**Smart CCTV Camera With Live Stream APP using IOT**

**Abstract:** Security is crucial concern now a days and there are lot of technologies present today to keep our place secure and monitored. But these technologies cost more for domestic and small-scale business where security is required but with less expenditure and maintenance. Upon that in traditional CCTV cameras, it is required for a person to continuously monitor the system. IOT based smart CCTV camera with video Recording is focused on authorized user can get live stream in android application. So, they can easily track their home using mobile app. This mechanism is cost efficient, effective and a great solution to address security concerns for domestic and small-scale business. This system automatically detects, monitor and alert the user of any intruder in monitored premises. When the camera detects an intruder, it triggers an alert and send a notification to the authorized user’s mobile app. The notification will include a live video stream to provide real time evidence of the event.

**Introduction:**

The IoT has taken the world by storm in the present scenario, playing a crucial role in making the ordinary devices around us connect to as well as communicate with each other over the internet while bringing whole new levels of experience in our-to-day lives. The IoT is a backbone for smart cities and home automation which are trending fields now-a-days. One of the most vital applications of IoT can be in the smart security systems. Smart Security Camera has been developed significantly over the years and is becoming important tool for home for safety and security purpose. Like this system mostly used for social security. The main feature of this system is that, it introduces an automated smart CCTV camera which automatically detects, monitor and alert the user of any intruder in monitored premises. The Arduino UNO microcomputer is capable of implementing a cost-effective security system for various applications. The Arduino UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. This new arising technology related to security provides a comfortable and safe environment for small homes. The various objectives of the system are to detect an intruder, take an image of the intruder and also convey an alert message to the facility owner. The HD camera which installed in front of a front door will get turned on. If the human face inside the camera frame it will detect and recognize the visitor. If the Camera is on and starts face recognition capturing image of a visitor and the camera screen will start recording video and live stream can access through android app.

**Literature Survey:**

“IoT Based Smart Surveillance System” presented by M Sri Lakshmi, C Padma et al [1] elaborates the way of using the power of Iot in the field of Surveillance. The IoT based surveillance systems enables the user to view the activity from a remote location. It also facilitates the user to receive notifications whenever the intrusion is detected with the help of sensors connected with the surveillance cameras. This reduces the human intervention in the Surveillance monitoring and reduces the errors of manual surveillance.

“Implementation of Closed-circuit Television (CCTV) Using Wireless Internet Protocol (IP)Camera” presented by A Michael F Adaramola et al[2]. In this paper, the implementation of Surveillance camera using Wi-Fi based technology is presented. The live streaming of video based surveillance can be adapted for the image detection and tracking for real-time intelligent.

“Action Recognition using Surveillance system” presented by Rishabh Paunikar, Shubham Thakare, Utkarsh Anuse et al [3]. They elaborated that Surveillance systems use CCTV cameras or other surveillance equipment continuously record the footage while they are in use. The majority of the data is idle data, meaning there is no activity taking place. When viewing a previously recorded activity, the viewer must go through all of the film to determine when and what occurred.

“ Automation in Surveillance” presented by Prajakta Jadhav, Shweta Suryawanshi, Mr. Devendra Jadhav et al[4]. In this paper, the authors discussed the approaches in the automation and how to make it possible. It also mentions the storing the data in a minimal space. Most of the idle data where no event takes place occupies the storage and also the operator has to go through the entire footage to identify the particular incident. So, by using Smart surveillance systems, this time-consuming task can be reduced. This automation in surveillance can be achieved through Smart surveillance monitoring system.

“ IoT Based Facial Recognition Security System” presented by Prashanth Balraj Balla, K.T. Jadhao et al.[5] . The main purpose of this paper is to set as an alert for home visitors and provide information about the visitors in a dynamic website and phone application. The alerts are sent based on the data acquisition using sensors and the alerts of intrusion or thefts, will be sent to the registered user along with the picture of the incident using a camera module.

“Design and Implementation of Home Automation System” presented by A. Alheraish, Member[6].  Explained that IEEEA remote control system is designed and implemented using the GSM cellular connection network. This design incorporates the controlled device, the microcontroller, and the GSM Module, allowing it to be used in a variety of applications. Instead of a microcontroller, the proposed M2M system in this study uses a PC as the terminal user.

“Design and Implementation of UPnP-Based Surveillance Camera System for Home Security”. This paper is presented by Yi Gu, Myoungjin Kim Division of Internet & Multimedia Engineering, Konkuk University, Seoul, South Korea[7] . The main focus of this article is on the rapid development of mobile devices and Internet services, and how these devices and services might be used to manage home security. They proposed the UPnP based Security Camera System (USCS), which uses UPnP technology to search, operate, and administer IP-based cameras, to broaden the range of usability of traditional home surveillance cameras.

**Proposed Method**:

In the proposed system, we are designing a Smart CC TV Camera with face recognition module. Along with face recognition, Notification send to the user for their mobile phone through android app. If the human face inside the camera frame it will detect and recognize the visitor. If the Camera is on and starts face recognition by capturing image of a visitor and the camera screen will start recording video and live stream can access through android app. If the human face not found inside the frame, then it will not notify to the owner.

**Methodology :**

IOT based smart CC Tv camera with video Recording is focused on authorized user can get live stream in android application. So, can easily track his home using that app. This mechanism is to provide user with cost efficient but effective monitoring system.



The mobile application will communicate with the server to access the images and live stream. The server will receive the images sent by the ESP32 camera module and store them in a database. The mobile application will then request the images from the server and display them in the app. To ensure security, the system will require a login for access to the mobile application. Users will need to provide valid credentials to access the images and live stream. If the credentials are invalid, the system will deny access.

**System Implementation:**

**Main Components:**

 **Arduino UNO R3:** The Arduino UNO R3 is frequently used microcontroller board in the family of an Arduino. This is the latest third version of an Arduino board and released in the year 2011. The main advantage of this board is if we make a mistake we can change the microcontroller on the board. The ATmega328-based Uno with Cable is a microcontroller board. It contains 14 digital input/output pins (including 6 PWM outputs), 6 analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you'll need to get started with the microcontroller; simply plug it into a computer via USB or power it with an AC-to-DC adapter or battery. In Italian, "uno" means "one," and it is the name given to the future Arduino 1.0 release. Moving forward, the Uno and version 1.0 will be the reference versions of Arduino. The Uno is the most recent in a series of USB Arduino boards and the platform's reference model; see the index of Arduino boards for a comparison with previous version. Figure (4.d) Arduino UNO

**R3 ESP32 Camera Module**: The ESP 32 Camera is a smallsize, low-power camera module based on ESP32. It comes with an OV2640 camera and provides an onboard TF card slot. This board has 4MBPSRAM which is used for buffering images from the camera into video streaming or other tasks and allows you to use higher quality in your pictures without crashing the ESP32. The ESP32-CAM development board includes an ESP32-S processor, an OV2640 camera, a microSD card slot, and various GPIOs for connecting peripherals. Aside from the OV2640 camera and many GPIOs for connecting peripherals, it also has a microSD slot for storing photographs. the AI-Thinker ESP32-CAM. Figure (4.e) ESP 32 Camera Module

**Algorithm Used:**

**Haar Cascade Classifier:**

The algorithm uses edge detection features proposed by Viola and Jones in their research paper. This is basically a machine learning based approach where a cascade function is trained from a lot of images both positive and negative. Based on the training it is then used to detect the objects in the other images. A Haar-like feature consists of dark regions and light regions. It produces a single value by taking the difference of the sum of the intensities of the dark regions and the sum of the intensities of light regions. It is done to extract useful elements necessary for identifying an object

It works in four stages:

* **Haar-feature selection:** A Haar-like feature consists of dark regions and light regions. It produces a single value by taking the difference of the sum of the intensities of the dark regions and the sum of the intensities of light regions. It is done to extract useful elements necessary for identifying an object. The features proposed by viola and jones are:
* **Creation of Integral Images:** A given pixel in the integral image is the sum of all the pixels on the left and all the pixels above it. Since the process of extracting Haar-like features involves calculating the difference of dark and light rectangular regions, the introduction of Integral Images reduces the time needed to complete this task significantly.
* **AdaBoost Training:** This algorithm selects the best features from all features. It combines multiple “weak classifiers” (best features) into one “strong classifier”. The generated “strong classifier” is basically the linear combination of all “weak classifiers”.
* **Cascade Classifier:** It is a method for combining increasingly more complex classifiers like AdaBoost in a cascade which allows negative input (non-face) to be quickly discarded while spending more computation on promising or positive face-like regions. It significantly reduces the computation time and makes the process more efficient.

**Experimental Result**

This system utilizes the ESP32 Camera Module to detect human faces, capture images, and send them to the owner via our custom-built Android application. Only the owner can view the captured images, videos and also, he can access live streams through the app