

IOT BASED ATM SURVEILLANCE SYSTEM USING DEEP LEARNING

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Abstract

ATM(Automated Teller Machine) security is very important to people nowadays. ATM transactions are very simple and easy, but the machines and the areas around them can be vulnerable to theft and need to be guarded. Using real-time video surveillance via hidden camera will make ATM transactions much safer. Robberies occur pretty much in our everyday lives. This system deals with the development of a video surveillance automation framework in ATM machines and detects any form of possible criminal activity and therefore brings out a solution to current problem with the existing systems. Deep learning techniques can be used to achieve impressive results in the detection of the activities. The proposed system makes effective use of an algorithm such as Yolov3 which includes methodologies such as detecting objects such as weapons and eventually ending up identifying the action required to prevent fraud activities. Our goal is to build a real-time system using Camera to catch the person entering the system. If some weapons are identified by the system it will take necessary actions. It will send alert message to the nearest police station and corresponding bank through GPS and GSM. This system also produce an alarm with beep sound once theft or robberies are recognised. The DC motor is used for closing doors of ATM.

Index Terms—*Arduino, YOLOV3, GSM, GPS, Camera*

I. INTRODUCTION

As large number of people are depending ATM for money transactions its maintenance and mainly security is very important. The banking system has been making extensive use of Closed Circuit Television Systems (sometimes called CCTV systems) over the past years to deal with the matter. Nowadays, there are two common ATM related crimes. The primary is non-violent crimes like fraud, theft of passwords. The second, is violent crimes like robbery. Violent crimes like vandalism, robbery, physical attack are increasing. These crimes are done purely for destructive reasons or to steal money and sometimes the cardholder is physically threatened and compelled by hijackers to draw money from the ATM. Most of those crimes occur on or around the unguarded ATM's offering 24-hour services. ATM counters have surveillance cameras that often goes unnoticed until an issue arises that requires surveillance footage from these cameras. Here we propose our system to detect thefts inside ATM counters. To detect and recognise theft inside ATM counter's, we propose a real time ATM surveillance system.

1.1 Relevance

The real world scenario is seeing the growing use of ATM machines that have a critical role to play in our everyday lives. While many research is happening within the field of ATM crime detection, as lot of crimes are happening related to ATM these studies are quite relevant nowadays. ATM Surveillance's existing approach is assessed mostly by tracking CCTV footage from the CCTV mounted in an ATM. But, it is impossible to centralise CCTV for monitoring. Both customer service and ATM banking safety must be improved. This technique deals with the planning of an application for real time video surveillance and detects any sort of potential criminal activity that would occur with the existing system and make it inefficient.

1.2 Socio-economic Importance

Transaction of cash is required by the customer everywhere and at anytime. So it must be safe and guarded. In banking sectors several problems are resulting from the rise of attack on ATM. ATM transactions are quick, easy and convenient. But it is susceptible to criminal activity so got to be properly protected. The increasing number of ATM fraud involving activities like theft, fighting and vandalism is a problem that the proposed system will tackle to permit secure financial transactions throughout the day and night.

- Real Time Detection: Any attempts of robbery or damage to ATM machine are detected in real time. The person using knife inside ATM for robbery is caught at real time.
- Reduction of Thefts: As the system works for 24x7, the need for manual monitoring is reduced and cause a huge reduction in theft.
- Safe Environment for Transactions: Because the system works for 24x7, provides a safe platform for quick and safe transactions.
- Less Maintenance: It's long lasting and wish less maintenance apart from the camera modules.

II. LITERATURE REVIEW

A. Automatic Video Surveillance for theft detection in ATM machines: An enhanced approach

This was proposed by Rupesh Mandal and Nupur Choudhury in 2016. They proposed a system that deals with development of an application for detecting any type of possible theft and criminal activities happening in ATM systems. An advanced digital image processing techniques along with the combination of unsupervised machine learning and computer vision is used for the detection of activities and their classification. The system also uses matching techniques like pose clustering for training the system and to make it an automated one as a whole. Here the captured video is fragmented into smaller frames and vector graphics and image processing techniques are implemented. In this system the entire process takes place in real time therefore decreasing time complexity to a great extent and that makes the system an efficient mechanism to prevent anti-social activities. The primary approach for the proposed system primarily consists of 5 steps and they are Background Registration, Background subtraction, Object Tracking, Feature Extraction and Pattern Matching. This system provides a video file as an input. Then the system will process the video and identifies the action performed by the person, whether it's a safe or theft action.

B. Detection of Unusual Events in Low Resolution Video for Enhancing ATM Security and Prevention of Thefts

This was published in the year 2017 by Prajwal B.K, Sreeharsha M.S, Rahulan Sumanth Babu S and Kiran M. In recent decades, efforts in the field of moving target object tracking have made many applications reliable, accurate and efficient. However, there are difficulties for its enhancement. The challenges are dynamic background, illumination changes, shadow etc. This becomes more difficult when

target object tracking is performed in low resolution video. In low resolution video, it is very hard to precisely find out the target object of interest and need massive computational cost. In this system, a state-of-the-art system is proposed. An algorithm is used which is capable of detecting unusual events and for enhancement of ATM security where simple and low resolution cameras are used to detect the existence of unusual events like face masking, camera masking, fight or overcrowding. It processes low resolution frames and also sends alert messages to concerned authorities for enhancing the ATM security and prevention of thefts.

C. To Enhance the Security for ATM with the help of Sensor and Controllers

It was written by Kande Archana, Dr. P. Bhaskara Reddy and Dr. A. Govardhan in the year 2017. There is no protection and security for ATM systems with the latest technologies in current environments. – The main aim of this paper is to provide protection for the ATM network. Day-to-day awareness of the robberies is taking place in our everyday lives. The goal comes with being conscious of the ATM fraud from robberies, and then the issues with current strategies in our culture can be minimised. When robbery happens, the PIR sensor is used to look at the human activity on the basis of which the alarm can produce beep sound from the ATM. This machine uses an embedded device-based ARM controller to handle them in real time. DC Motor can close the ATM door until the alarm generates the beep signal, Stepper motor is used to leak the gasoline inside the ATM to put the thief into unconscious phase. Camera sends the videos continuously to the device for potential monitoring. The message is then sent via the GSM to the nearest police station and the corresponding bank and in the second the videos to the bank concerned. This will stop the robbery and one who is interested in fraud will be found out easily. Here, to run the entire application using keil tool.

III. PROPOSED WORK

ATM Surveillance system is a technology with great benefits that can implemented on existing ATM machines and in ATM rooms, in order to detect unusual activities that might take place in an ATM room. This system can give an intelligent surveillance for the corresponding bank. Our aim is to develop a real time ATM surveillance system. The proposed system detect any type of criminal activities that might be arising with the system which would considerably decrease the inefficiency that are present with the existing system. Here in our system we use YOLOv3 algorithm. The system uses COCO dataset. ATM Surveillance System is a deep learning based System. With this system, we can prevent theft in ATM. Here, the system detects weapons mainly knife with the help of YOLOv3 object detection algorithm. We use a micro controller for the connections of various hardware components. Inside ATM counter, the camera unit capture the videos. If there is any weapon like knife found used by customer, then the system produce a loud sound using buzzer to seek the attention of responsible persons nearby. Also, our system would send an alert message to the police station and as well as to the bank using GSM module. The DC motor is used for closing doors of ATM. We believe that through this system it can reduce the theft towards ATM systems.

A. OBJECTIVES

ATM Surveillance system if implemented on existing ATM machines and in ATM rooms, can detect unusual activities like using weapons inside ATM rooms that might take place. Other features of our system is, this is designed so that it can give an intelligent surveillance for the corresponding bank. The main feature of the system is that we could be able to detect robbery at an early stage and theft can be stopped. In short we can say that this is a best solution to most of the ATM robberies in our country.

B. DESIGN

ATM Surveillance system is a deep learning based System. With this system, we can protect ATM machines from theft and robberies. If a person enters the ATM counter with a weapon like knife, it can be detected with the help of YOLOv3 object detection algorithm. We use a micro controller for the

connections of various hardware components. When a person enters the counter, the camera unit used to capture the videos of object that enter into the ATM counter. This video is divided into frames and the yoloV3 object detection algorithm detect the object in each frame. Then we check whether the object in each frame is a knife or not. If a knife is detected, then the system send an input signal to the micro controller. Finally the entire system is connected to the buzzer which produces a loud sound to alert people nearby. Then send a message via the GSM to the nearest police station and corresponding bank and send the videos via the GPS to the same bank and police station in the next second. Also Motor will close the ATM door and person who used weapon is caught inside.

C. METHODOLOGY

We have used the You Only Look Once Version 3 (YOLOv3) prediction model for our project. The model which we have used was pre-trained on the COCO dataset. The model was modified and condition statements were added accordingly so as to predict weapon of interest that are specified previously depending on the region where the system is being deployed, like to predict knife of our current interest. This model has been designed to detect theft in real time from the footage of the surveillance cameras that have been set up in ATM.



Fig. 1. Single Frames from Input Videos

The video input to the detection system is considered as a sequence of frames. Each frame goes into the system as the primary input which is preprocessed to suit the input frame size requirements. The frame thus obtained is then passed through the model which detects any weapon of interest from the frame and classifies it accordingly. The conditional statements were made such that they can be modified to suit any set of weapons, as long as it is included in the list of weapons on which this model has been trained. When a weapon of interest appears completely at a position within the frame, the model detects and classifies it to be of a certain class of weapon.

If this class label corresponds with one of the class labels that have been specified in the conditional statements, in our case, a knife, an alarm function is triggered. This alarm function generates a buzzer alarm on an Arduino board connected directly to the system and also on an Internet of Things (IoT) module that is not connected to the system directly, but works through an Application Program Interface (API) key that is used to access the module's cloud server that activates the buzzer through the internet, whilst the IoT module is linked to the BOLT Cloud site on the internet through any available wireless internet source such as Wireless Fidelity (Wi-Fi), that has been previously set to the module. Along with these Buzzer alarms, an alert in the form of SMS is also generated to inform required authorities.



Fig. 2. Single Frames from Detected Videos

ATM Surveillance system is a system which is a hybrid of Computer Vision, Machine Learning and IoT to make our road a safer place. The system mainly consists of 2 design phase:

Phase 1 – Real-time robbery detection Phase 2 – Alerting system

There is no need to create a knife's dataset in our Proposed Work. Already knife's dataset is available. We use this pre-trained MS Coco Data set of knife. Similarly, there are two stages in the project.

Phase 1 – Real-time robbery detection

As we know ATM machines are used both day and night. So there is a high risk that the robbery might happen during any time of the day. So in our project we use Machine Learning and Computer Vision to detect the weapons that are used for robbery. The first part is to detect robbery. Therefore, when a person enters the ATM counter, the real time video will be first recorded using the cameras placed in the ATM counter and then the yoloV3 object detection algorithm will be used to detect the weapon, that is knife.

Object Detection

Here, we are use YoloV3 algorithm for the object Detection. The Yolo system uses COCO dataset to detect weapons. The image is divided as grids of matrixes. Each grid undergoes classification and localisation of the object. The location of an object is typically represented by a bounding box. So we can predict the bounding boxes and their corresponding class probabilities. YoloV3 contain three level of detection and produce an accurate result.

Phase 2 – Alerting system

The second stage is Alerting System. Here we use a buzzer to make the sound. It is connected to the Arduino board. Whenever the system detects a knife used by the person inside the ATM counter, the signal to generate the sound will be sent to the Arduino board. Suddenly the buzzer will make the sound and alert people nearby. Since our system uses, RPi camera and GPS module we can use those to track the location of ATM. When enabled RPi, it terminates all other process and starts executing a new routine to continuously send Location data using GPS module. This makes easier for Police to catch the thief very easily.

Also DC motor is used to lock the doors of ATM so that the person should not escape.

The various hardware component used in our project are:

- Arduino board
- Neo 6m GPS Module
- No IR Camera for RPi
- DC Motor
- GSM Module

Software Required: Here the software library used are:

- Arduino IDE
- Pycharm • Python
- OpenCV

Arduino board

Arduino is a single board microcontroller designed for the connections of various hardware components. It contain 14 digital input/output pins,6 analog inputs, a USB connection, a power jack, an ICSP header and a reset button. The 14 digital input/ output pins can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in arduino programming. Each pin operates at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 K Ohms which are disconnected by default. It has improved functionalities and performance compared to its other microcontrollers.

IR Camera

We are using the surveillance camera to capture the events that occur in the ATM counter to capture the real time video using any IP Camera or webcam. The camera will be kept ON for 24 hours. The camera captures the image in the video format in order to detect knife. An image is a single frame. A video contains 20 to 30 frames in one second. These images are further being used for comparing the images from target folder. We are using a pre-trained COCO dataset to detect knife.

Neo 6m GPS Module

This is a very common, cost-effective, high-performance GPS module featuring a ceramic patch antenna, an on-board memory chip and a backup battery that can be easily combined with a wide range of microcontrollers. It's also extremely prone to indoor applications.

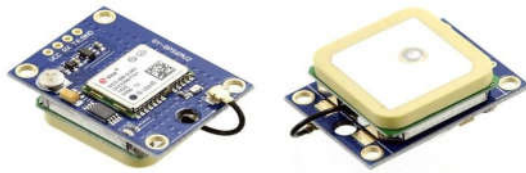


Fig. 3. Neo 6m GPS Module

GSM Module

GSM modules are among the communications modules widely used in embedded systems. A GSM module is used to enable microcontroller (or microprocessor) to communicate with the GSM / GPRS network. Here, GSM stands for Global Mobile Communication System and is used to transmit warning messages to the nearest police station and the bank in question.



Fig. 4. GSM Module

DC Motor

When the thieves try to break the ATM machine, we have placed DC motor for closing the ATM door.

BUZZER

The buzzer is a sound-making device. We use the buzzer here to alert people nearby ATM counter about theft inside it. It is connected to digital pins of Arduino board.



Fig. 5. Arduino Board with Buzzer

OpenCV

It is a python library which helps Real time object detection and resolve computer vision issues. It is a cross- platform computer vision library as an open source. It can be programmed by using several programming languages like C, C++, Python, Java, etc. This will help in writing more powerful image process functions and high-level algorithms. Open CV helps a wide range of image processing applications and it can be used simply also it is easy to handle.

Python

Python is an interpreted, high-level, general-purpose programming language. Python is the main codebase in which the project runs. The coding done on the microcontroller is using python. Knife detection is coded with help of python.

PyCharm

PyCharm is an integrated development environment(IDE) specifically for the Python language, used in computer programming. It offers code analysis, a graphical debugger, an integrated device tester, integration with version control systems (VCSes), and facilitates web creation with Django as well as with Anaconda Data Sciences.

Arduino IDE

The Arduino Integrated Development Environment-or Arduino Software (IDE)-includes a text editor for code writing, a message field, a text screen, a toolbar with specific function buttons and a set of menus. It linked to and interacted with Arduino and Genuino Hardware to upload programs. Code written using Arduino Interface (IDE) is called sketching. Such sketches are written in the Text editor and saved with the .ino file extension. The editor has cutting / pasting functionality and document search / replacement functions. The message area offers input when exporting and saving, and also shows errors. The Arduino Software (IDE) console displays text output including complete error messages and other information.

IV RESULT

If anybody enters ATM counter with a knife, our project will detect it as below. So any sort of theft or damage to ATM Machine can be identified. Alarm sound will be produced, doors will be automatically closed and alert messages will be automatically sent to bank and police stations. So theft can be prevented in real time.

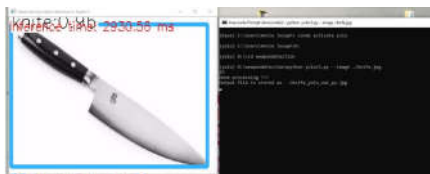


Fig. 6. Result

V CONCLUSION

We all know that the existing security for the present day ATM are facing a number of threats and are increasing. Among these threats thefts in ATM is the most common one. To avoid this problem we develop a system which provides a real time surveillance in ATM. Here we mainly focus on developing a real time system that provide a great security to the ATM system. If the user uses weapons like knife inside ATM counter will report suspicious activities and can be caught at real time. The main aim of our project is to reduce crimes in ATM by using deep learning techniques. By implementing our proposed system a robust and secure environment can be created inside the ATM room and evaluate whether user uses any weapons inside the ATM.

VI FUTURE SCOPE

The current system of detecting knife and producing alarm sound can be extended by providing message passing feature to authorities, automatic door locking system, detection of unusual behaviour, more weapons like gun, iron rode etc, training of covered weapons . This system can be extended to identify violence in public places, theft in houses, jewellery etc.

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