Deep Learning based Smart Surveillance using Cloud Computing

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Abstract - **A novel and technologically advanced system designed to enhance ATM security and transaction processes. This cutting-edge solution incorporates real- time object detection techniques, particularly leveraging edge computing for efficient and rapid analysis of video feeds from ATM locations. The primary aim of this project is to bolster ATM security by employing real-time object detection. By continuously analyzing video footage, the system can promptly identify and flag suspicious activities or potential threats, such as unauthorized access attempts or skimming devices. In addition to security, the system serves as a transaction monitoring tool. It can track and verify transactions in real time, ensuring that they align with authorized and legitimate actions. Any irregularities or discrepancies can trigger immediate alerts. A noteworthy feature of this system is its use of edge computing, which allows for processing video data locally at the ATM site. This minimizes latency, reduces data transfer requirements, and enhances the system's responsiveness, making it well-suited for real-time security and transaction monitoring. By integrating smart video analysis with ATM operations, this technology aims to provide a seamless and secure banking experience for customers while also minimizing the risk of fraudulent activities. This innovative approach holds the potential to significantly enhance the safety and efficiency of ATM services in the modern banking landscape.**

Keywords: ATM, Arduino, Cloud Computing

I.INTRODUCTION

In recent years theft has been seriously increased and there is no safety for people and their property. Security plays a vital role in monitoring a building in the absence o presence of people. Theft refers to the crime involving the taking of a person’s property without their permission. Most of the theft happens by door break-ins. 75% of theft occurs during night time. The thief may take off the fuse, so they cannot be easily identified and if they caught, they can be easily escaped. Bluetooth is mainly used to provide the message and the application which is used to conserve the power when the system is not in use.

This will also give alert to the owner through a mobile phone. In this industrialized world, stealing valuable and prosperous things has become a serious concern for police and common people. Theft may mentally affect the people because their hard work for years. Smart surveillance is a vital component of smart cities, where security and safety of people and assets are ensured by using advanced technologies. However, traditional surveillance systems are often limited by high cost, low efficiency, and human intervention. Therefore, there is a need for developing intelligent video surveillance systems that can automatically detect and recognize objects, faces, and activities of interest in real-time and with high accuracy.

Real-time Surveillance Enhancement: Implement advanced deep learning algorithms to analyze live video streams from ATM cameras, enabling real-time detection of suspicious activities, unauthorized access and potential threats outside the ATM premises.

Intrusion Detection: Develop a robust intrusion detection system using deep learning models to identify any unauthorized individuals or objects in the vicinity of the ATM. This will help prevent physical attacks and tampering with the ATM equipment.

Facial Recognition: Implement facial recognition technology using deep neural networks to accurately identify authorized personnel, customers, and potential threats. This feature can assist in tailoring security responses and monitoring specific individuals of interest.

Anomaly Detection: Train the deep learning models to identify anomalies in ATM user behavior during transactions. This includes detecting unusual patterns, gestures, or activities that might indicate fraudulent transactions, card skimming, or identity theft.

Multi-modal Security: Integrate various sensors such as motion detectors, card insertion sensors, and thermal cameras to provide a multi-modal security approach. Deep learning models will fuse data from these sensors to make more accurate security judgments.

Edge Computing: Utilize edge devices with sufficient computational power at the ATM location to process real-time data locally. This reduces latency and ensures continuous monitoring even ifthe internet connection is unstable.

II.PROPOSED SYSTEM

1. Aim of the Project

The aim of the project "Real-Time Object Detection Based on Edge Group for Smart Video Using ATM Security and Transactions" is to leverage cutting-edge technologies to enhance ATM security and transaction processes. The primary objectives of this project are as follows:

Enhance ATM Security: The project aims to improve the security of Automated Teller Machines (ATMs) by implementing real-time object detection algorithms. It seeks to identify and mitigate potential security threats, such as unauthorized access, vandalism, or the installation of skimming devices, as they occur in real-time.

Real-Time Transaction Verification: In addition to security, the project focuses on real-time transaction monitoring and verification. It aims to ensure that ATM transactions are legitimate and authorized, promptly flagging any suspicious or fraudulent activities.

Edge Computing Integration: One of the key goals is to utilize edge computing capabilities for processing video data locally at the ATM site. This approach reduces latency and minimizes the need for transmitting large amounts of video data to centralized servers, ensuring rapid and efficient analysis.

Smart Video Analytics: The project aims to harness the power of smart video analytics, including machine learning and artificial intelligence, to extract valuable insights from video feeds. This involves the identification and classification of objects, activities, and anomalies within the ATM environment.

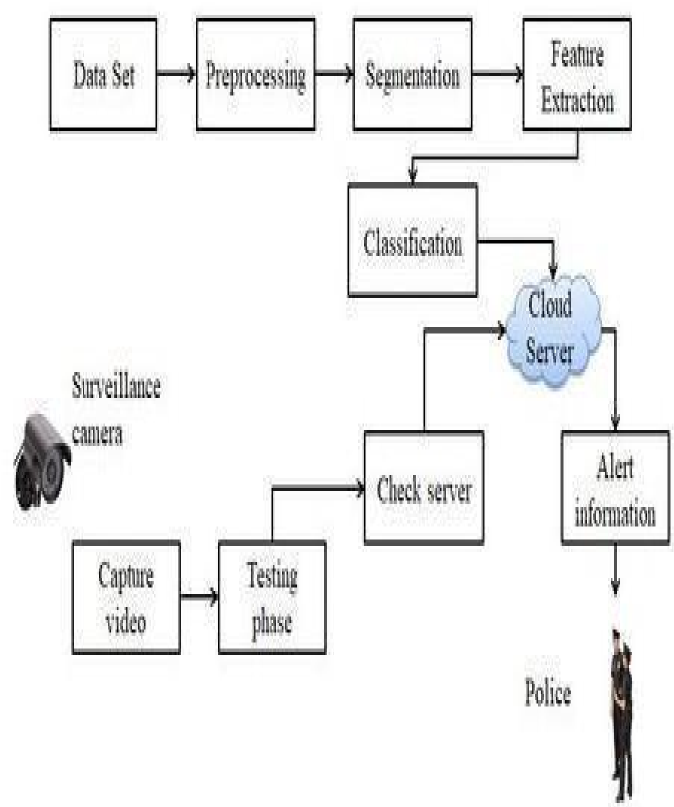
Improved Customer Experience: While enhancing security and transaction verification, the project also strives to provide a seamless and secure banking experience for ATM users. It aims to minimize disruptions caused by false alarms or technical issues.

Scalability and Adaptability: The project seeks to create a scalable solution that can be deployed across a network of ATMs, adapting to diverse environments and ATM configurations.

Cloud Computing Integration: Cloud integration is a system of tools and technologies that connects various applications, systems, repositories, and IT environments for the real-time exchange of data and processes. Cloud integration can also be referred to as cloud data integration, cloud system integration, cloud-based integration, as well as IPAAS. Deployments that are either fully in the cloud or hybrid are both considered cloud integration the ultimate goal is to function as a cohesive IT infrastructure that streamlines data flow.

2. Hardware Requirements

2.1.1 Arduino



2.1 Arduino

The Arduino hardware and software was designed for artists, designers, hobbyists, hackers, newbies, and anyone interested in creating interactive objects or environments. Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smart-phone or your TV!

This flexibility combined with the fact that the Arduino software is free, the hardware boards are pretty cheap, and both the software and hardware are easy to learn has led to a large community of users who have contributed code and released instructions for a huge variety of Arduino-based projects. Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments.

2.2 DC MOTOR

DC motors are among the most commonly used electric motors in a broad range of applications today. Like every electric motor, they convert electric energy into mechanical work (in the form of shaft rotation). However, DC motors differ from other electric motors because they are powered by direct current (DC), such as batteries and DC power supplies.

The construction of a DC motor follows the same principle as the example of the simple motor discussed above. However, large DC motors use a field coil instead of permanent magnets to create the stator's magnetic field. In this section, we discuss the different components of a generic DC motor. The DC motor diagram shows the most important components of the device. It consists of the Armature (rotating part), the yoke, field windings, carbon brushes, and the commutator.

2.2 BUZZER

Buzzer applications are versatile and can be used for various purposes, such as game shows, quizzes, or reminders. They often provide customizable settings for sound and timing to suit different needs. If you have a specific use case in mind, let me know for more tailored recommendations! This board has many functions and features like an Arduino Duemilanove board. However, this Nano board is buzzer is an electromechanical device that produces a buzzing or beeping sound when activated. It typically consists of a coil, a vibrating diaphragm, and an electronic circuit. Buzzers find applications in alarm systems, game shows, electronic games, and various signaling devices where an audible alert is needed. They are activated by an electrical current, causing the diaphragm to vibrate and create the distinctive sound.

2.4 LCD DISPLAY

LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden: preset words, digits, and seven-segment displays (as in a digital clock) are all examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight.

2.5 MOTION SENSOR

A motion sensor is an electronic device that detects movement within a specified area. It operates by sensing changes in infrared radiation, heat, or sound patterns, triggered when an object, person, or animal enters its coverage zone.Regarding home security, motion sensors play a pivotal role by promptly alerting homeowners or security systems to potential intrusions.This real-time detection enables swift responses, such as activating alarms, sending notifications, or even triggering lights to create an illusion of occupancy. Motion sensors act as a crucial layer of protection, fortifying homes against unauthorized access and enhancing overall security measures.

2.6 SENSOR

A sensor is a device, module, machine, or subsystem that detects events or changes in its environment and relays the information to other electronics, most commonly a computer processor. A sensor converts physical phenomena into a measurable digital signal, which can then be displayed, read, or processed further. The figure illustrates the working of a sensor. Various specialists and researchers classify sensors in a variety of ways. In the first classification, the sensors are divided into Active and Passive categories.

3. Software Requirements

3.1 PYTHON

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics developed by Guido van Rossum. It was originally released in 1991. Designed to be easy as well as fun, the name "Python" is a nod to the British comedy group Monty Python. Python has a reputation as a beginner-friendly language, replacing Java as the most widely used introductory language because it handles much of the complexity for the user, allowing beginners to focus on fully grasping programming concepts rather than minute details.

3.2 TENSOR FLOW

TensorFlow is an open-source platform and framework for machine learning, which includes libraries and tools based on Python and Java — designed with the objective of training machine learning and deep learning models on data. Google's TensorFlow is an open-sourced package designed for applications involving deep learning. Additionally, it supports conventional machine learning. TensorFlow was initially created without considering deep learning for large numerical calculations. However, it has also proven valuable for deep learning development, so Google made it available to the public.

3.3 KERAS

Keras is the high-level API of the TensorFlow platform. It provides an approachable, highly-productive interface for solving machine learning (ML) problems, with a focus on modern deep learning. Keras covers every step of the machine learning workflow, from data processing to hyperparameter tuning to deployment. It was developed with a focus on enabling fast experimentation. With Keras, you have full access to the scalability and cross-platform capabilities of TensorFlow. You can run Keras on a TPU Pod or large clusters of GPUs, and you can export Keras models to run in the browser or on mobile devices. You can also serve Keras models via a web API.

3.4 PANDAS

As an open-source software library built on top of Python specifically for data manipulation and analysis, Pandas offers data structure and operations for powerful, flexible, and easy-to-use data analysis and manipulation. Pandas strengthens Python by giving the popular programming language the capability to work with spreadsheet-like data enabling fast loading, aligning, manipulating, and merging, in addition to other key functions. Pandas is prized for providing highly optimized performance when back-end source code is written in C or Python.

3.5 NUMPY

NumPy (Numerical Python) is an open source Python library that's used in almost every field of science and engineering. It's the universal standard for working with numerical data in Python, and it's at the core of the scientific Python and PyData ecosystems. NumPy users include everyone from beginning coders to experienced researchers doing state-of-the-art scientific and industrial research and development. The NumPy API is used extensively in Pandas, SciPy, Matplotlib, scikit-learn, scikit-image and most other data science and scientific Python packages.

5. METHODOLOGY

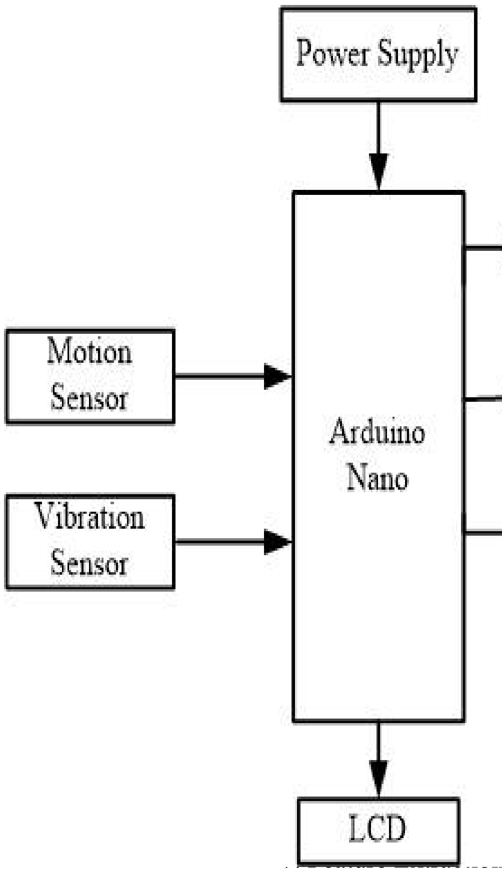
5.1 Working Principle

Video Input: The project starts with capturing video input from a camera or a video file. This stream of frames serves as the primary data source for object detection.
Pre-processing: Each frame of the video undergoes pre-processing to enhance its quality and reduce noise. This may involve techniques such as resizing, normalization, and noise reduction to improve the accuracy of object detection.
Feature Extraction: The pre-processed frames are then fed into a feature extraction stage. This step involves analyzing the frames to identify relevant features that can help in detecting objects. Common techniques include edge detection, color histogram analysis, and texture analysis.
Edge Grouping: In the context of this project, edge grouping plays a crucial role in identifying object boundaries within the video frames. Edge grouping algorithms are used to connect edge points or segments that belong to the same object, effectively delineating the object's outline.

Object Detection Model: The grouped edges are then inputted into an object detection model. This model is trained to recognize specific objects or classes within the video frames. It may utilize machine learning algorithms such as deep learning-based convolutional neural networks (CNNs) trained on labeled datasets for object detection.
Real-time Processing: To achieve real-time object detection, the system must process each frame of the video stream rapidly. This requires efficient algorithms and optimized hardware (such as GPUs) to handle the computational load within the desired timeframe.
Output Visualization: Once objects are detected within the video frames, the system may overlay bounding boxes or labels around the detected objects to visualize their location and class. This information can be displayed in real-time alongside the video stream.

Integration with Smart Video Applications: The detected objects' information can be further utilized in various smart video applications, such as surveillance systems, traffic monitoring, or automated object tracking. Integration with higher-level systems allows for intelligent decision-making based on the detected objects.

6. Block Diagram



In this Future work is field of real-time object detection based on edge computing for smart video holds exciting possibilities and research directions. One avenue for exploration is the refinement and optimization of edge device hardware, making them more energy- efficient, powerful, and cost-effective. Additionally, the development of advanced machine learning models and algorithms tailored for edge- based object detection can further enhance accuracy and speed. Interoperability and standardization between various edge devices and platforms are crucial to promote the seamless integration of smart video systems across different applications and industries. As edge computing evolves, researchers can focus on reducing the computational and power requirements for resource-constrained edge devices, which is particularly important for applications in remote or resource-Limited environments. Exploring real-time object detection for novel applications, such as augmented reality, healthcare, and smart cities, presents exciting possibilities.

Future work can focus on enhancing the performance of the object detection algorithm to achieve higher accuracy and faster processing speeds. This may involve optimizing the edge grouping algorithms, leveraging more advanced deep learning architectures, or utilizing hardware accelerators like GPUs or TPUs.
The project on real-time object detection based on edge grouping for smart video can continue to evolve and address emerging challenges in computer vision and smart video analytics.

VIII. RESULT and CONCLUSION

Real-time object detection based on edge computing represents a transformative approach for smart video systems. This technology offers numerous advantages, including reduced latency, improved responsiveness, enhanced privacy, and cost savings. By processing data closer to the source and enabling local decision- making, it not only enhances the speed and reliability of smart video applications but also ensures better security and compliance with data protection regulations. Moreover, the scalability, customization, and environmental benefits make edge- based object detection a valuable solution for a wide range of use cases, from smart surveillance and autonomous vehicles to interactive video applications. As the demand for real-time, efficient, and secure smart video systems continues to grow, leveraging edge computing for object detection stands as a promising and innovative solution with the potential to reshape the way we interact with and benefit from video technology.

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