Theft Detection using Machine Learning

Ajay Kushwaha[1], Ankita Mishra[2], Komal Kamble[3], Rutuja Janbhare[4],
Prof. Amruta Pokhare[5]

[1](Department of Information Technology, Atharva College of Engineering/Mumbai University, India)
[2](Department of Information Technology, Atharva College of Engineering/Mumbai University, India)
[3](Department of Information Technology, Atharva College of Engineering/Mumbai University, India)
[4](Department of Information Technology, Atharva College of Engineering/Mumbai University, India)
[5](Department of Information Technology, Atharva College of Engineering/Mumbai University, India)

Abstract: *Theft is increasing day by day and it has become one of the never ending problem in the world. Since, there are several detecting devices which are already available in the market today, but these devices had no provision to automatically detect theft attempts by alarming the owner. To solve this problem, Camera footage based theft detection will be used with the help of machine learning to detect theft occurrence. System will detect the motion with the help of convolution neural networks and an alert message will be sent to the owner along with captured image and options such as neglect, call the police or fire brigade.*
Keywords: *Anti-Theft Device, Convolutional Neural Networks (CNN), Machine Learning, Raspberry Pi, Tensor Flow.*

I. Introduction

1.1 Need

Theft is one of the most common and oldest criminal behaviors and it is increasing day by day. Theft of valuable objects is some of the never ending problem in the world. Due to increase rate in theft the people has suffered in fear and loss. In order to stop this increasing theft across the world, there is a need for a theft deterrent system that is convenient in use, relatively free from false alarms and does not require frequent user action to arm and disarm the system. So, to meet all such requirements, we will be creating a device that would be able to detect theft in any shops or residential areas and alarm the owner along with the options to act against the theft situations.

1.2 Problem Statement

The development of an anti-theft device which would be capable enough to detect theft using motion sensing camera using machine learning and alarm the owner with alert message along with the captured image of that instance of motion. The device will be a real-time system along with easy to use interface, which will be proved useful in terms of security of people as well as their valuable things/objects.

1.3 Aims and Objectives

Security against theft is a major concern in our today's changing and evolving world. People need more security in terms of their valuable things. Jwellery shops or any protected areas are equipped with security cameras but not with an smart anti-theft system, which can take care of the security of their property even in their absence.

This project focuses specifically on the room security system. Shop or room security system is important nowadays. The whole building security system or civilian home security system is expensive. Most security systems available in the market nowadays are complicated, and installation of the system will cost another amount of money to be invested in order to have a good security system. A variety of security devices for deterring, detecting, and identifying offenders or intruders can be found. However, very few provide a working relationship to a room. So, the main goal of this project to use machine learning techniques in camera to detect any motion in the specified area and alarm the owner with an alert message along with captured image and options to take actions against theft or to neglect it, in case of false alarm.

The project aims at providing good and efficient security to the general public and mostly to those shop owners who lives far away from their shops. This project also aims, to develop Graphical User Interface (GUI) which will be used by the user to manage and control the system.

1.4 Application and Scope

The project has many applications in terms of security and motion detection. Machine Learning library i.e. TensorFlow is used which follows Convolutional Neural Networks to differentiate between image frames and hence it detects theft. This Anti-Theft device can be used to provide security to particular room or objects. Due to its feature extraction ability it can make difference in real theft or simple movements of persons and objects. Beside this, it can have various applications.

II. Literature Surveyed

1.5 Anti-Theft Device using Motion Detection and Body Temperature

This work was carried out in 2014 by Rhowel Dellosa with an aim to design, assemble and determine the performance of the anti-theft device using motion detection and body temperature. The study utilized developmental design to observe the functionality of the device. Study showed that the anti-theft device can detect motion from a moving object for those with body temperature like human being, animals. A signal from the sensor circuit triggered the receiver circuit to produce an audible sound that served as alarm [1].

It was also found that the output of the study is accurate in terms of detecting moving objects with body temperature during day and night times. The researchers formulated an evaluation instrument to determine its performance. Results showed that the device had a good performance and acceptable in terms of functionality [1]. The device was having following advantages and disadvantages:

Advantages:

1. The device was capable in distinguishing between human and animal intrusion using sensor for body temperature detection.

2. It was using an alarm system which uses to alert the owner by making sound.

3. It was convenient in use, relatively free from false alarms and does not require frequent user action to arm and disarm the system.

Disadvantages:

1. The use of sensor for body temperature detection increases the cost of the project.

2. The sound was made by device will not be recognized by the owner, if he/she is not present there.

1.6 Moving Objects Detection using Camera

It was carried in 2012 by Yong-Deuk Shin, Jae-Han Park, Ga-Ram Jang and Moon-Hong Baeg. The detection of moving objects for the surveillance and monitoring has been studied in this paper. Traditionally, the studies assume the use of a stationary camera. When using a 3D point cloud, research is restricted to the fixed laser scanner because of the slow data acquisition time. In this paper, a new method was proposed for detecting moving objects based on a freely moving sensor that provides two-dimensional three-dimensional (2D-3D) fused data. The method used was frame-differencing, which compares two consecutive frames combining visual features and a 3D point cloud. The RANSAC and ICP algorithms are applied for more accurate results [3].

Advantages:

1. The method was able to handle outliers using RANSAC algorithm.

2. It used segmentation method to remove the ghost points that were produced during the frame differencing method.

Disadvantages:

1. The project or system was unable to detect motion in case of moving camera.

2. The risk of outliers and ghost points, reduces the performance of the motion detection system.

1.7 Application of Deep Learning in Object Detection

This paper deals with the field of computer vision, mainly for the application of deep learning in object detection task. On the one hand, there is a simple summary of the datasets and deep learning algorithms commonly used in computer vision [2].

On the other hand, a new dataset is built according to those commonly used datasets, and choose one of the network called faster r-cnn to work on this new dataset. Through the experiment to strengthen the understanding of these networks, and through the analysis of the results learn the importance of deep learning technology, and the importance of the dataset for deep learning.

1.8 Comparison between Previous and Current Implementation

Table 1: Comparison

Rhowel Dellosa's Implementation, Dec-2014	Current Implementation
In this paper, they have used alarm system to provide alert against any motion detected.	We have replaced the alarm system with alert message system along with the image captured.
It include sensors for recognition of body temperature for distinguishing between humans and animals.	We have used tensorflow library for image recognition which will help to distinguish the same .
They have used MATLAB programming language which is easy to use.	We have used Anaconda Python 3.6 and imported Tensorflow to achieve good performance and speed.
They have used BLOB analysis technique which is used to distinguish between large and small objects.	We have used CNN algorithm which is used to handle the false alarm by detecting the objects.

III. System Design

To resolve the problems of existing work we propose a new approach, which would be helpful to remove the unnecessary use of hardware and the cost of the project will be reduced. The propose work will solve the problems of false alarm by removing outliers using various algorithms such as frame differencing, segmentation, etc. This work will majorly describe the flow of the process.

1.9 System Block Diagram

System Block Diagram i.e. fig.1 below served as framework of the system. The Raspberry Pi 3b and Raspberry Pi Camera module is the main components of the system. When the system is turned on, the camera module will capture image frames and send it to Raspberry Pi for processing using tensorflow library of Machine Learning which will detect motion and send alert message to the owner. Here, external power supply is required for the Raspberry Pi device.
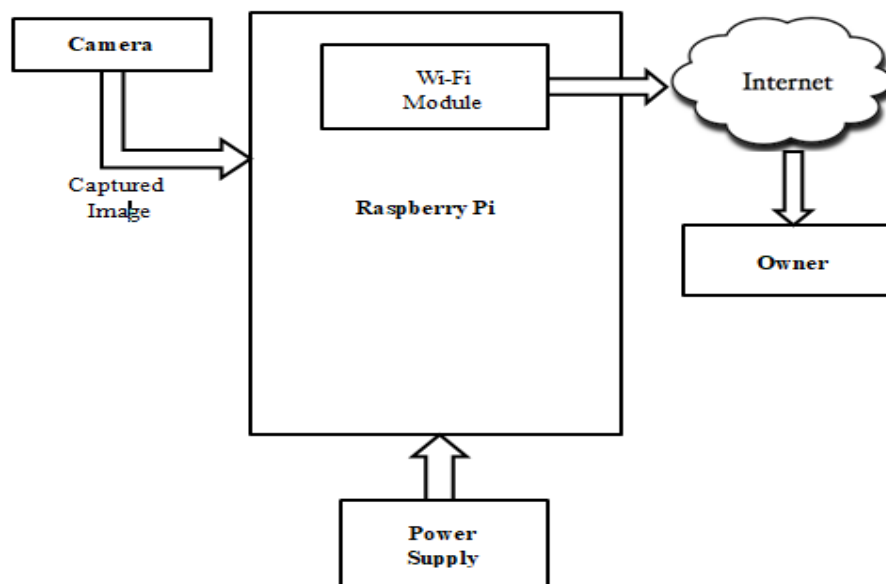

Figure 1: System Block Diagram

1.10 Flowchart

The below flowchart i.e. fig. 2 gives the complete flow of working of the system from the capturing of an image to sending the alert message to the owner.
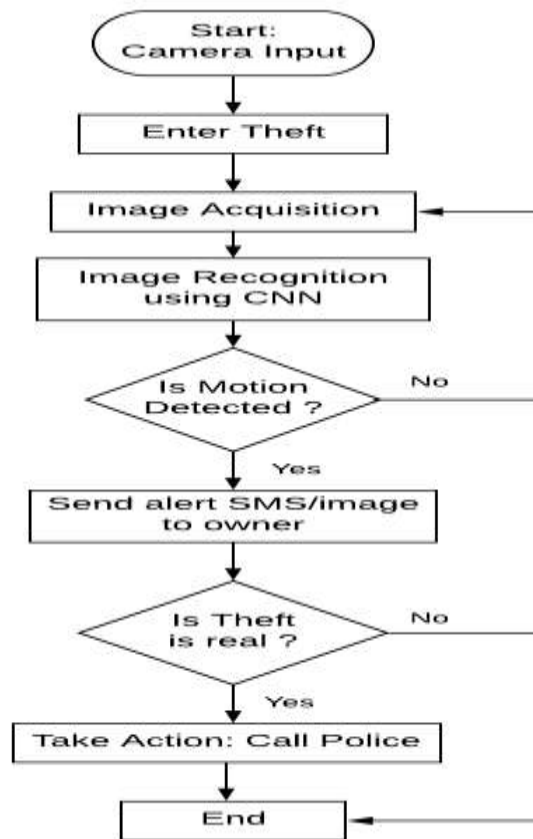
Figure 2: Flowchart of the System

1.11 Use Case
The below Use-case diagram i.e. fig. 3 describes the overall role of the Anti-Theft device and the user.
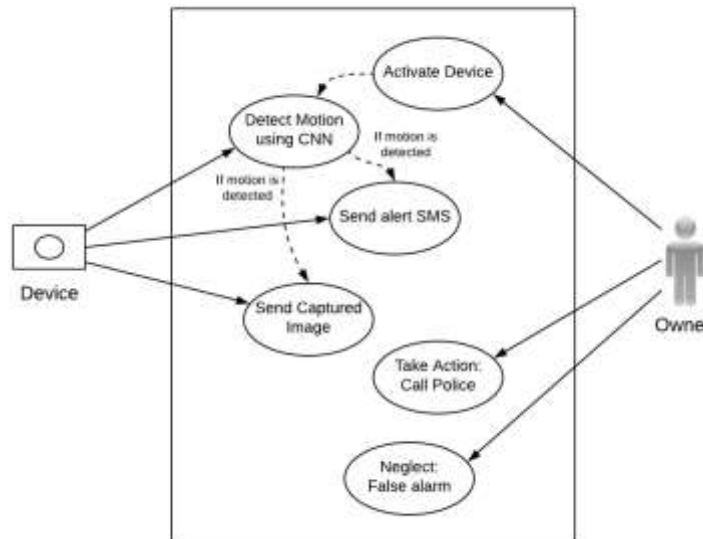

Figure 3: Use Case diagram

1.11.1   Device/System
      The Anti-Theft device, once installed will be activated by the owner and then the motion detection work will be started by the camera with the help of written code for image processing techniques. If motion will be detected, then it will send the alert message to the owner along with the captured image. The application on the owner side provides option to the user for handling the received alert message.

1.11.2   Owner/User

The device will require 5-12V of continuous power supply, which should be provided by the owner before starting it. If the device detects motion and sends alert message to the owner, the owner will check the image that will be sent along with the message and decides whether it is a real theft or not. If the theft is real, the owner will take action against that and click on the "Call Police" option on the application and ask for help with police and if the message is the false alarm, then the owner will neglect it by clicking on the "Neglect" option.

IV. Expected Output

With the approach to smart surveillance, the user will be allowed to depict a time for monitoring intruders. During the survey time, the systems will continuously polls data from pi camera. In case of an intrusion, the motion will be detected by the Pi camera and sent it to raspberry pi for further analysis. If the Convolutional Neural Networks flags a possible intruder, the user is notified through the alert message along with the captured image. User can also view and download the footage of the intruder to be used as evidence.
Along with all these features, the overall results which are expected from the system are as follows:

➢ Anti-Theft device which can give a real-time alert message to the owner.
➢ A user-friendly application for owner to control the device i.e. when to start or stop.
➢ Efficient device that has the ability to distinguish between the real theft and false alarm.
➢ Device that can give authority to the user or owner to take actions against the alert message through options.

V. Conclusions

The research work that will be carried out in this thesis would be mainly focused to design and develop efficient and convenient motion detection surveillance i.e. an Anti-Theft device to solve security problems which will help to reduce/stop theft. Though a significant amount of research has been done in the past to solve such security problems, but it still remains to be a challenging due to increased complexity and various theft actions are taking place daily.

The system will capture images only when the motions exceed a certain threshold that is pre-set in the system. It thus reduces the volume of data that needs to be reviewed. Also, it will help to save data space by not capturing static images which usually do not contain the object of interest. It will be applicable for both office and home uses. After successfully implementing the project, it can be apply for the motion detection for smart home security system which would be very much helpful in auto theft detection for security purpose. It can also be useful in bank, museum and street at mid-night.

References

[1]   Rhowel Dellosa, "Development of an Anti-Theft Device using Motion Detection and Body Temperature", Asia Pacific Journal of Multidisciplinary Research, December 2014. P-ISSN 2350-7756 | E-ISSN 2350-8442

[2]   Xinyi Zhou, Wei Gong, WenLong Fu, Fengtong Du, "Application of Deep Learning in Object Detection", International Journal of Innovative Research in Advanced Engineering (IJIRAE), June 2014. ISSN: 2349-2163

[3]   Yong-Deuk Shin, Jae-Han Park, Ga-Ram Jang, Moon Hong Baeg, "Moving Objects Detection using Freely Moving Depth Sensing Camera", 21st International Conference on Pattern Recognition, November 2012.

[4]   Dixit Suraj Vasant, Babar Apeksha Arun, Meher Priya Shivaji,"Raspberry-Pi Based Anti-Theft Security System with Image Feedback", Journal Of Information, Knowledge, And Research in Electronics and Communication Engineering, October 2017. ISSN: 0975 – 6779

[5]   Rahane Madhuri, Pathak Mayuri, Wadekar Ashabai, More Rupali, "Study of Theft Detection and Tracking using Raspberry Pi and PIR Sensor", International Journal of Latest Trends in Engineering and Technology (IJLTET), September 2015. ISSN: 2278-621X

[6]   Rahul Raguram1, Jan-Michael Frahm1, and Marc Pollefeys, "A Comparative Analysis of RANSAC Techniques Leading to Adaptive Real-Time Random Sample Consensus", ECCV 2008, Part II, LNCS 5303.

[7]   Ashwini Patil, Shobha Mondhe, Tejashri Ahire, Gayatri Sonar, "Auto-Theft Detection using Raspberry Pi and Android App", International Journal of Research in Engineering Application & Management (IJREAM), October 2016. ISSN: 2494-9150

[8]   Ali Javed and Sidra Noman, "Theft Prevention Alarm Based Video Summarization Algorithm", International Journal of Information and Education Technology, February 2012.

[9]   Mayur J. Charadva, Ramesh V. Sejpal, Dr. Nisha P. Sarwade, "A Study of Motion Detection Method for Smart Home System", International Journal of Innovative Research in Advanced Engineering (IJIRAE), June 2014. ISSN: 2349-2163