
    delay(1000);

    mySerial.println("AT"); //Once the handshake test is successful, it will back to OK
    updateSerial();

    mySerial.println("AT+CMGF=1"); // Configuring TEXT mode
    updateSerial();
    mySerial.println("AT+CMGS=\"+8801636954725\""); //change ZZ with country code and xxxxxxxxxx with phone number to sms
    updateSerial();
    mySerial.print("ATM DOOR SECURITY ALERT!!!\n Theft occuring at Law Gate PNB ATM\n Please take immediate action"); //text content
    updateSerial();
    mySerial.write(26);
}

void updateSerial() {

    delay(500);
    while (Serial.available())
    {
        mySerial.write(Serial.read()); //Forward what Serial received to Software Serial Port
    }
    while(mySerial.available())
    {
        Serial.write(mySerial.read()); //Forward what Software Serial received to Serial Port
    }
}

```

For ESP32 Camera module:

```

sketch_apr23a $
const char* ssid      = "Honor 9 Lite_2A51"; //WIFI SSID
const char* password = "17Pandey#"; //WIFI password
String token = "1790759758:AAFdcz_MpaTRXEL0xT6SrLvIk9fn8LmPEy4";
String chat_id = "827579422";
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include "soc/soc.h"
#include "soc/rtc_cntl_reg.h"
#include "esp_camera.h"
//CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM    32
#define RESET_GPIO_NUM  -1
#define XCLK_GPIO_NUM    0
#define SIOD_GPIO_NUM    26
#define SIOC_GPIO_NUM    27
#define Y9_GPIO_NUM      35
#define Y8_GPIO_NUM      34
#define Y7_GPIO_NUM      39
#define Y6_GPIO_NUM      36
#define Y5_GPIO_NUM      21
#define Y4_GPIO_NUM      19
#define Y3_GPIO_NUM      18
#define Y2_GPIO_NUM      5
#define VSYNC_GPIO_NUM   25
#define HREF_GPIO_NUM    23
#define PCLK_GPIO_NUM    22
int gpioPIR = 13; //PIR Motion Sensor

```

```

void setup()
{
    WRITE_PERI_REG(RTC_CNTL_BROWN_OUT_REG, 0);
    Serial.begin(115200);
    delay(10);
    WiFi.mode(WIFI_STA);
    Serial.println("");
    Serial.print("Connecting to ");
    Serial.println(ssid);
    WiFi.begin(ssid, password);
    long int StartTime=millis();
    while (WiFi.status() != WL_CONNECTED)
    {
        delay(500);
        if ((StartTime+10000) < millis()) break;
    }
    Serial.println("");
    Serial.println("STAIP address: ");
    Serial.println(WiFi.localIP());
    Serial.println("");
    if (WiFi.status() != WL_CONNECTED) {
        Serial.println("Reset");
        ledcAttachPin(4, 3);
        ledcSetup(3, 5000, 8);
        ledcWrite(3,10);
        delay(200);
        ledcWrite(3,0);
        delay(200);
        ledcDetachPin(3);
        delay(1000);
        ESP.restart();
    }
}

```

```

else
{
    ledcAttachPin(4, 3);
    ledcSetup(3, 5000, 8);
    for (int i=0;i<5;i++) {
        ledcWrite(3,10);
        delay(200);
        ledcWrite(3,0);
        delay(200);
    }
    ledcDetachPin(3);
}
camera_config_t config;
config.ledc_channel = LEDC_CHANNEL_0;
config.ledc_timer = LEDC_TIMER_0;
config.pin_d0 = Y2_GPIO_NUM;
config.pin_d1 = Y3_GPIO_NUM;
config.pin_d2 = Y4_GPIO_NUM;
config.pin_d3 = Y5_GPIO_NUM;
config.pin_d4 = Y6_GPIO_NUM;
config.pin_d5 = Y7_GPIO_NUM;
config.pin_d6 = Y8_GPIO_NUM;
config.pin_d7 = Y9_GPIO_NUM;
config.pin_xclk = XCLK_GPIO_NUM;
config.pin_pclk = PCLK_GPIO_NUM;
config.pin_vsync = VSYNC_GPIO_NUM;
config.pin_href = HREF_GPIO_NUM;
config.pin_sscb_sda = SIOD_GPIO_NUM;
config.pin_sscb_scl = SIOC_GPIO_NUM;
config.pin_pwdn = PWDN_GPIO_NUM;
config.pin_reset = RESET_GPIO_NUM;
config.xclk_freq_hz = 20000000;
config.pixel_format = PIXFORMAT_JPEG;
if(psramFound())

```

```

{
    config.frame_size = FRAMESIZE_VGA;
    config.jpeg_quality = 10; //0-63 lower number means higher quality
    config.fb_count = 2;
}
else
{
    config.frame_size = FRAMESIZE_QQVGA;
    config.jpeg_quality = 12; //0-63 lower number means higher quality
    config.fb_count = 1;
}
// camera init
esp_err_t err = esp_camera_init(&config);
if (err != ESP_OK)
{
    Serial.printf("Camera init failed with error 0x%x", err);
    delay(1000);
    ESP.restart();
}
sensor_t * s = esp_camera_sensor_get();
s->set_framesize(s, FRAMESIZE_XGA);
}
void loop()
{
    pinMode(gpioPIR, INPUT_PULLUP);
    int v = digitalRead(gpioPIR);
    Serial.println(v);
    if (v==1)
    {
        alerts2Telegram(token, chat_id);
        delay(10000);
    }
    delay(1000);
}

}
String alerts2Telegram(String token, String chat_id)
{
    const char* myDomain = "api.telegram.org";
    String getall="", getBody = "";
    camera_fb_t * fb = NULL;
    fb = esp_camera_fb_get();
    if(!fb)
    {
        Serial.println("Camera capture failed");
        delay(1000);
        ESP.restart();
        return "Camera capture failed";
    }

    WiFiClientSecure client_tcp;
    if (client_tcp.connect(myDomain, 443))
    {
        Serial.println("Connected to " + String(myDomain));
        String head = "--India\r\nContent-Disposition: form-data; name=\"chat_id\"; \r\n\r\n" + chat_id + "\r\n--India\r\nContent-Disposition: form-data; name=\"photo\"; filename=\"esp32-cam.jpg\"\r\nContent-Type: image/jpeg\r\n\r\n";
        String tail = "\r\n--India--\r\n";
        uint16_t imagelen = fb->len;
        uint16_t extralen = head.length() + tail.length();
        uint16_t totalen = imagelen + extralen;
        client_tcp.println("POST /bot/" + token + "/sendPhoto HTTP/1.1");
        client_tcp.println("Host: " + String(myDomain));
        client_tcp.println("Content-Length: " + String(totalen));
        client_tcp.println("Content-Type: multipart/form-data; boundary=India");
        client_tcp.println();
        client_tcp.print(head);
        uint8_t *fbBuf = fb->buf;
        size_t fbLen = fb->len;
        for (size_t n=0;n<fbLen;n+=1024)
        {

```

```

    {
        if (n+1024<fbLen)
        {
            client_tcp.write(fbBuf, 1024);
            fbBuf += 1024;
        }
        else if (fbLen%1024>0)
        {
            size_t remainder = fbLen%1024;
            client_tcp.write(fbBuf, remainder);
        }
    }

    client_tcp.print(tail);
    esp_camera_fb_return(fb);
    int waitTime = 10000; // timeout 10 seconds
    long startTime = millis();
    boolean state = false;
    while ((startTime + waitTime) > millis())
    {
        Serial.print(".");
        delay(100);
        while (client_tcp.available())
        {
            char c = client_tcp.read();
            if (c == '\n')
            {
                if (getAll.length()==0) state=true;
                getAll = "";
            }
            else if (c != '\r')
                getAll += String(c);
            if (state==true) getBody += String(c);
            startTime = millis();
        }
        if (getBody.length()>0) break;
    }

    ,
    client_tcp.stop();
    Serial.println(getBody);
}
else {
    getBody = "Connection to telegram failed.";
    Serial.println("Connection to telegram failed.");
}
return getBody;
}

```


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