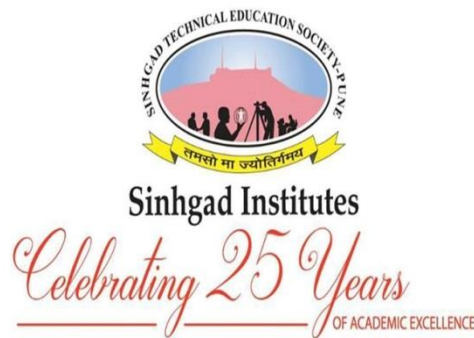**Final Year [BE] Electronics and Telecommunication Engineering**

PROJECT SYNOPSIS ON

Artifical Intelligence Security System

B.E. (E&TC) - 2021-2022

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PROJECT SYNOPSIS

Title Of Project:

Security System Based On Artificial Intelligence

Introduction:

Nowadays, the evolution of technology-based systems has drastically increased over the past few years. As the technology grows, it is no surprise that most of the work that was done by human will be taken over by machines. Although many people believe that this will make everyone to be lazy, it is an undeniable fact that this is for the betterment of humankind. Consequently, they have to confront this technology every day, which undoubtedly affects their lifestyle from the way they live until the way they work or relax. The convenience that technology provides them is the most common reason for their willingness to get it to affect their daily lifestyle to such extent. Many corporate buildings have an integrated automation system, which controls their power management, ventilation, security and other operations, often with less or no involvement of human. This automation system is also integrated into many homes now, which is known as smart homes. Similar to their corporate counterparts, the advantages of smart homes compared to a regular one include more efficient power management, higher surveillance and other household operations. House owners or tenants are able to monitor their household operations in detail and they can be controlled remotely using active internet connections, which helps to improve comfort. In general, most of the smart homes or home automation systems cover the security aspect in the house passively or actively contributing to the increase of the home security. Surveillance plays an important role in the security aspect from smart homes to corporate-based automation. It refers to close observation using electronic equipment such as CCTV cameras.

Security has always been a major issue everywhere around the globe and the importance of security cannot be denied in today's society because of the increasing crime rate.

AI security system is an intelligent vision-based security service designed to automatically detect humans in a visual scene and notify the property owner in real-time. This is to ensure any and all unauthorized personnel on the private property are identified as soon as possible to provide a record of intrusions. The functionality is provided using a combination of deep learning, edge computing, and cloud technology, where the camera on-board the edge device continuously monitors an area. When the real-time analytics on the edge device detects one or more people in the scene, an image is immediately captured and the user is notified via email. Soon

afterwards, a video clip of the scene with the person(s) is recorded and also sent to the user via email. The image and video are stored in the cloud for on-demand user access.

Problem Statement:

[i] There are roughly 2.5 million burglary a year, 66% of those being home breakins,commerical shops,goverment property. Police solve only 13% due to lack of evidence. CCTV camera footages are usually analysed hours after event has happened, this delays investigation and further damage. Studies shows, a burglar usually checks on your house few times before robbing to ensure a perfect time to rob. A CCTV camera has no means to alert you when a stranger shows up at your doorstep.

[ii]However there are some security systems available in which either users can manually monitor there property manually or the most common and traditional features of the home security system are motion detection, live monitoring, and alert notification. Systems relying only on a Passive Infrared (PIR) sensor to accommodate for motion detection have unreliable detection rate because it could trigger a false alarm due to abnormal conditions such as pet intrusion or rapid heating [2] e.g. from sunlight exposure. False alarms can have significant impacts such as in security systems that trigger calls to the police [3] or other emergency agencies.

[iii] In order to overcome these limitations. this paper presents an implementation of vision-based intruder detection system using OpenCV prototyped on a Nvidia Jetson-nano.

Abstract:

The objective is to design a Artifical Intelligence Security system which is a machine learning based security platform that automatically monitors and detects people in a scene, and then alerts the user in real time by sending an image and video of victim through their email or app.

Motivation:

Home break-ins, porch pirates stealing deliveries, trespassers, breakins of shops such as jwellery shops.Installation of surveillance cameras equipped with motion sensors are a common solution to this problem. However, surveillance cameras only detect motion and collect data - meaning that the user must go through frames in the video footage to discern any meaningful information. As a result, this visual information is typically inspected after an unfortunate incident, such as a package being stolen or robbery. To improve this situation, we propose AI a machine vision security system to automatically collect and analyse relevant images to identify critical and actionable information and send it to the user, in real-time.

Literature Survey:

[i]Vigneswari et al. [1] presented an automated security system with surveillance. A PIR sensor and a camera were installed respectively to detect the presence of an intruder   and capture his/her picture. The owner will be alerted   through Short Message Service (SMS) using the GSM technology. At the heart of the system was an Atmega644p
microcontroller, which receives and processes signals from the PIR sensor and decides whether it is necessary to send a notification message with the captured image over SMS.

[ii]Suresh et al. [2] proposed a home monitoring and security system where a PIR sensor and a temperature and humidity sensor are connected to an Arduino Uno microcontroller. The system intends to apply changes in both motion and temperature in a monitored room to improve the accuracy of the intrusion detection by reducing false detections based on line of sight that can be cut by any entity and not necessarily an intruder. If the temperature is above a set threshold and a change in motion is detected, an SMS message will then be sent to the owner's mobile phone via GSM.

[iii]An Arduino-based, low-cost, and multi-level home security system was proposed by Zaman et al. [3] for developing countries. Their system consists of two parts,namely internal and external parts to make the system more effective. The internal part is controlled by an Arduino Mega microcontroller with GSM shield to detect intruder(s) and notify the owner through SMS or phone call. Each room was installed with PIR sensors and LED lights attached to the ceiling. When a PIR sensor is triggered, a signal is sent to the microcontroller, LED lights blink, respective lights of the affected room get turned on, an installed alarm starts to buzz for three seconds with intervals to alert the surrounding, and the GSM module sends an SMS notification to the owner. On the other hand, the external part is controlled by an Arduino Uno microcontroller that includes a fingerprint-based door lock and a

webcam. Only users with authorized fingerprints saved in the sensor memory will be granted access.

[iv]Sruthy and George [4] presented a Wi-Fi enabled home security and surveillance system using Raspberry Pi and NodeMCU IoT/Wi-Fi module integrating sensor alerts with video surveillance. Intrusion and fire detections are the prime features of this system. As the system is purely based on Wi-Fi connectivity, data can be fetched from almost anywhere or moved to a cloud storage for future monitoring. A PIR sensor node and a fire sensor node are connected to the NodeMCU module to detect human presence and fire, respectively. If a detection takes place, a signal is then sent to the Raspberry Pi and an installed webcam will be activated to record the event. This feature allows the user to watch a live video of the scene remotely by connecting to the IP address of the Raspberry Pi. The system has two ways of sending an alert notification, which are through SMS with the help of a GSM module as well as by email. The GSM module will also notify the police for an intrusion alert and the fire force for fire alert.

[v]Embedded home surveillance system with pyroelectric infrared sensor using GSM was introduced by Ragrade [5]. The system is designed with the use of PIR sensor and ultrasonic sensor to detect intruders in a home. If there is an intruder present, a buzzer will be triggered, and SMS will be sent and camera is used to capture image. The microcontroller unit used is the Atmega 328. Two sets of PIR and ultrasonic sensors are used to detect for intruders, one for outdoors and one for indoors.

[vi]Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor was introduced by Prasad et. al. [6]. The system makes use of a 3G dongle to transmit information to a smartphone on web application. Live streaming is also carried out by the camera and is stored for future playback. When motion is detected by the PIR sensor, the cameras automatically begin the recording and owner is alerted via his smartphone regarding the possible intrusion.The two main components of the Raspberry Pi interacting are the web application on the smartphone browser, and the server-scripts that run on a cloud.

[vii]Kaur et al. [7] introduced An Illustration of Making a Home Automation System Using Raspberry Pi and PIR Sensor. When PIR sensor detects motion, it displays string outputs stating there is an intruder on the Raspbian terminal, and vice versa. No external user interface was set up, and only made use of the Raspbian terminal to show whether or not there is an intruder present in the house.These systems make use of PIR sensors, which may be unreliable at times, hence could cause false detectionsand alarms when implemented in surveillance systems. One example is how PIR sensor might detect motion when receiving rapid heating from being exposed to the sun. On the other hand, there are in fact other options such as computer vision techniques which can be used to replace the said sensor. Hence, this work aims to improve theeffectiveness of motion detection by using OpenCV by carrying out a comparison between the use of PIR sensor and OpenCV techniques in motion detection.

Block Diagram/Methodology:

Explaination:
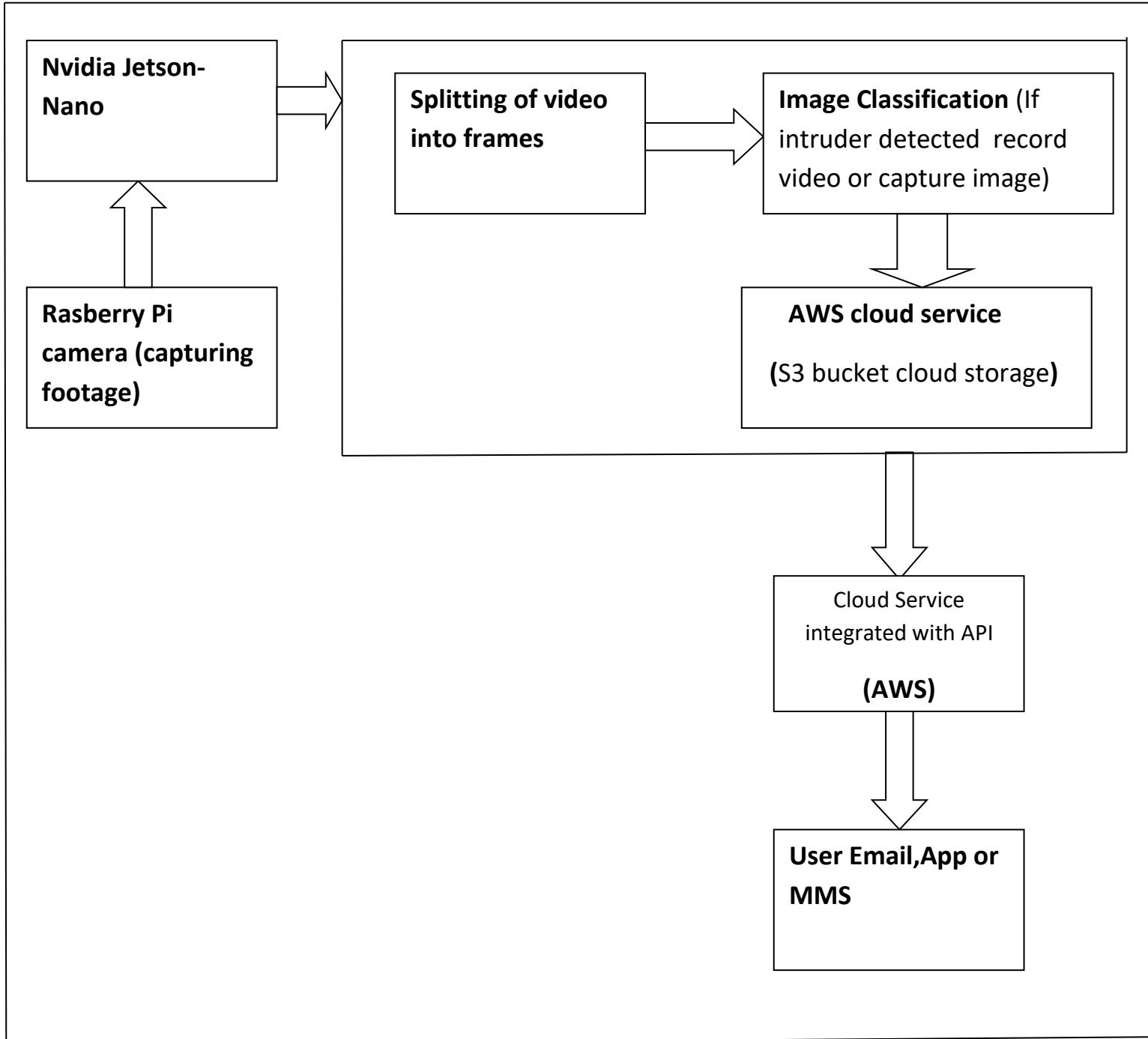
Rasberry pi cam: The Pi camera v2 video module connects directly to the Camera Serial Interface (CSI) port in the Nvidia Jetson-Nano using a 15-pin ribbon cable. The pattern noise and smearing from an earlier version have been fixed, which reduces faulty image. There are automatic control functions such as luminance detection, white balance and exposure control.This camera chosen to monitor activity as security system camera .

Nvidia Jetson-Nano: Given the goal of detecting a human in a scene, the initial plan was to use a hardware sensor on a Raspberry Pi 4 Model and use a hardware sensor to detect motion in that scene. Nvidia Jetson Nano was a more suitable platform for our use case. While the Nvidia Jetson is slightly more expensive, it comes with an onboard 128-core Maxwell GPU which can be used to process frames better than Raspberry Pi 4 Model, which would enable real time processing, a significant advantage for security.The given frames are can be processed efficiently onboard 128-core Maxwell GPU using and classified with the help of state-of-the-art detection and segmentation algorithms.With the help of machine learning algorithms and image processing using OpenCV camera can detect or classify between objects ,animals, person present in its feed.Once person gets detected or intruder appears in footage.The footage gets uploaded on cloud storage.

Cloud Service: Amazon Web Services, Inc. is a subsidiary of Amazon providing on-demand cloud computing platforms and APIs to individuals, companies, and governments, on a metered pay-as-you-go basis. AWS (Amazon Web Services) is a comprehensive, evolving cloud computing platform provided by Amazon that includes a mixture of infrastructure as a service (IaaS), platform as a service (PaaS) and packaged software as a service (SaaS) offerings. AWS services can offer an organization tools such as compute power, database storage and content delivery services.

The overall goal of the cloud infrastructure is to save processed images and videos uploaded from camera , store it in S3, add records to the database, and send links of that instance of the video and image when intruder detected to the user for easy access via email, app or MMS.

Software Requirements:

1)Python

2)IDE (Microsoft Visual Studio Code, Pycharm, Google collab etc.)

3) NVIDIA's DeepStream toolkit.

4)Cloud service(AWS)

Hardware Requirements:

1) Rasberry pi camera or other camera modules

2) NVIDIA Jetson Nano

NVIDIA® Jetson Nano: NVIDIA® Jetson Nano™ Developer Kit is a small, powerful computer that lets you run multiple neural networks in parallel for applications like image classification, object detection, segmentation, and speech processing. All in an easy-to-use platform that runs in as little as 5 watts.The ideal hands-on platform for teaching, learning, and developing AI and robotics applications. The NVIDIA Jetson platform introduced six years ago revolutionized embedded computing by delivering the power of artificial intelligence to edge computing devices. NVIDIA Jetson today is widely used in diverse fields such as robotics, retail, industrial, agriculture, and AIoT.

In March 2019, NVIDIA launched the original Jetson Nano Developer Kit and enabled developers, students, and enthusiasts alike to learn, explore, and build AI applications for edge devices. Rapid adoption by the enthusiast community made this our most-loved developer kit and created a Jetson movement. The new NVIDIA Jetson Nano Developer Kit making it affordable for learning AI and robotics. This developer kit is the ultimate starter AI computer and is available worldwide starting at the end of October 2020.The Jetson Nano Developer Kit includes a Jetson Nano module with memory and delivers 472 GFLOPS of compute performance with a 128-core NVIDIA Maxwell GPU and 64-bit Quad-core Arm A57 CPU. The included carrier board is equipped with interfaces commonly used in edge and embedded

project development, including USB 3.0 and USB 2.0 ports to connect peripherals including USB cameras, one MIPI CSI-2 camera connector, a 40-pin header which is compatible out of the box with many peripherals and add-ons, an HDMI display interface, and a Gigabit Ethernet port. The developer kit also includes an 802.11ac wireless networking USB adapter.

Processing	
GPU	128-core NVIDIA Maxwell™
CPU	64-bit Quad-core ARM A57 (1.43 GHz)
Memory	2 GB 64-bit LPDDR4 (25.6 GB/s bandwidth)
Video Encoder*	4Kp30	(4x) 1080p30	(2x) 1080p60
Video Decoder*	4Kp60	(2x) 4Kp30	(8x) 1080p30	(4x) 1080p60
Interfaces	
Networking	10/100/1000 Base-T Ethernet
Wi-Fi	Available via included 802.11ac wireless adaptor†
USB	1x USB 3.0 Type A port 2x USB 2.0 Type A ports 1x USB 2.0 Micro-B (Device Mode)
Display	HDMI
40-Pin Header	GPIOs, I2C, I2S, SPI, PWM, UART
Camera	1x MIPI CSI-2 connector
Storage	microSD (Card not included)
Other IO	12-pin header (Power and related signals, UART) 4-pin fan header†
Power	USB-C 5V 3A

Raspberry Pi Camera Module v2:

The Raspberry Pi Camera Module v2 replaced the original Camera Module in April 2016. The v2 Camera Module has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel OmniVision OV5647 sensor of the original camera).The Camera Module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge. There are lots of examples online of people using it for time-lapse, slow-motion, and other video cleverness. We can also use the libraries we bundle with the camera to create effects.You can read all the gory details about IMX219 and the Exmor R back-illuminated sensor architecture on Sony's website, but suffice to say this is more than just a resolution upgrade: it's a leap forward in image quality, colour fidelity, and low-light performance. It supports 1080p30, 720p60 and VGA90 video modes, as well as still capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi.

The camera works with all models of Raspberry Pi 1, 2, 3 and 4. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library. See the Getting Started with Picamera resource to learn how to use it.

The camera module is very popular in security applications, and in wildlife camera traps.

Applications :

Home security system: Home security system has established its importance and benefits numerous times by providing immediate monitoring of the house. CCTV based security systems are not real-time because the alert comes to the owner after the incident occurred unless they are at home during the incident.The traditional apporach of security system can be replaced by AI security system

Restricted Areas: There are some places such as goverment properties or military areas where no one can enter without permission.In such places this system can be implemented ensuring that no one allowed if intruder peresence detected secuiry authorities get notified with footage.

Private Sector: Private sector does not hold back when it comes to installing the cameras in the work environment mainly to avert unethical practices or the department where confidencial files are kept.

Banking Sectors: Banking sectors such as locker rooms. Where only authorized person are allowed.

Retails Shops: There are chances of breakins in shops such as jwellery shops, mobile shops etc and the chances of breakins mostly at night.In such cases intruder get detetcted instantly and owner get notified with footage instantly.

Conclusion: This proposed system aims at enhancing the safety of property and security from intruders/burglars with the help camera integrated with jetson nano.The footage can be processed with Jetson Nano and with the help of machine learning algorithm it can automatically monitors and detects people in a scene, and then alerts the user in real time by sending an image and video of victim through their email or app.

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