

**A PROJECT REPORT**  
**ON**  
**“AI SMART SURVEILLANCE SYSTEM”**

**Submitted to**  
**Chhatrapati Shivaji Maharaj University**

**SUBMITTED BY**

<b>Mr. APURBA DEY</b>	<b>190100034</b>
<b>Ms. PRASANNA GADADE</b>	<b>190100037</b>
<b>Mr. HASAN JALAL</b>	<b>203121081281</b>

**UNDER THE GUIDANCE OF**  
**PROF. Pradheep M**

**DEPARTMENT OF COMPUTER ENGINEERING**  
**Chhatrapati Shivaji Maharaj University**

**2022-2023**

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ON  
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**Submitted to  
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**In Partial Fulfilment of the Requirement for the Award of**

**BACHELOR’S DEGREE IN  
COMPUTER ENGINEERING**

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<b>Mr. APURBA DEY</b>	<b>190100034</b>
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**2022-23**

**AFFILIATED TO**



**Chhatrapati Shivaji Maharaj University**

**Chhatrapati Shivaji Maharaj University**  
**Department of Computer Engineering**



**CERTIFICATE**

This is certify that the project entitled  
**“AI SMART SURVEILLANCE SYSTEM“**  
submitted by

<b>Mr. APURBA DEY</b>	<b>190100034</b>
<b>Ms. PRASANNA GADADE</b>	<b>190100037</b>
<b>Mr. HASAN JALAL</b>	<b>203121081281</b>

is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Computer Engineering) at Chhatrapati Shivaji Maharaj University, . This work is done during year 2022-23, under our guidance.

**Date:**     /     /

**(Prof. Pradheep M)**  
**Project Guide**

**(Prof. Pradheep M)**  
**Project Coordinator**

**(Prof. Vikas K)**  
**HOD, Computer Department**

**External Examiner**

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APURBA DEY	7045093859	90100034
PRASANNA M GADADE	9137581187	190100037
HASAN JALAL	9458510550	203121081281

# ABSTRACT

Surveillance is becoming a need in any public or private area to cope up with increasing number of threats starting from burglary, robbery to terrorist activities. The traditional methods for monitoring are commonly confined in the use of CCTV cameras or wireless sensor network (WSN).

This project presents a way of using Artificial Intelligence to improve current surveillance system to a whole new advance system taking it to a next level using some AI powered tools and techniques. To perform this task Digital Image processing is used. It is a computer vision technology. Which when combined with AI can power face recognition and authentication functionality for ensuring security in public and private places. In this article Image processing techniques object detection is described which Identity's objects and locate them in images and videos seen through CCTV or any camera operated through the system. Object detection is also computer vision technology. It can be used to count objects from a scene, accurately detect their location and label them for better understanding of the objects captured. It basically draws a box around the each object and label them. This software would allow end user to monitor, find motion in object, capture in and out activity, find motion in the whole frame and record activity of the person.

**Keywords:** Artificial Intelligence, CCTV, Image processing, Camera

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Literature Survey</b>	<b>4</b>
2.1	Introduction . . . . .	4
2.2	Literature Survey . . . . .	4
2.2.1	Paper 1 . . . . .	4
2.2.2	Paper 2 . . . . .	5
2.2.3	Paper 3 . . . . .	5
2.2.4	Paper 4 . . . . .	5
<b>3</b>	<b>Existing Systems</b>	<b>7</b>
3.1	Limitation . . . . .	8
3.2	Problem statement . . . . .	9
3.3	Objectives . . . . .	10
3.4	Project Scope . . . . .	11
3.4.1	Applications . . . . .	11
3.4.2	Goal . . . . .	11
3.5	Advantages . . . . .	12
<b>4</b>	<b>Proposed Systems</b>	<b>13</b>
4.1	Computer Vision . . . . .	13
4.2	Proposed system . . . . .	15
4.3	Flow of Proposed project . . . . .	16
<b>5</b>	<b>Software Requirements Specification</b>	<b>18</b>
5.1	Introduction . . . . .	18
5.2	Functional Requirements . . . . .	19
5.3	Non-functional Requirements . . . . .	19
5.3.1	Product Requirements . . . . .	20
5.3.2	Organizational Requirements . . . . .	21

5.4	User Requirements . . . . .	21
5.4.1	Basic Operational Requirements . . . . .	21
5.4.2	Hardware requirements . . . . .	22
5.4.3	Software Requirements . . . . .	23
<b>6</b>	<b>Project Design</b>	<b>24</b>
6.1	Introduction . . . . .	24
6.2	System Development Methodology . . . . .	24
6.2.1	Model Phases . . . . .	24
6.2.2	Reason for choosing waterfall model as development method	25
6.3	DFD Diagram . . . . .	27
6.4	Use Case Diagram . . . . .	29
6.5	Sequence Diagram . . . . .	31
<b>7</b>	<b>System Testing</b>	<b>32</b>
7.1	Introduction . . . . .	32
7.2	Test Cases and Test Results . . . . .	33
<b>8</b>	<b>Project Planning</b>	<b>34</b>
8.1	Introduction . . . . .	34
8.2	Gantt Chart . . . . .	36
<b>9</b>	<b>Implementation</b>	<b>37</b>
9.1	Introduction . . . . .	37
9.2	Block Diagram . . . . .	37
<b>10</b>	<b>Screenshots of Project</b>	<b>39</b>
10.1	Login/Register . . . . .	39
10.2	Modules . . . . .	42
<b>11</b>	<b>Conclusion and Future Scope</b>	<b>46</b>
11.1	Conclusion . . . . .	46
11.2	Future Scope . . . . .	46
<b>12</b>	<b>Future Work</b>	<b>48</b>
12.1	Future Work for the project . . . . .	48
	<b>References</b>	<b>48</b>

# List of Figures

4.1	<b>FLOW OF PROPOSE PROJECT</b>	16
6.1	<b>Waterfall model</b>	26
6.2	<b>DFD Diagram</b>	28
6.3	<b>Use Case Diagram</b>	30
6.4	<b>Sequence Diagram</b>	31
8.1	<b>Project Implementation plan</b>	35
8.2	<b>Gantt chart</b>	36
9.1	<b>Block Diagram of System</b>	38



# Chapter 1

## Introduction

Machine learning and understanding of human actions is a challenging area that has received much attention within the past years. Video Surveillance is one of the active research topics in Image Processing. Video Surveillance started with analogue CCTV systems, to gather information and to monitor people, events and activities. Existing digital video surveillance systems provide the infrastructure only to capture, store and distribute video, while leaving the task of threat detection exclusively to human operators. Human monitoring of surveillance video is a very labour-intensive task.

Detecting multiple activities in real-time video is difficult in manual analysis. Thus the Intelligent video surveillance system is emerged. The analytic software processes video flow images to automatically detect objects (peoples, equipment's, and vehicles) and event of interest for security purposes. In real time, video surveillance systems detect situations in video flow that represent a security threat and trigger an alarm. Observing or analysing a particular site for safety and business purposes is known as video surveillance. Security and crime control concerns are the motivating factors for the deployment of video surveillance cameras.

Video surveillance cameras are used in shopping centres, public places, banking institutions, companies and ATM machines. Nowadays, researches experience continuous growth in network surveillance. The reason being is the instability incidents that are happening all around the world. Therefore, there is a need of a smart surveillance system for intelligent monitoring that captures data in real time, transmits, processes and understands the information related to those monitored. The video data can be used as a forensic tool for after-crime inspection. Hence, these systems ensure high level of security at public places which is usually an extremely complex challenge. As video cameras are available at good price in the market, hence video

surveillance systems have become more popular. Video surveillance systems have wide range of applications like traffic monitoring and human activity understanding. In video surveillance system we demonstrate a system which analyses activity in the monitored space in real time, and makes the events available for generating real time alerts and content based searching in real time.

## **Chapter 2**

### **Literature Survey**

#### **2.1 Introduction**

Literature survey is mainly carried out in order to analyze the background of the current project which helps to find out flaws in the existing system and guides on which unsolved problems we can work out. So, the following topics not only illustrate the background of the project but also uncover the problems and flaws which motivated to propose solutions and work on this project.

#### **2.2 Literature Survey**

The beginning of the era with automation and digital world always requires a safety and security measures as the data flow from different sectors have various security threats in different forms, either as malicious or suspicious activity through the network or physically over the data preserved in the network and physically respectively. These security systems might be a well- trained dog or person in charge of the area in the early days. Nowadays, the technological growth has led to utilization of modern equipment's in detecting the doubtful movements, minimizing the weariness of the humans and enabling an easy identification and tracking of person.

##### **2.2.1 Paper 1**

1) A Progress Review of Intelligent CCTV Surveillance Systems:  
CCTV based surveillance has developed from simple systems comprising a camera connected directly to a viewing screen with an observer in a control room, watching for incidents of crime or vandalism or searching for targeted individuals, to complex multi camera systems with many computers. The project Smart CCTV camera surveillance system is to enhance the CCTV camera based security systems, which

presently exist in different places. The Project Security System by using CCTV Camera is designed using wireless technology. For the object detection no need of multiple camera only single camera cover large area. As the number of camera increases also the cost increases therefore in this project single camera is used for cost effectiveness.

### **2.2.2 Paper 2**

#### **2) Webcam Based Intelligent Surveillance System:**

The objective of this project is to develop a system that monitors the area in which it is being implemented. An Intelligent Monitoring Sensor is applicable in the area where no one is permissible to enter, also where we need to detect if any motion has been done. Camera used here is not movable. It is fixed in the monitoring area also the camera is continuously on. In this project in automatic mode PIR sensor will detect person movement and will give signal to the micro-controller to start the CCTV camera by using Relay. IR sensor will track the person movement and give the signal to micro controller. Accordingly stepper motor will be actuated to rotate the CCTV assembly.

### **2.2.3 Paper 3**

#### **3) Real Time Face Detection and Tracking Using OpenCV**

Context: In this paper, we intend to Implement a real-time Face detection and tracking the head poses position from high definition video using Haar Classifier through Raspberry Pi BCM2835 CPU processor which is a combination of SoC with GPU based Architecture. SimpleCV and OpenCV libraries are used for face detection and tracking the head poses position. The experimental result computed by using computer vision SimpleCV and OpenCV framework libraries along with above mentioned hardware results were obtained through of 30 fps under 1080p resolutions for higher accuracy and speediness for face detection and tracking the head poses position.

### **2.2.4 Paper 4**

#### **4) Enhanced Home Security Using IOT and Raspberry PI**

Context: A smart home application features great help to our everyday life. This system rejuvenates facilities of a house to evolve into a smart home by adding more

security features. The improvement in security aspect offers innovative and productive scope to the means of living. All these characteristics is adapted by using Internet of Things (IoT) and Raspberry Pi. The recognition problem is always questionable in smart home applications. So, a recovery is done to identify the intruder as known or unknown by the use of image processing techniques for face recognition. This tend to solve many issues in terms of authentication. This protection mechanism notifies the user accordingly, giving a clear picture of the scenario happening at the users house. The sensor based system highlights many features enabling it to be widely used. Fire sensor detects any temperature increase in the living room and posts its status in the URL given to the user. The gas sensor helps in detecting the presence of any gas leakage based on the intensity of the gas in air. With the help of DC motor, auto door locking mechanism is actuated. This is very useful. All the statuses are processed between the sensors and the user via IoT. Raspberry Pi connects all the components and brings forth the proper functioning of the whole package. The procedures that are used here are very simple. Hence, even novice users could understand the systems advanced features and use it with ease. The use of surveillance camera also helps in identifying the presence of flame and thus a buzzer is activated in the case of fire detection.

## **Chapter 3**

### **Existing Systems**

In today's world security is of utmost importance and also the space available to store data. Generally surveillance security systems like video cameras store all the video footage recorded. As the qualities of these cameras have been increasing there is a shortage in storage. Also another main of these security services is that a lot of idle footage exists in these videos when nothing happens. The footage of actual activity is very less compared to the footage where nothing usually happens.

#### **A. Current Surveillance Systems**

The current Surveillance systems used are old and outdated. Most of them run on the same functionality. Storing video for 40 - 45 days and then deleting the old Videos. This is due to storage issues. The storage is limited and cannot store so much data. Most of the data however is still footage of nothing happening. This is the biggest drawback. Around 75% of storage space can be saved in the database. The storage capacity of the no. of days of video content can be increased up to three times.

#### **B. Surveillance System using Face recognition**

Some advanced secure facilities like military research facilities and parts of high secure cities like in China implement a surveillance system using facial recognition. This method requires taking information of a particular person's face and using expensive high quality cameras with codes implemented in them. This system however is very heavy and not light enough to be implemented on a mobile platform or low end computers.

### Drawbacks of Existing System:

- No motion and object detection.
- Requires high quality heavy systems.
- No remote access
- Cannot identify the objects.
- No intrusion notification system.
- Need to refer long hours of recording for investigation.

## **3.1 Limitation**

Although use of AI based Surveillance system technology is becoming popular day by day, there are however some limitations to it.

- This type of system requires use of internet or network so as to get remote access.
- Good quality CCTV cameras are required to capture more accurate and precise images or record video.
- The system need to run at all time to perform surveillance. If the application crashes or system shuts down the software won't work.

### **3.2 Problem statement**

Most of the current surveillance system only allows to see live footage or recorder footage and requires a person to monitor the system at all time. If we want to see a particular instance in the footage we need to go through all CCTV footages which are in tons. Also the limitation in the ability of human to vigilantly monitor live video surveillance and keep a track of what's happening around the camera lacks the security protocol. The current system can only be accessed from that system not allowing the administrator to access the footages from other locations. It becomes difficult to identify objects seen in the footages and keep a track of known and unknown people or any object.

As the current system is totally manual there are some limitations to the system.



### **3.3 Objectives**

The objective of this project is to create an advanced surveillance system using AI, machine learning and Deep learning tools and techniques. This techniques could be motion detection system, object detect and recognize system. Using this type of advanced software the system would do all the manual surveillance work in no time creating less human error. Also the aim of this project is to allow the administrator to access live recording and stored content to be view through any of his digital device like smartphone or alert messages if any unauthorized or unknown person tries to break security rules. This would allow increase in security to that area.

Wann-Yun Shieh(Wann-Yun Shiehet al., 2009) proposed a human-shape-based falling algorithm and this algorithm was implemented in a multicamera video surveillance system. The algorithm is implemented in real world environment for functionality proof. In this algorithm, multiple cameras are used to fetch the images from different regions required to monitor. A falling-pattern recognition approach is used to determine if an accidental falling has occurred. Also, in that case a short message will be sent to someone who needs to be alerted. Hae-Min Moon(Hae-Min Moonet al.,2010) proposed the system on human identification method that uses height and clothing-colour information appropriate for the intelligent video surveillance system based on smartcard. Reliable feature information can be obtained using the smartcard. It uses octree-based colour quantization technique to the clothing region for colour extraction and height is extracted from the geometrical information of the images. The similarities between the two images are compared based on the Euclidean distance.

### **3.4 Project Scope**

Security has become one of the most important factor in life and with the help of AI in surveillance system it will become an ease. Since it has a practical real life implementation it could be used anywhere easily and efficiently just like any other software, providing 24/7 security and great results. If the system could be attached with infrared cameras or any device which could be used to detect objects at night time even if the environment is dark could end up providing more security.

Using Cloud based computing the security and surveillance sector can be reshaped to whole new level. Security can be offered as a service that can be managed remotely, freeing up valuable human and capital resources that no longer need to be on site at every location that requires monitoring. Secure remote access to security systems will increase in use, including by end users who want the convenience and real-time benefits of being able to monitor property and events without having to be physically present.

It will also allow much larger volumes of data to be stored, cost-effectively and securely, at dedicated server facilities, allowing users to archive video and associated data for longer periods of time and improve its accessibility as well.

#### **3.4.1 Applications**

1)Automatically detect objects/people in motion as seen in the video frame. 2) Connect to multiple different surveillance cameras. 3) Access through mobile devices. 4) Remote access

#### **3.4.2 Goal**

Goal of this project is to develop a system that focus on following major criteria:

- Record keeping and archiving.
- Efficient and automated capture images/video and store.
- Reduce capture Time.
- Reduced manual monitoring.
- To recognize objects accurately and precisely.
- Make data available in orderly efficient manner and for long time without any loss.

### **3.5 Advantages**

As the current system is having many limitations, the new system overcomes them and has many advantages. The advantages are as follows:-

- 1) While monitoring also detects the face of the person.
- 2) We can define a rectangle inside anywhere in the frame and can find out the motion inside that.
- 3) Captures in and out activity of a person and stores the images in respective folders.
- 4) Can recognize motion of more than one person.
- 5) Can detect more than one face while monitoring.

## **Chapter 4**

### **Proposed Systems**

#### **4.1 Computer Vision**

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe and understand.

Computer vision works much the same as human vision, except humans have a head start. Human sight has the advantage of lifetimes of context to train how to tell objects apart, how far away they are, whether they are moving and whether there is something wrong in an image.

Computer vision trains machines to perform these functions, but it has to do it in much less time with cameras, data and algorithms rather than retinas, optic nerves and a visual cortex. Because a system trained to inspect products or watch a production asset can analyze thousands of products or processes a minute, noticing imperceptible defects or issues, it can quickly surpass human capabilities.

Computer vision needs lots of data. It runs analyses of data over and over until it discerns distinctions and ultimately recognize images. For example, to train a computer to recognize automobile tires, it needs to be fed vast quantities of tire images and tire-related items to learn the differences and recognize a tire, especially one with no defects.

Two essential technologies are used to accomplish this: a type of machine learning called deep learning and a convolutional neural network (CNN).

Machine learning uses algorithmic models that enable a computer to teach itself about the context of visual data. If enough data is fed through the model, the computer will “look” at the data and teach itself to tell one image from another. Algorithms enable the machine to learn by itself, rather than someone programming it to recognize an image.

A CNN helps a machine learning or deep learning model “look” by breaking images down into pixels that are given tags or labels. It uses the labels to perform convolutions (a mathematical operation on two functions to produce a third function) and makes predictions about what it is “seeing.” The neural network runs convolutions and checks the accuracy of its predictions in a series of iterations until the predictions start to come true. It is then recognizing or seeing images in a way similar to humans.

Much like a human making out an image at a distance, a CNN first discerns hard edges and simple shapes, then fills in information as it runs iterations of its predictions. A CNN is used to understand single images. A recurrent neural network (RNN) is used in a similar way for video applications to help computers understand how pictures in a series of frames are related to one another.

Some of the modules provided in Computer Vision also used in this project are:-

- **Image classification** sees an image and can classify it (a dog, an apple, a person’s face). More precisely, it is able to accurately predict that a given image belongs to a certain class. For example, a social media company might want to use it to automatically identify and segregate objectionable images uploaded by users.
- **Object detection** can use image classification to identify a certain class of image and then detect and tabulate their appearance in an image or video. Examples include detecting damages on an assembly line or identifying machinery that requires maintenance.
- **Object tracking** follows or tracks an object once it is detected. This task is often executed with images captured in sequence or real-time video feeds. Autonomous vehicles, for example, need to not only classify and detect objects such as pedestrians, other cars and road infrastructure, they need to track them in motion to avoid collisions and obey traffic laws.
- **Content-based image retrieval** uses computer vision to browse, search and retrieve images from large data stores, based on the content of the images rather than

metadata tags associated with them. This task can incorporate automatic image annotation that replaces manual image tagging. These tasks can be used for digital asset management systems and can increase the accuracy of search and retrieve.

## **4.2 Proposed system**

The proposed system developed will allows the end user to monitor, find motion in a selected region, to capture in and out activity, find motion in the whole frame, monitor in night mode, record the activity of the person with system date and time.

The different modules for user access will be:

**1.Monitor:** In the monitor module the activity of the person gets monitored. While monitoring it will show the current date and time. Also detects the faces of people.

**2.Rectangle:** In a rectangle module we can create a rectangle by dragging a box around the object or person and it will automatically track the dragged object/person at all time wherever the object or person may move within that camera frame.

**3.In and Out:** In this module it detects activity of the person going in and out. If he/she enters the room/any gate then it will detect that, capture the image and store it inside the 'in' folder. When he/she got out of the room/gate then it will detect that, capture the image and store it inside the 'out' folder. Both the 'in' and 'out' folders will be stored in common folder called 'visitors'. Which will store all the data of the persons going inside and outside.

**4.Motion:** In this module it will detect the motion in the whole frame. If there is any motion then it will detect motion in green color and if there is no motion then it will detect no motion in red color.

**5.Record:** In this module it will record the activity of the person and store the footage inside the 'recordings' folder with current system date and time.

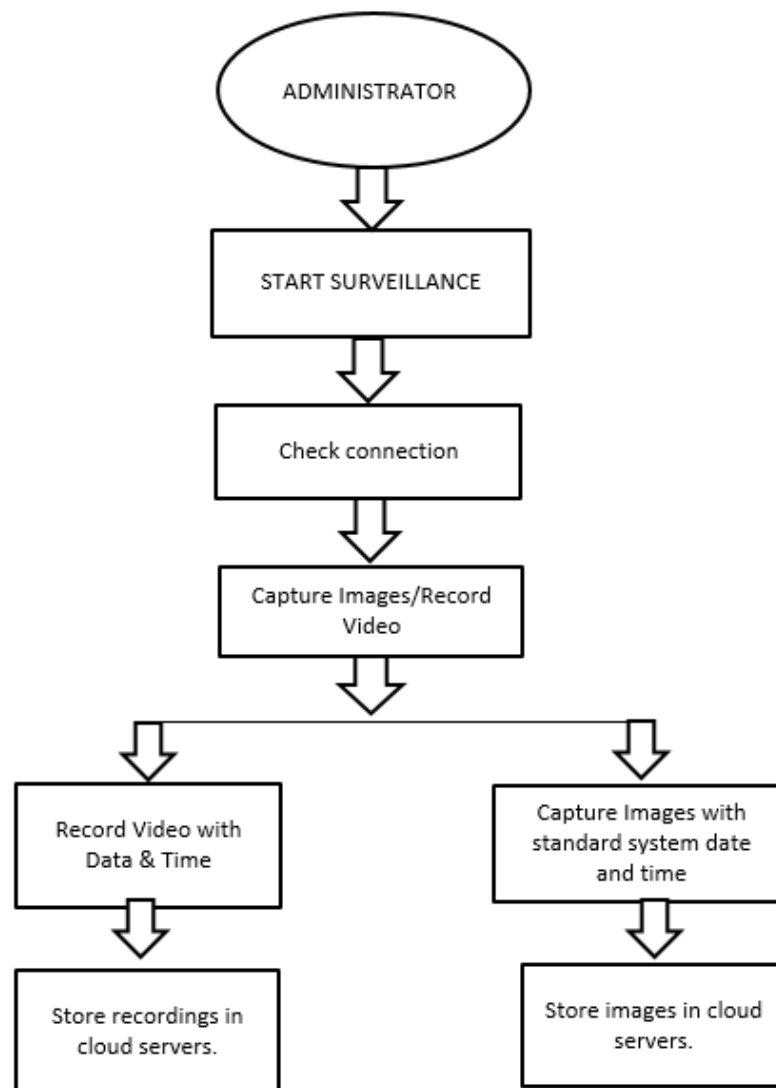
**6.Night Vision:** In this module the user will be able to monitor the surveillance area at night time. Two frames are provided one greyscale and second threshold.

**7.Detection:** In this module the object appearing within the camera frame will be detected and labeled with object name.

**8.Exit:** In the exit module the user can close the software.

### 4.3 Flow of Proposed project

Smart video surveillance provides a cost-effective alternative for public safety workers to monitor activities in almost any location, without adding more feet on the street. Both fixed and mobile video services can be deployed to deliver a range of benefits to communities while increasing the efficiency and effectiveness of public safety workers. The following diagram shows the flow of our system and the processes involved.



**Figure 4.1: FLOW OF PROPOSE PROJECT**

First administrator has to configure all the CCTV cameras with the system while installation. Login credentials will also be provided to user. On start the application will first check for if the device is having camera. If camera is available it will obtain steady image

Which is used as standard image. Now our application will continuously takes photo frames and compare current frame with previous one. This will help it to detect any movement is there or not. The rate of frame capturing is 10frames/sec i.e. the application can detect movement even it is in 1msec. As soon as there is detection of intrusion application will store captured frame to a specified folder of System. The images will be stored with system date and time exactly when the image was captured into system folder.

Using the auto sync of cloud services available such as Microsoft OneDrive and Google drive the images and recordings stored in the folder will be directly available on that particular cloud service application. The admin/user can login into the cloud service platform and access the images and recording folder.



## **Chapter 5**

# **Software Requirements Specification**

### **5.1 Introduction**

This chapter describes about the requirements. It specifies the hardware and software requirements that are required in order to run the application properly. The Software Requirement Specification (SRS) is explained in detail, which includes overview of dissertation as well as the functional and non-functional requirement of this dissertation. A SRS document describes all data, functional and behavioral requirements of the software under production or development. SRS is a fundamental document, which forms the foundation of the software development process. Its the complete description of the behavior of a system to be developed. It not only lists the requirements of a system but also has a description of its major feature. Requirement Analysis in system engineering and software engineering encompasses those tasks that go into determining the need or conditions to meet for a new or altered product, taking account of the possibly conflicting requirements of the various stakeholders, such as beneficiaries or users. Requirement Analysis is critical to the success to a development project. Requirement must be documented, measurable, testable, related to in identified business needs or opportunities, and defined to a level of detail sufficient for system design. The SRS functions as a blueprint for completing a project. The SRS is often referred to as the parent document because all subsequent project management documents, such as design specifications, statements of work, software architecture specification, testing and validation plans, and documentation plans, are related to it. It is important to note that an SRS contains functional and non-functional requirements only. Thus the goal of preparing the SRS document is to

- To facilitate communication between the customer, analyst, system developers, maintainers.
- To serve as a contrast between purchaser and supplier.

- To firm foundation for the design phase.
- Support system testing facilities.
- Support project management and control.
- Controlling the evolution of the system.

## **5.2 Functional Requirements**

Functional Requirement defines a function of a software system and how the system must behave when presented with specific inputs or conditions. These may include calculations, data manipulation and processing and other specific functionality. In this system following are the functional requirements:-

- Acquiring object images
- Acquiring face images
- Processing face images
- Face detection
- Automation storage
- Automatic connect to database
- Auto sync cloud application

## **5.3 Non-functional Requirements**

Non-functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviors. They may relate to emergent system properties such as reliability, response time and store occupancy. Non-functional requirements arise through the user needs, because of budget constraints, organizational policies, the need for interoperability with other software and hardware systems or because of external factors such as:-

- Product Requirements
- Organizational Requirements
- User Requirements
- Basic Operational Requirements

In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. This should be contrasted with functional requirements that define specific behaviour or functions. The plan for implementing

non-functional requirements is detailed in the system architecture. Broadly, functional requirements define what a system is supposed to do and non-functional requirements define how a system is supposed to be. Functional requirements are usually in the form of system shall do requirement, an individual action of part of the system, perhaps explicitly in the sense of a mathematical function, a black box description input, output, process and control functional model or IPO Model. In contrast, nonfunctional requirements are in the form of system shall be requirement, an overall property of the system as a whole or of a particular aspect and not a specific function.

The system's overall properties commonly mark the difference between whether the development project has succeeded or failed.

Non-functional requirements of our project include:

- **Security**
- **Maintainability** - As a tool to obtain the ease of maintainability UML will be used in the development process.
- **Portability** - To ensure portability, the system will be developed in PYTHON language.

### **5.3.1 Product Requirements**

- **Portability:** Since the AI Surveillance system is designed to run using python language with its packages, the system is portable.
- **Correctness:** It follows a well-defined set of procedures and rules to compute and also rigorous testing is performed to confirm the correctness of the data and working of modules.
- **Ease of Use:** The front end is designed in such a way that it provides an interface which allows the user to interact in an easy manner.
- **Modularity:** The complete product is broken up into many modules and well defined interfaces are developed to explore the benefit of flexibility of the product.
- **Robustness:** This software is being developed in such a way that the overall performance is optimized and the user can expect the results within a limited time with utmost relevancy and correctness.

whereas evolution quality involves testability, maintainability, extensibility or scalability.

### **5.3.2 Organizational Requirements**

Process Standards: IEEE standards are used to develop the application which is the standard used by the most of the standard software developers all over the world. Design Methods: Design is one of the important stages in the software engineering process. This stage is the first step in moving from problem to the solution domain. In other words, starting with what is needed design takes us to work how to satisfy the needs.

## **5.4 User Requirements**

The user requirements document (URD) or user requirements specification is a document usually used to software engineering that specifies the requirements the user expects from software to be constructed in a software project. Once the required information is completely gathered it is documented in a URD, which is meant to spell out exactly what the software must do and becomes part of the contractual agreement. A customer cannot demand feature not in the URD, whilst the developer cannot claim the product is ready if it does not meet an item of the URD. The URD can be used as a guide to planning cost, timetables, milestones, testing etc. The explicit nature of the URD allows customers to show it to various stakeholders to make sure all necessary features are described. Formulating a URD requires negotiation to determine what is technically and economically feasible. Preparing a URD is one of those skills that lies between a science and economically feasible. Preparing a URD is one of those skills that lies between a science and an art, requiring both software technical skills and interpersonal skills.

### **5.4.1 Basic Operational Requirements**

Operational requirement is the process of linking strategic goals and objectives to tactic goals and objectives. It describes milestones, conditions for success and explains how, or what portion of, a strategic plan will be put into operation during a given operational period, in the case of, a strategic plan will be put into operation during a given operational period, in the case of commercial application, a fiscal year or another given budgetary term. An operational plan is the basis for, and justification of an annual operating budget request. Therefore, a five-year strategic plan would typically require five operational plans funded by five operating budgets. Operational plans should establish the activities and budgets for each part of the organization for the next 1-3 years. They link the strategic plan with the activities the

organization will deliver and the resources required to deliver them. An operational plan draws directly from agency and program strategic plans to describe agency and program missions and goals, program objectives, and program activities. Like a strategic plan, an operational plan addresses four questions:

- Where are we now?
- Where do we want to be?
- How do we get there?

The customers are those that perform the eight primary functions of systems engineering, with special emphasis on the operator as the key customer. Operational requirements will define the basic need and, at a minimum, will be related to these following points:

- Mission profile or scenario: It describes about the procedures used to accomplish mission objective. It also finds out the effectiveness or efficiency of the system.
- Performance and related parameters: It points out the critical system parameters to accomplish the mission
- Utilization environments: It gives a brief outline of system usage. Finds out appropriate environments for effective system operation.
- Operational life cycle: It defines the system lifetime

#### **5.4.2 Hardware requirements**

- a) Processor type : Pentium III-compatible processor or faster.
- b) Processor speed : Minimum: 1.0 GHz, Recommended : 2.0 GHz or faster
- c) RAM : Minimum 4 GB or more
- d) HARD DISK : 20GB or more to store images and recordings.
- e) Monitor : VGA or higher resolution 800x600 or higher resolution
- f) CCTV Cameras : Any type of CCTV camera including mobile cameras by connecting over same network using 3rd party application.

### **5.4.3 Software Requirements**

- a. Python 3.7/3.10 : Coding Application Interface.
- b. Tinker GUI KIT : Access and Run CCTV cameras.
- c. OpenCV : Computer vision Library
- d. Xampp : Localhost Server
- e. MySQL : Database
- f. Microsoft OneDrive : Cloud Server Platform
- g. dlib : A toolkit for making real world machine learning.

## **Chapter 6**

### **Project Design**

#### **6.1 Introduction**

Design is a meaningful engineering representation of something that is to be built. It is the most crucial phase in the developments of a system. Software design is a process through which the requirements are translated into a representation of software. Design is a place where design is fostered in software Engineering. Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. Design is the perfect way to accurately translate a customers requirement in the finished software product. Design creates a representation or model, provides details about software data structure, architecture, interfaces and components that are necessary to implement a system. The logical system design arrived at as a result of systems analysis is converted into physical system design.

#### **6.2 System Development Methodology**

System development method is a process through which a product will get completed or a product gets rid from any problem. Software development process is described as a number of phases, procedures and steps that gives the complete software. It follows series of steps which is used for product progress. The development method followed in this project is waterfall model.

##### **6.2.1 Model Phases**

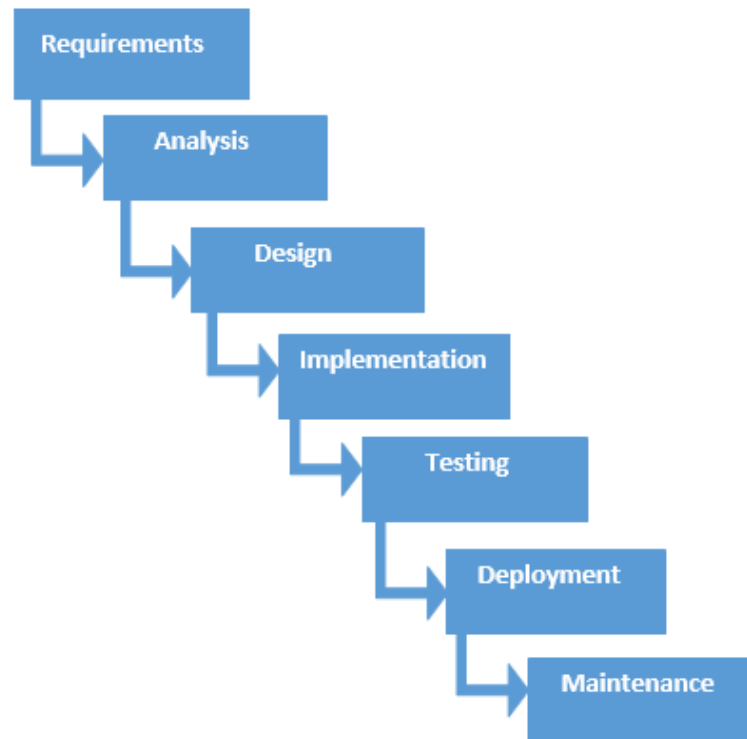
The waterfall model is a sequential software development process, in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Requirement initiation, Analysis, Design, Implementation, Testing and maintenance.

- **Requirement Analysis:** This phase is concerned about collection of requirement of the system. This process involves generating document and requirement review.
- **System Design:** Keeping the requirements in mind the system specifications are translated in to a software representation. In this phase the designer emphasizes on:- algorithm, data structure, software architecture etc.
- **Coding:** In this phase programmer starts his coding in order to give a full sketch of product. In other words system specifications are only converted in to machine readable compute code.
- **Implementation:** The implementation phase involves the actual coding or programming of the software. The output of this phase is typically the library, executables, user manuals and additional software documentation
- **Testing:** In this phase all programs (models) are integrated and tested to ensure that the complete system meets the software requirements. The testing is concerned with verification and validation.
- **Maintenance:** The maintenance phase is the longest phase in which the software is updated to fulfill the changing customer need, adapt to accommodate change in the external environment, correct errors and oversights previously undetected in the testing phase, enhance the efficiency of the software.

### **6.2.2 Reason for choosing waterfall model as development method**

- Clear project objectives.
- Stable project requirements.
- Progress of system is measurable.
- Strict sign-off requirements.
- Helps you to be perfect.
- Logic of software development is clearly understood.
- Production of a formal specification
- Better resource allocation.
- Improves quality. The emphasis on requirements and design before writing a single line of code ensures minimal wastage of time and effort and reduces the risk of schedule slippage.
- Less human resources required as once one phase is finished those people can start working on to the next phase.





**Figure 6.1: Waterfall model**

### **6.3 DFD Diagram**

The DFD is also called as bubble chart. A data-flow diagram (DFD) is a graphical representation of the “flow” of data through an information system. DFD’s can also be used for the visualization of data processing. The flow of data in our system can be described in the form of dataflow diagram as follows:-

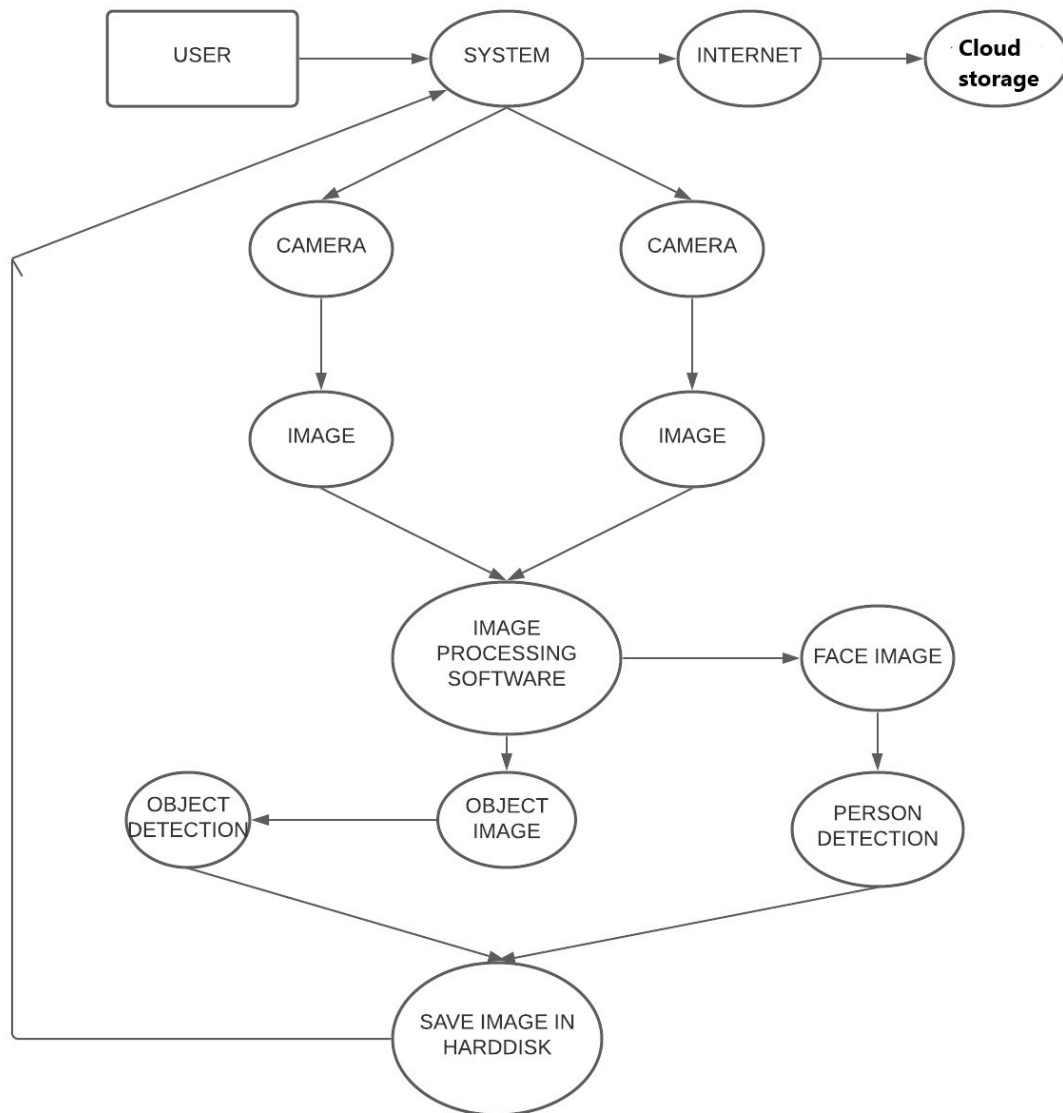
In our system when the user gives CCTV camera access to the computer system containing application software , It starts to capture all sorts of images such as object images , person’s face images and stores in the desired folder in the system using the image processing concept.

It will also compare captured images with the standard already stored images to find any unknown intrusion in that surveillance premises.

Image Processing will allow to capture accurate and precise images for more efficient security.

The image processing software involves the following modules:-

- 1)**Object Detection:** This set of technologies can detect moving objects in a video sequence generated by a static camera. The detection techniques are tolerant to changes in natural lighting, reasonable changes in the weather, distracting movements (like trees waving in the wind), and camera shake.
- 2) **Object Tracking:** This set of technologies can track the shape and position of multiple objects as they move around a space that is monitored by a static camera. The techniques are designed to handle significant occlusions as objects interact with one another.
- 3) **Object Classification:** These technologies use various properties of an object including shape, size and movement to assign a class label to the objects. Typical labels include, Person, Group and Vehicle.

**Figure 6.2: DFD Diagram**

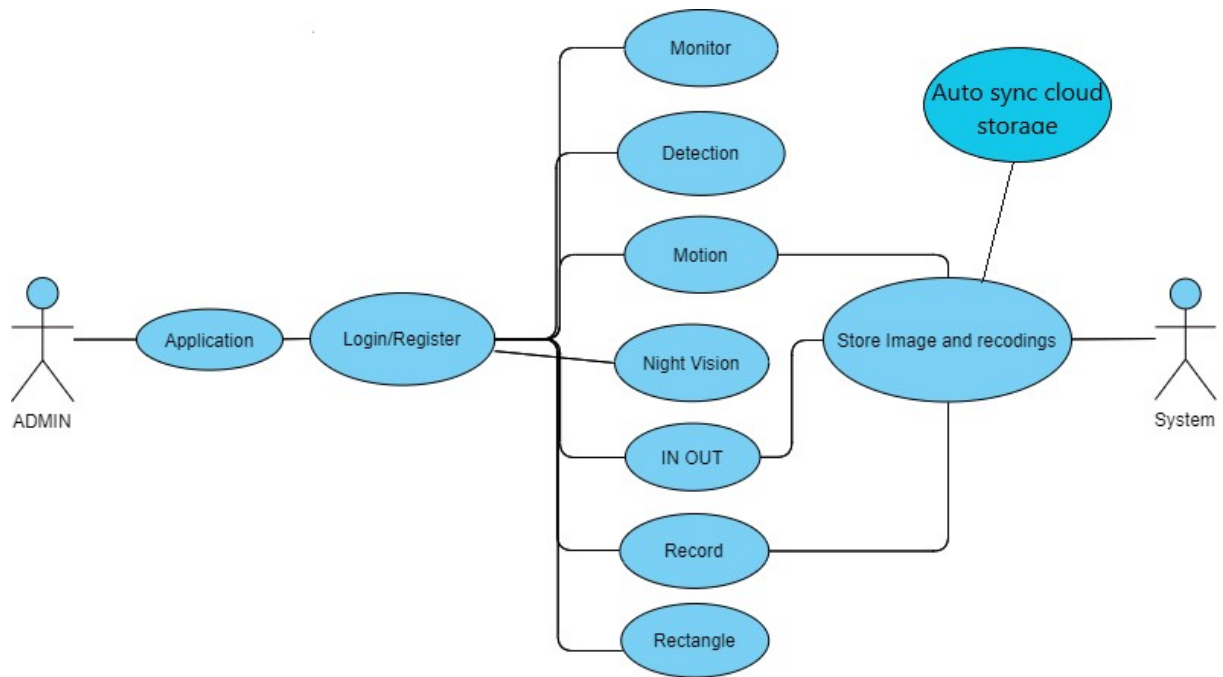
## **6.4 Use Case Diagram**

A use case diagram is a graphical depiction of a user's possible interactions with a system. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses. The actors are often shown as stick figures.

The following use case diagram shows how the user will be able to communicate with the System.

The Use case diagram of our AI Based surveillance system consists of 9 modules available to access for the user. They are

1. Login/Register module
2. Monitor module
3. Rectangle module
4. In and Out Module
5. Motion Module
6. Record module
7. Detection module
8. Night Vision module
9. Exit module

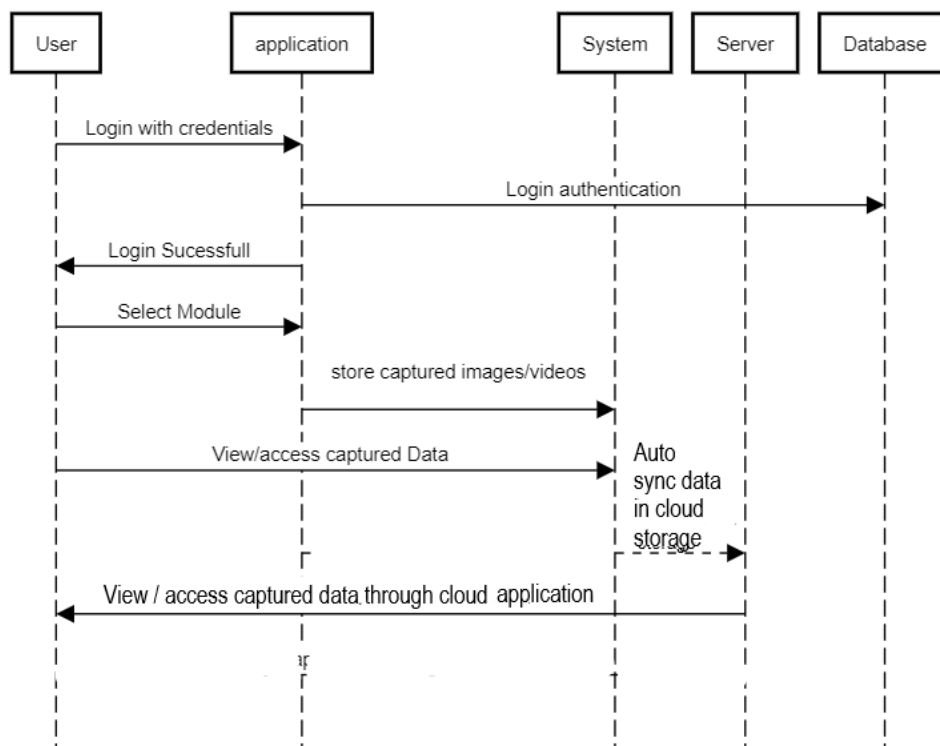


**Figure 6.3: Use Case Diagram**

## 6.5 Sequence Diagram

Sequence diagrams are sometimes called Event-trace diagram, event scenarios, and timing diagrams. A sequence diagram shows, as parallel vertical lines(lifelines), different processes or object that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

In this sequence diagram, the main objects are user, application, System, server and Database that are used to describe the interaction between user and the system.



**Figure 6.4: Sequence Diagram**

## **Chapter 7**

# **System Testing**

### **7.1 Introduction**

Testing is an important phase in the development life cycle of the product this was the phase where the error remaining from all the phases was detected. Hence testing performs a very critical role for quality assurance and ensuring the reliability of the software. Once the implementation is done, a test plan should be developed and run on a given set of test data. Each test has a different purpose, all work to verify that all the system elements have been properly integrated and perform allocated functions. The testing process is actually carried out to make sure that the product exactly does the same thing what is suppose to do. Testing is the final verification and validation activity within the organization itself. In the testing stage following goals are tried to achieve:-

- To affirm the quality of the project.
- To find and eliminate any residual errors from previous stages.
- To validate the software as the solution to the original problem.
- To provide operational reliability of the system.

During testing the major activities are concentrated on the examination and modification of the source code. The test cases executed for this project are listed below. Description of the test case, steps to be followed; expected result, status and screenshots are explained with each of the test cases.

## 7.2 Test Cases and Test Results

Test ID	Test Case Title	Test Condition	System Behavior	Expected Result
T01	CCTV Camera	CCTV camera access	CCTV camera access ON	CCTV camera ON
T02	Monitor module	track objects	tracking object with green box	track object surrounding a color box
T03	In OUT module	capture objects moving in direction	drawing box on object seen in motion	capture object if moved in any direction
T04	Motion module	detect motion	tracking object in motion	Track object when in motion in a box
T05	Rectangle module	track a particular object	tracking object in green box	track object which is selected by dragging box over that object
T06	Detection module	Detect and Label object	Detecting object in green box with label	Detect object in a color box with object name
T07	Record module	Record movements in camera frame	recording camera frame with date and time	Record all behaviours with date and time.
T08	Night Vision module	Open two camera frames	opened two particular camera frames	Open greyscale and threshold frame.
T09	Exit module	Close the software	Crashes the software	Close the application
T010	Database	Database connection	Register entries stored	Database SQL connection and store values
T011	Login	Authenticate Login with email and password	Successfull login	successfull login with database verification

**Note: Testing should be performed manually**



# Chapter 8

## Project Planning

### 8.1 Introduction

A project plan is a series of formal documents that define the execution and control stages of a project. The plan includes considerations for risk management, resource management and communications, while also addressing scope, cost and schedule baselines. Project planning software is used by project managers to ensure that their plans are thorough and robust.

The project plan, also called project management plan, answers the who, what, where, why, how and when of the project—it's more than a Gantt chart with tasks and due dates. The purpose of a project plan is to guide the execution and control project phases.

Project plan consists of the following documents:

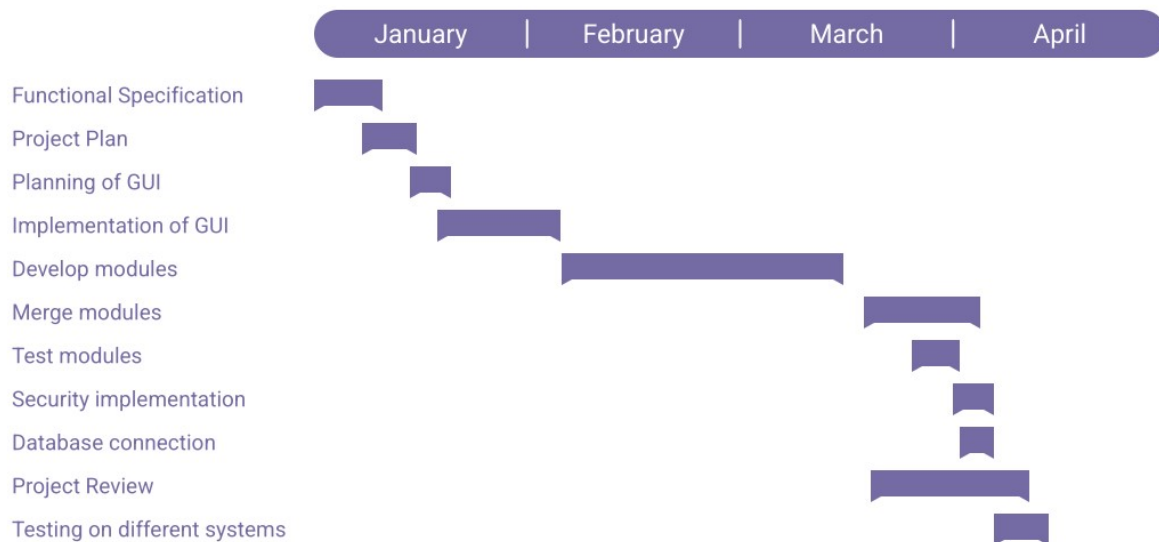
1. **Project Charter:** Provides a general overview of the project. It describes the project's reasons, goals, objectives, constraints, stakeholders, among other aspects.
2. **Statement of Work:** A statement of work (SOW) defines the project's scope, schedule, deliverables, milestones, and tasks.
3. **Work Breakdown Structure:** Breaks down the project scope into the project phases, subprojects, deliverables, and work packages that lead to your final deliverable.
4. **Project Plan:** The project plan document is divided in sections to cover the following: scope management, quality management, risk assessment, resource management, stakeholder management, schedule management and the change management plan.

SR NO	WEEKS	NAME OF STUDENTS	DESCRIPTIONS
1	WEEK 1	Apurba Dey	FUNCTIONAL SPECIFICATIONS (OPEN CV)
		Prasanna Gadade	PLANNING OF GUI
2	WEEK 2	Prasanna Gadade	CREATE PROJECT PLAN
		Apurba Dey	Learning of algorithms
		Hasan Jalal	Reviewing plan
3	Week 3/ Week 4	Apurba Dey	Implementations of GUI
		Prasanna Gadade	
4	Week 5/ Week 6	Prasanna Gadade Hasan Jalal	Project review /design interface
		Apurba Dey	Create database interface (test database)
		Hasan Jalal	
5	Week 7/ Week 8	Apurba Dey	Software design
		Prasanna Gadade	Create design specification
		Hasan Jalal Apurba Dey Prasanna Gadade	
			Design Complete
6	Week 9	Apurba Dey Prasanna Gadade	Design Coding
7	Week 10	Apurba Dey Hasan Jalal	Project Review
8	Week 11	Apurba Dey Hasan Jalal	System Programming(python Language)& Connecting server for remote access
9	Week 12	Apurba Dey	Testing
		Prasanna Gadade	
10	Week 13	Prasanna Gadade	Project Review
		Hasan Jalal	
11	Week 14	Apurba Dey	Maintenance
		Hasan Jalal	

Figure 8.1: Project Implementation plan

## 8.2 Gantt Chart

A Gantt chart, commonly used in project management, is one of the most popular and useful ways of showing activities (tasks or events) displayed against time. On the left of the chart is a list of the activities and along the top is a suitable time scale. Each activity is represented by a bar; the position and length of the bar reflects the start date, duration and end date of the activity.



**Figure 8.2: Gantt chart**

## **Chapter 9**

# **Implementation**

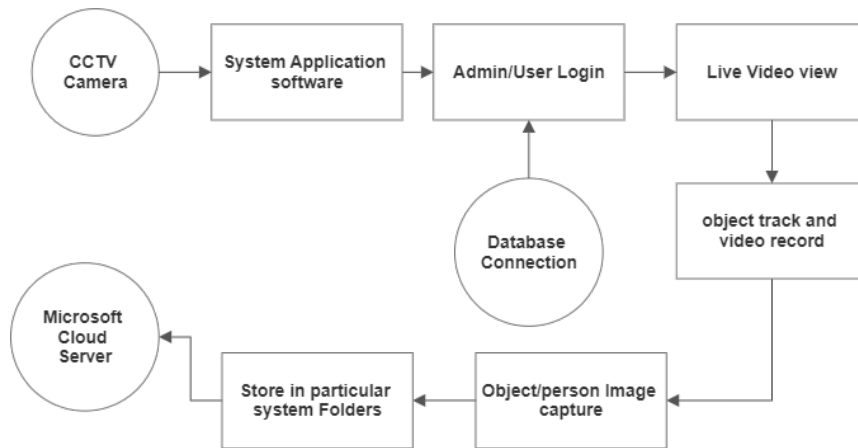
### **9.1 Introduction**

The implementation phase of the project is where the detailed design is actually transformed into working code. Aim of the phase is to translate the design into a best possible solution in a suitable programming language. This chapter covers the implementation aspects of the project, giving details of the programming language and development environment used. It also gives an overview of the core modules of the project with their step by step flow. The implementation stage requires the following tasks:

- Careful planning.
- Investigation of system and constraints.
- Design of methods to achieve the changeover.
- Evaluation of the changeover method.
- Correct decisions regarding selection of the platform.
- Appropriate selection of the language for application development.

### **9.2 Block Diagram**

The block diagram of the paper is quite simple which has a few basic components but it is quite efficient in producing the result as required.



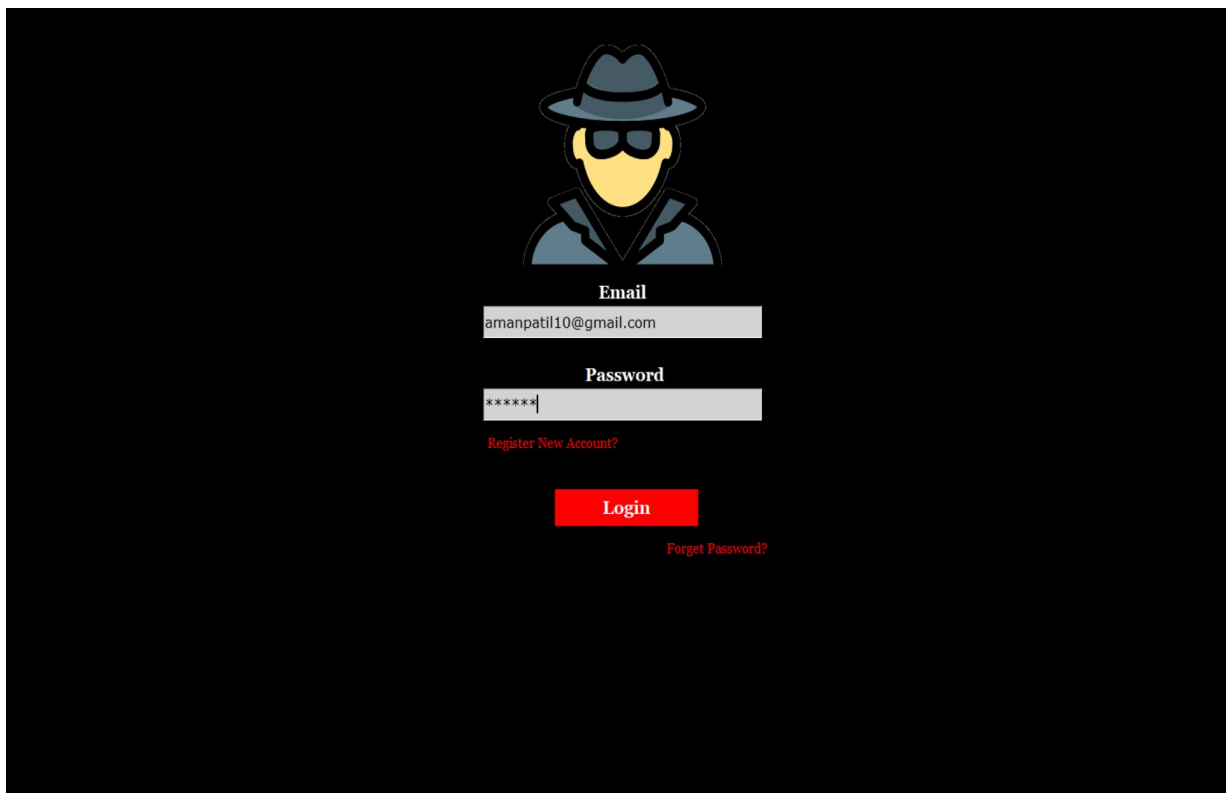
**Figure 9.1: Block Diagram of System**

The real time live video is captured by the CCTV camera connected to the system. The Admin/User Login the system to avail access to software application modules which is authenticated with the credentials stored in database. As the module selected the system performs tasks such as image capture, image tracking and recording with system date and time. The captured Images and recorded videos are stored into the particular system folder which by auto sync with cloud server will be available on cloud applications like Microsoft OneDrive.

## Chapter 10

### Screenshots of Project

#### 10.1 Login/Register



## REGISTER

First Name

Aman

Last Name

Patil

Contact Number

9876543210

Email

amanpatil10@gmail.com

Security Question

Your First School Name

Answer

Delhi Public School

Password

\*\*\*\*\*

Confirm Password

\*\*\*\*\*

☒ I Agree The Terms & Conditions

Register

[Log In](#)

## REGISTER

First Name

Aman

Last Name

Patil

Contact Number

9876543210

Email

amanpatil10@gmail.com

Security Question

Your First School Name

Answer

Delhi Public School

Password

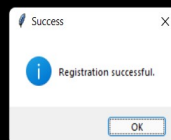
\*\*\*\*\*

Confirm Password

\*\*\*\*\*

☒ I Agree The Terms & Conditions

Register

[Log In](#)

## Reset Password

Security Question

Your First School Name

Answer

Delhi Public School

New Password

\*\*\*\*\*

Reset

## Reset Password

Security Question

Your First School Name

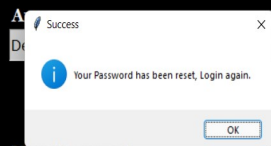
A

De

New Password

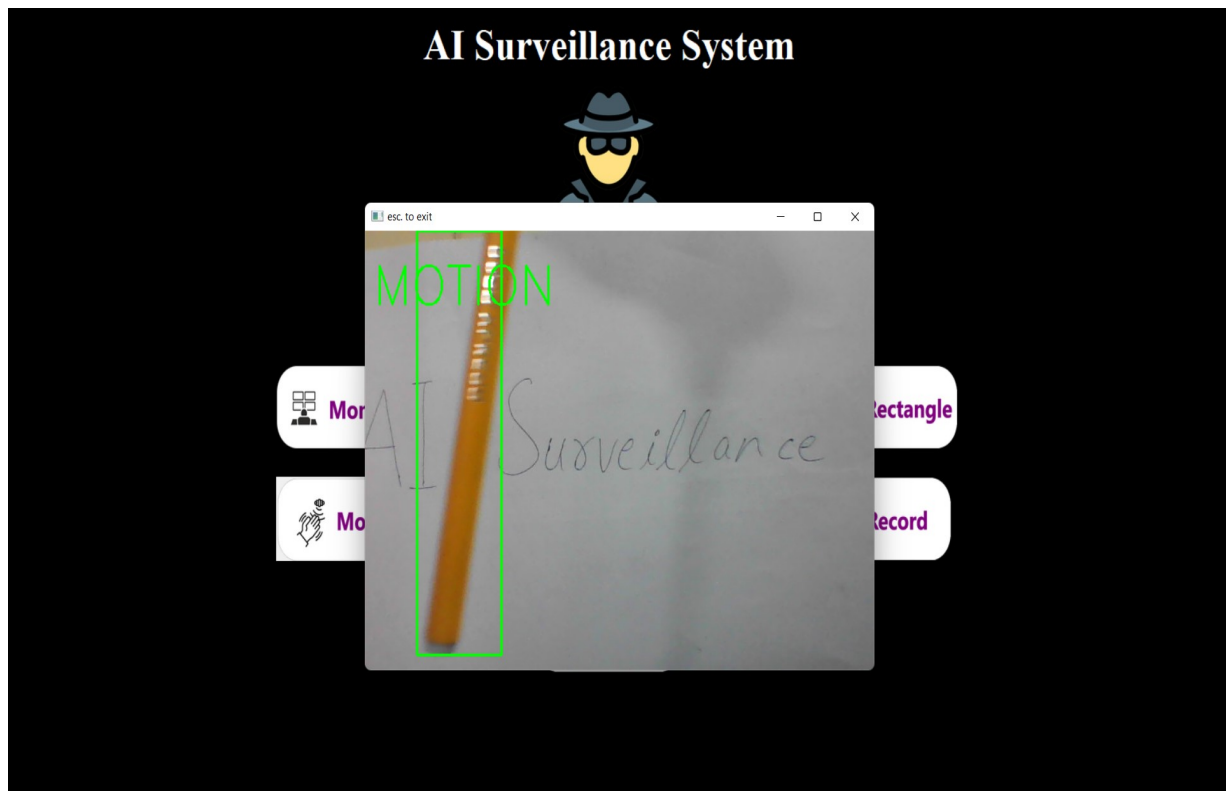
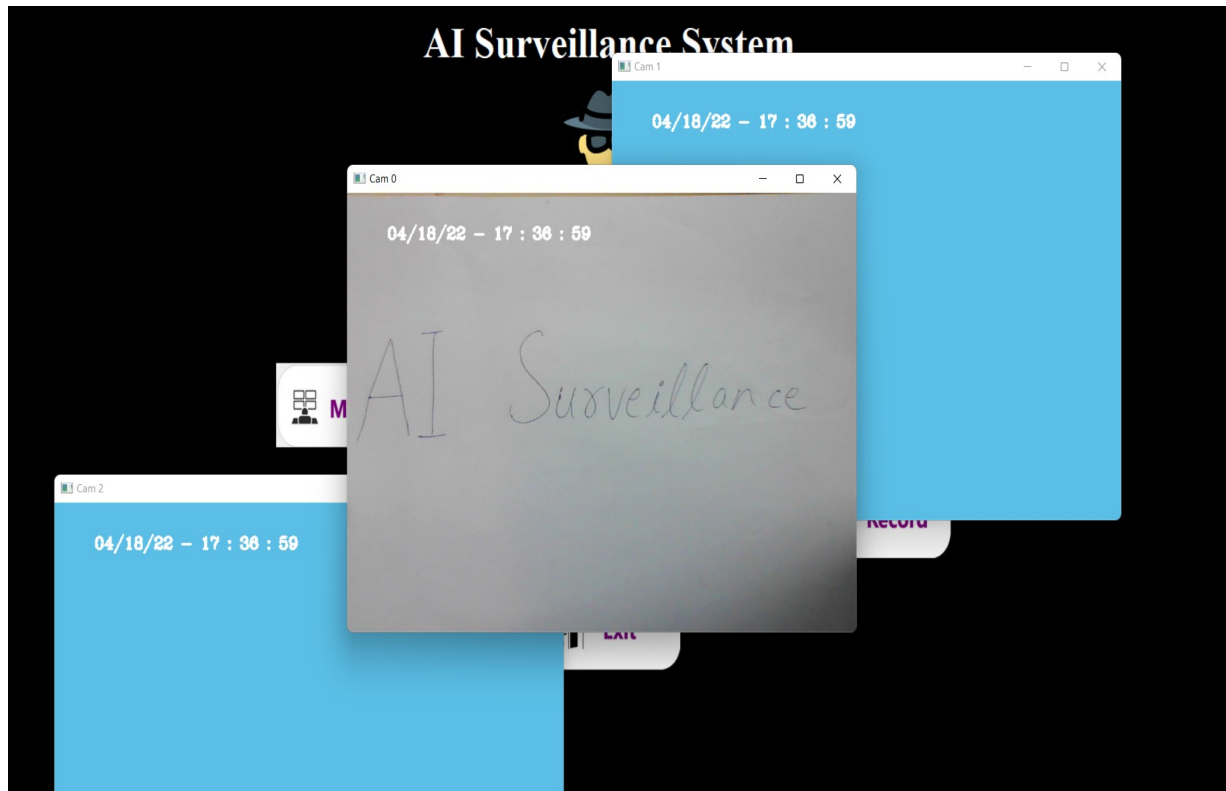
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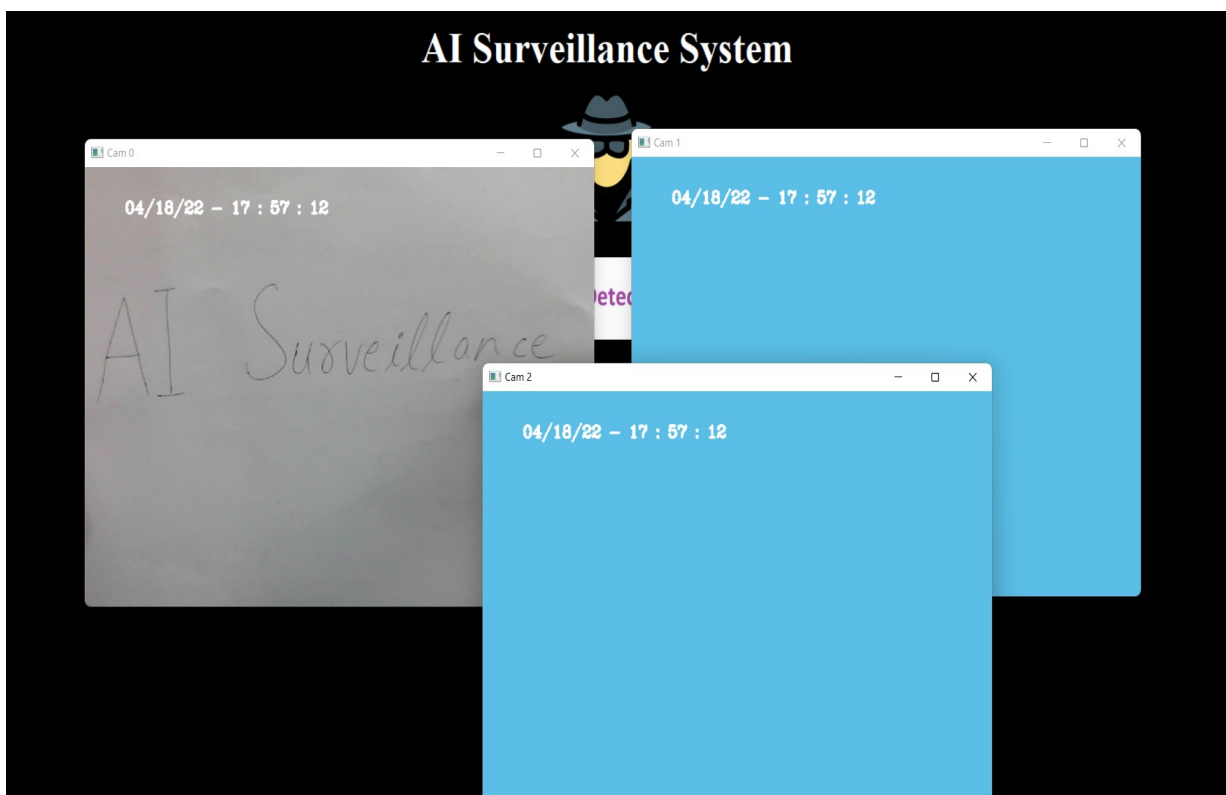
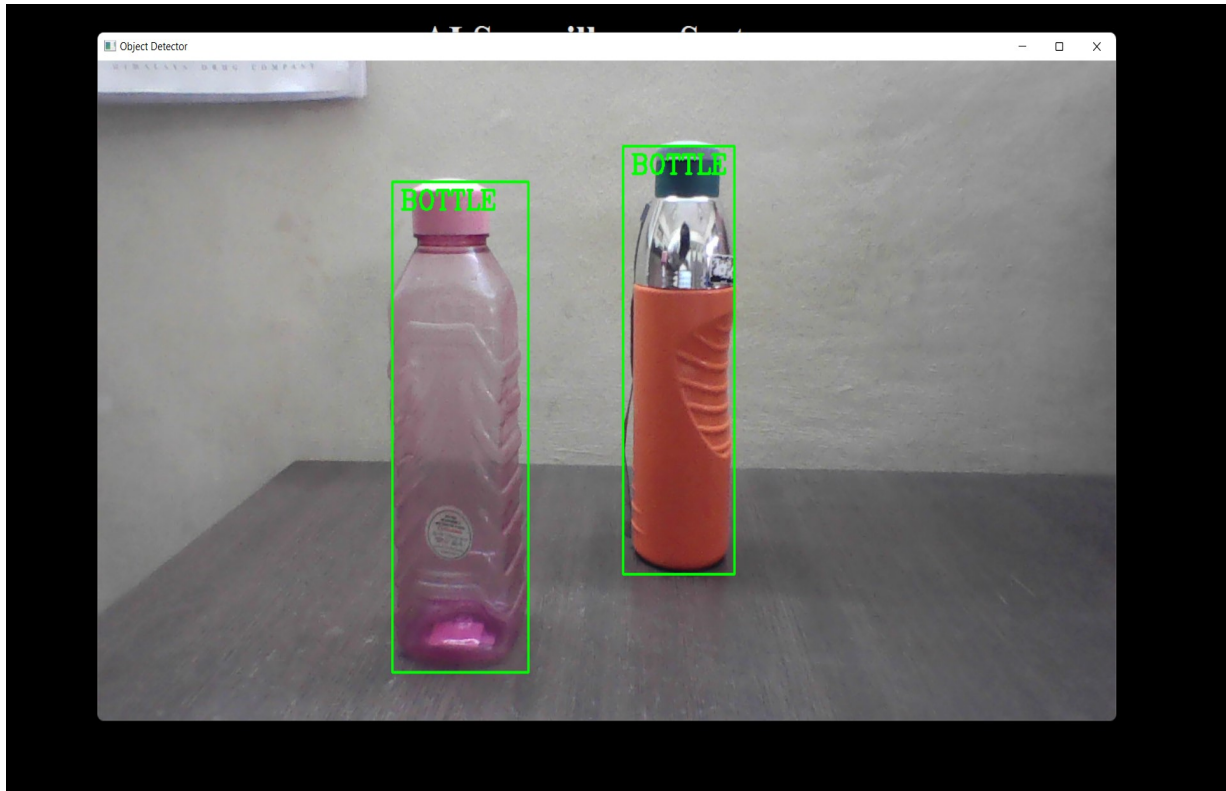
Reset

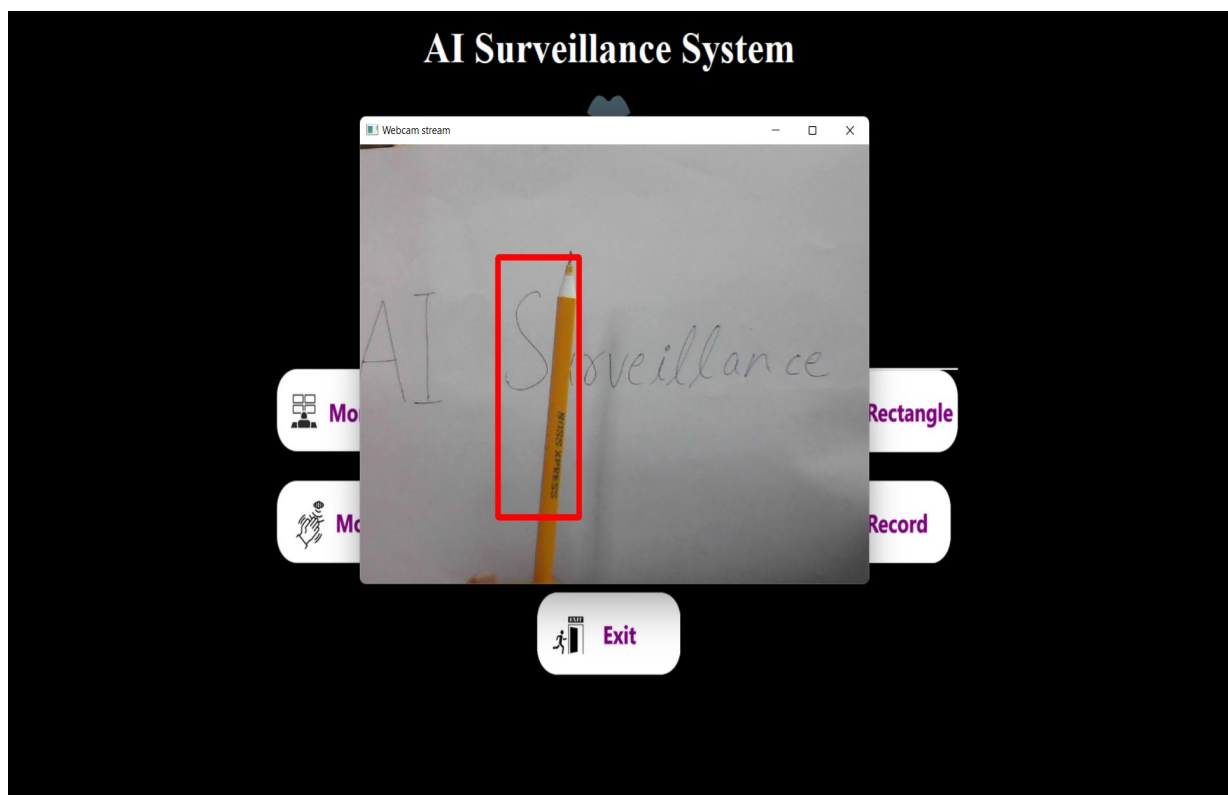
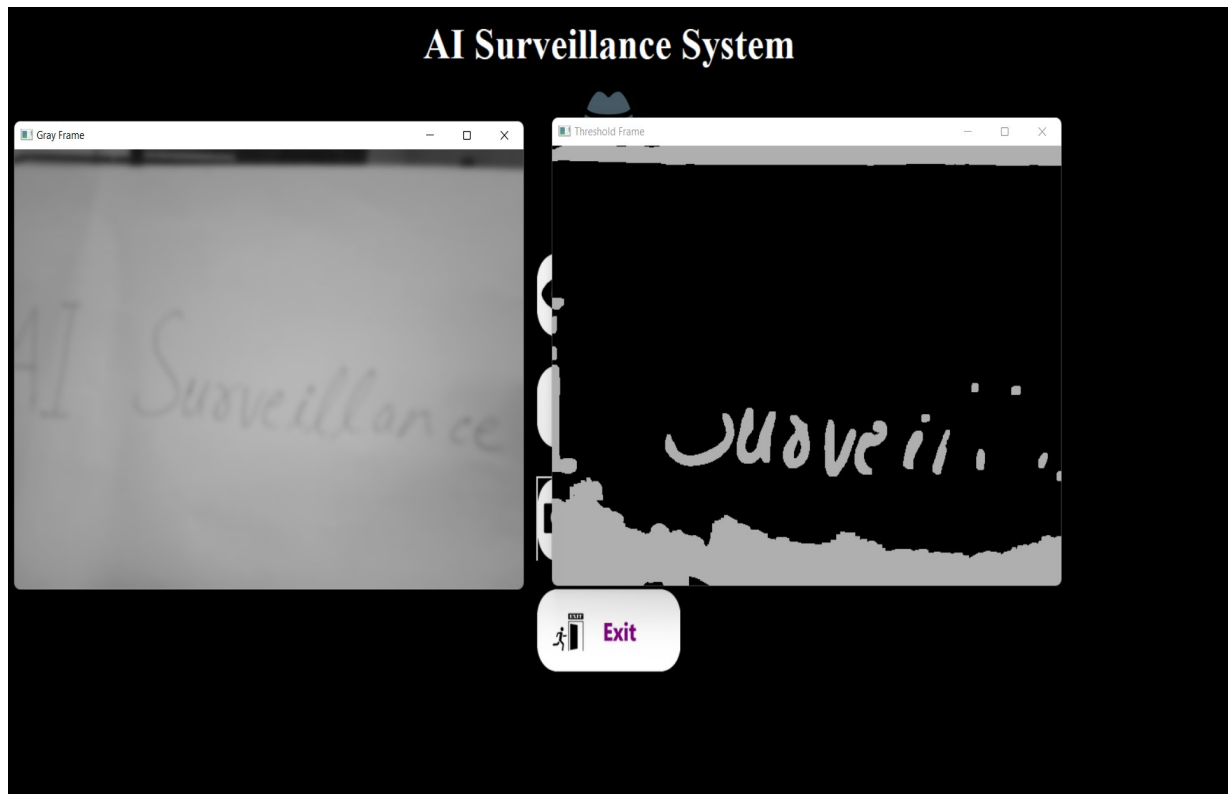




## 10.2 Modules







```
XAMPP for Windows - mysql X + v

Setting environment for using XAMPP for Windows.
apurb@LAPTOP-891UHVW4 c:\xampp
# mysql
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 20
Server version: 10.4.25-MariaDB mariadb.org binary distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> show databases;
+-----+
| Database |
+-----+
| ai_surveillance_system |
| information_schema |
| mysql |
| performance_schema |
| phpmyadmin |
| test |
+-----+
6 rows in set (0.023 sec)

MariaDB [(none)]> use ai_surveillance_system
Database changed
MariaDB [ai_surveillance_system]> show tables;
+-----+
| Tables_in_ai_surveillance_system |
+-----+
| admin |
| user |
+-----+
2 rows in set (0.001 sec)

MariaDB [ai_surveillance_system]> select * from user;
+----+-----+-----+-----+-----+-----+-----+-----+
| id | f_name | l_name | contact | email | question | answer | password |
+----+-----+-----+-----+-----+-----+-----+-----+
| 1 | apurba | dey | 1425263744 | apurbadey854 | Your First School Name | ryan | 1234 |
+----+-----+-----+-----+-----+-----+-----+-----+
1 row in set (0.001 sec)

MariaDB [ai_surveillance_system]>
```

# **Chapter 11**

## **Conclusion and Future Scope**

### **11.1 Conclusion**

Security has become one of the most important factor in life and with the help of AI in surveillance system it will become an ease. Since it has a practical real life implementation it could be used anywhere easily and efficiently just like any other software, providing 24/7 security and great results.

The system has its advantages such as no human requirement for monitoring, Very Small Database, High Adaptability to any Computer System and with many number of features to monitor any surveillance area as compared to the traditional method followed in yet; the system has a large scope for further developments.

Our proposed system gives excellent result for motion detection, face recognition, object detection whenever any of such kind of thing comes in contact of CCTV camera. In addition our system is computationally inexpensive and easier to implement.

### **11.2 Future Scope**

With the advancements of artificial intelligence, edge devices and 5G networks, traditional surveillance technology is being disrupted with cloud-managed AI powered video security solutions.

This technology is becoming so powerful and commercially viable that native feature sets such as human analytics, face recognition and retail analytics can be built directly into the camera using AI-enabled chipsets, enabling rapid deployment and unlimited scalability across enterprise sites.

As AI processing is becoming the new standard for surveillance solutions, opportunity to incorporate features such as face recognition for enhanced investigation, monitoring and public security to incorporate advanced human analytics built on deep learning algorithms and associated data becomes realistic.

Future scope implementable for this project are:

- **Cloud Managed Surveillance Systems**

Storing CCTV footages in the cloud in predominant. Easily accessible anywhere and anytime.

- **AI Powered CCTV**

With localized AI processing built-in to each camera, IP cameras are now able to exploit machine learning capabilities to support facial recognition, number plate recognition and people analytics to move the system beyond traditional NVR based security systems. With AI, empowering features to support compliance, ICT and retail analytics from the cloud improves overall security management and moves the solution into a proactive state – meaning organizations can take advantage of the video recording as it happens, not after it happens.

- **Human Analytics**

With the use of AI being able to identify humans vs. non-human objects, data sets can be created to provide analytical reporting capabilities and proactive alerts that would otherwise be difficult or impossible with traditional systems (in most cases require a AI compute server to work alongside the NVR). Cameras can now identify human behavior such as recognition of an individual passing frame, humans being seen within an applicable zone or more complex behavior analysis such as motion heatmapping, foot traffic patterns, people counting, loitering, unattended objects and unusual behavior. Face recognition can be easily deployed within commercial environments for VIP identification or person of interest alerting (such as thief or known suspect) directly to the floor managers – enabling rapid decision making as the event occurs.

# **Chapter 12**

## **Future Work**

### **12.1 Future Work for the project**

The project could be customized in many ways:

- Implementing intruder alert messaging system through Email/SMS with captured intruder image.
- Accessing more than one camera module on single system.
- Converting the current project into a software application executable file.
- Auto syncing project system with other available cloud server applications.
- Building a particular Android application for the project to access captured images and recordings on mobile devices.
- Implementing image classification and human analytics for detecting known and unknown people while understanding their behaviour through real time camera view.

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- [8] <https://syno.global/the-future-of-surveillance>
- [9] <https://www.projectmanager.com/guides/project-planning>
- [10] <http://203.201.63.46:8080/jspui/bitstream/123456789/1400/17/Smart%20Surveillance%20System%20By%20Amrit%20Sinha%2C%20Ankur%20Singh%20and%20Manas%20Kashyap%20USN%201CR14CS011%2C%201CR14CS015%20and%201CR14CS076.pdf>