Visvesvaraya Technological University

Jnana Sangama, Belagavi - 590018

A Project Work Phase-I (17CSP78)
Report on

"Armament Detection and Alert System using Yolo Algorithm"

Project Report submitted in partial fulfilment of the requirement for the

award of the degree of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

PARTH P SHAH	**1KS17CS052**
SHASHANK SHET K	**1KS17CS075**
ROHTIH R	**1KS17CS063**

Under the guidance of
Mr. ROOPESH KUMAR B.N
Assistant professor
Department of Computer Science & Engineering
K.S.I.T, Bengaluru-560109

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

K. S. Institute of Technology

#14, Raghuvanahalli, Kanakapura Road, Bengaluru - 560109
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K. S. Institute of Technology
#14, Raghuvanahalli, Kanakapura Road, Bengaluru - 560109

Department of Computer Science & Engineering

CERTIFICATE

Certified that the Project Work Phase-I (17CSP78) entitled **"Armament Detection and Alert System using Yolo Algorithm"** is a bonafide work carried out by:

PARTH P SHAH	**1KS17CS052**
SHASHANK SHET K	**1KS17CS075**
ROHTIH R	**1KS17CS063**

in partial fulfilment for VII semester B.E., Project Work in the branch of Computer Science and Engineering prescribed by **Visvesvaraya Technological University, Belagavi** during the period of September 2020 to February 2021. It is certified that all the corrections and suggestions indicated for internal assessment have been incorporated. The Project Work Phase-I Report has been approved as it satisfies the academic requirements in report of project work prescribed for the Bachelor of Engineering degree.

_____   _____   _____

Signature of the Guide   **Signature of the HOD**   **Signature of the Principal & CEO**

[Mr. Roopesh Kumar B.N]   [Dr. Rekha B. Venkatapur]   [Dr. K.V.A. Balaji]

DECLARATION

We, the undersigned students of 7th semester, Computer Science & Engineering, KSIT, declare that our Project Work Phase-I entitled "**Armament Detection and Alert System using Yolo Algorithm**", is a bonafide work of ours. Our project is neither a copy nor by means a modification of any other engineering project.

We also declare that this project was not entitled for submission to any other university in the past and shall remain the only submission made and will not be submitted by us to any other university in the future.

Place: Bangalore

Date:

Signature

PARTH P SHAH (1KS17CS052) _____

SHASHANK SHET K (1KS17CS075) _____

ROHITH R (1KS17CS063) _____

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PARTH P SHAH

SHASHANK SHET K

ROHTIH R

ABSTRACT

Nowadays, Closed Circuit Television cameras are installed everywhere in public places to monitor illegal activities like armed robberies. Mostly these footages are used as post evidence after the occurrence of crime. In many cases a person might be monitoring the scene from but the attention can easily drift on prolonged observation.
Efficiency of these types of surveillance can be improved by in- corporation of image processing and object detection algorithms into monitoring process.

The object detection algorithms, previously implemented in video analysis detect pedestrians, animals and vehicles. These algorithms can be extended further to detect a person holding weapons like firearms in public or restricted places.

Therefore, the objective of this project is to visually detect firearms in real time videos. This project helps to detect weapons via object detection algorithms which can have various real time applications such as detection of weapons. It can be integrated into surveillance cameras.

The main motive of this project is to safe guard people from threats by warning them if something suspicious is detected. We can do this by providing a notification message to the user whenever an object of interest is detected. It is a system that helps in reducing the crime rate by providing proper surveillance and notifying the relevant authorities resulting in reduced response time which will gradually reduce the crime rate.

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Chapter 1
INTRODUCTION

1.1   Project Introduction

To provide a safer place to people using AI technology, we envision a world where I, you and we all live must be safe, no mass shootings, security products are more intelligent, more…human.

We believe that AI will unlock another era of public safety, and that the R&D and deployment of computer vision and deep learning technologies will redefine human life as we know it and better protect us from gun violence at large.

Not only will this transform this industry as a whole, but it will push our safety forward as well. Our strategy is to build top-in-class AI platforms and safety services for mankind. This project is built to detect weapons and to rise alerts when person carrying gun or knife is detected.

1.2   Problem Description

Weapons are now a days are easily available to criminals, which is a huge danger for public around the world. To safeguard the security and safety for the people from criminals, such as children's holding the gun without their knowledge and this may lead to an accidental death or serious injury.

Safety for the common man who travels all around such as, railway stations, hotels, public places and public transport. Many a times a person is not safe around his house and he may notice suspicious activities which may lead to murder.

It can also be private and commercial places such as hotels, shopping malls, parks, religious places and historical places among few are tourist attraction. Can be implemented in forest areas to avoid animal hunting and other illegal activities.

1.3 Definitions

  ➢ **Machine Learning**

   Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or

decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

> **Python**

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics, created by Guido van Rossum and first released in 1991. Python features a dynamic type system and automatic memory management and supports multiple programming paradigms, including object-oriented, imperative, functional programming, and procedural styles. It has an expansive and extensive standard library its abnormal state worked in information structures, joined with dynamic writing make it extremely alluring for Rapid Application Development. Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.

> **Anaconda**

Anaconda is a free and open source distribution of the Python and R programming languages for data science and machine learning related applications (large-scale data processing, predictive analytics, scientific computing), that aims to simplify package management and deployment. Package versions are managed by the package management system conda. The Anaconda distribution is used by over 6 million users and it includes more than 250 popular data science packages suitable for Windows, Linux and MacOS.

Chapter 2
LITERATURE SURVEY

2.1 General Introduction

Literature Survey is an important activity, which we have to do while gathering information about a particular topic. It will help us to get required information or ideas to do work. The following paragraphs discuss the related work and issues in the area of object detection in a Computer Laboratory using machine learning algorithm.

2.2 Literature Survey

Paper 1:

Arif Warsi, Munaisyah Abdullah, Mohd Nizam Husen, Muhammad Yahya,“ Gun detection system using YOLO” .The objective of this paper is to visually detect the handgun in real time videos. The proposed method is using YOLO-V3 algorithm and comparing the number of false positive and false negative with Faster RCNN algorithm. To improve the result, we have created our own dataset of handguns with all possible angles and merged it with ImageNet dataset. The merged data was trained using YOLO-V3 algorithm. They have used four different videos to validate the results of YOLO-V3 compared to Faster RCNN. The detector performed very well to detect handgun in different scenes with different rotations, scales and shapes. The results showed that YOLO-V3 can be used as an alternative of Faster RCNN. It provides much faster speed, nearly identical accuracy and can be used in a real time environment.

Paper 2:

Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi "You Only Look Once: Unified, Real-Time Object Detection". YOLO is a new approach to object detection. Prior work on object detection repurposes classifiers to perform detection. Instead, they frame object detection as a regression problem to spatially separated bounding boxes and associated class probabilities. A single neural network predicts bounding boxes and class probabilities directly from full images in one evaluation. Since the whole detection pipeline is a single network, it can be optimized end-to-end directly on detection performance. Our unified architecture is extremely fast. Their base YOLO model processes images in real-time at 45 frames per second.

Paper 3:

Seshadri Sastry Kunapuli, Praveen Chakravarthy BH and Upasana Singh. Caytiles, "Designing and Implementing a Real time weapons detection system on ODROID-XU4" . ODROID is a thunder packed on-chip single board computer with 2 GB Ram and 8 core processor. The main difference between the original CPU and the ODROID-XU4 box is the built in hardware kernels. With respect to the size, we can take it to everywhere by carrying it in your pocket. It will also be helpful in designing/implementing a real time model which is explained in this paper by building a weapon detection system with an accuracy of nearly 100%. One can use it in making the drones/robots for the real time purpose, which will be our future scope, detecting weapons through drones/mini-robots made up with Odroid box that will be helpful in army borders and highly delicate areas, where person can't go. But the main drawback with this Odroid box is that it is quite costly when comparing to the raspberry pi kits but we can use this box in IFTTT also with the help of android operating system.

Chapter 3

PROBLEM IDENTIFICATION

3.1 Problem Statement

Nowadays, safety is a biggest measure and due to increase in illegal and criminal activities safety is becoming just a myth. In many countries' guns are given to citizens of country for their safety and many times this safety measures leads to a dangerous scene of misusing the guns. In shopping malls, Schools, community halls, Religious places safety should be main concern and many times we see crimes taking place at these areas where someone is shot by gun. In forest areas many Criminals do smuggling of weapons and kill innocent animals by shooting them for their benefits. Few times you may never know who is standing outside your house with a gun to shot you down. To maintain safety and secured surrounding around you. Hence, we want to build a peaceful and safety environment around everyone.

3.2 Project Scope

- Exploring the most relevant IEEE papers related to the project.
- Preparing the Literature survey document.
- Preparing the report including details like Problem Statement, Brief introduction,
- Applications, Business Scope and Research scope.
- Setting up the list of objectives for the proposed project ideas.
- Framing the methodology for the execution of the project.
- Identification of the Hardware and Software Requirements for the project and budget
- estimation.
- Identifying algorithms to be used - YOLOv3
- Preparing the data sets for training using annotation software.
- Dividing the data set in a ratio of 80 - 20 for training and testing respectively.
- The training produces weights used to prepare a model that does the object detection.
- Development of project code for accessing the camera module and performing detection.
- Integrating an api in the code for communicating the user upon detection of the weapon.
- Performing alterations in the code to contact the user only when the detection confidence value is high.

Chapter 4

GOALS AND OBJECTIVES

4.1 Project Goals and Objectives

The goals and objectives of the proposed project are as follows:

1. To develop a weapon detection system.

2. Training the machine using datasets to identify weapons.

3. Improving the currently used cctv cameras by using one's which can process important information as well.

4. Raising alerts by calling the authorities when weapon is detected.

4.2 Summary

The proposed project on Artificial Intelligence based weapon detection system based on object detection. Detection of weapons can be a big help to the authorities as it reduces their response time and help bringing the suspect to justice while saving lots of lives in the process

Chapter 5

SYSTEM REQUIREMENT SPECIFICATION

A software requirements specification (SRS) is a comprehensive description of the intended purpose and environment for software under development. The SRS fully describes what the software will do and how it will be expected to perform. Software requirements specification permits a rigorous assessment of requirements before design can begin and reduces later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules.

The software requirements specification document enlists enough and necessary requirements that are required for the project development. To derive the requirements, we need to have clear and thorough understanding of the products to be developed or being developed. This is achieved and refined with detailed and continuous communications with the project team and customer till the completion of the software.

5.1 Hardware Requirements

The hardware requirements for the proposed project are depicted in the table below:

Table 4.1: Hardware requirements

Sl.No	Hardware/Equipment	Specification (min)
1.	Processor	Intel i3
2.	Disk Space	40 GB
3.	RAM	4 GB
4.	Graphics	NVIDIA/ AMD/ INTEGRATED
5.	Camera	Minimum 2MP

5.2 Software Requirements

The software requirements for the proposed project are depicted in the table below:

Table 4.2: Software requirements

Sl.No	Software	Specification
1.	Anaconda	Jupyter Notebook
2.	Browser	Google Chrome
3.	Libraries	jupyter, pillow, OpenCV, matplotlib, Twillio
4.	Programming Language	Python

Chapter 6

METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.

A. DATASET

We have created our own image dataset containing arms with different position with ImageNet dataset. YOLO v3 algorithm has been trained and validated to evaluate our armament detection system for better results. Figure 1 shows some of the examples from the dataset being used for training our model.

B. YOLO-V3 ALGORITHM

In this work, we have used transfer learning for training YOLOv3 model for gun detection and used the weight trained on ImageNet by YOLOv3 instead of starting from zero.
YOLOv3 is an object detection algorithm widely used for real time processing. Input image is divided into $M \times M$ grids. A single object is then predicted by this grid cell.
Logistic regression is used to predict an object scores for each bounding box by YOLOv3 and changes the method to compute the cost function. If a ground truth object is early overlapped by a bounding box prior more than others, the resultant object score should be 1. No cost is experienced for other prior with overlap greater than predefined threshold 0.5.

Chapter 7

IMPLEMENTATION

7.1 Phases in weapon detection System

The object detection system is going to be trained using supervised learning approach in which it takes live feed from a camera as input. The system includes the training and testing phase followed by object classification and detection. Weapon detection and classification are carried training weights which will aid the mode in recognizing similar objects in various unseen circumstances. When weapon is detected depending upon the confidence value, the user is contacted.

Phases for implementing the Proposed Project are:

   1) Live Video feed as input

   2) Detection of firearm or knife

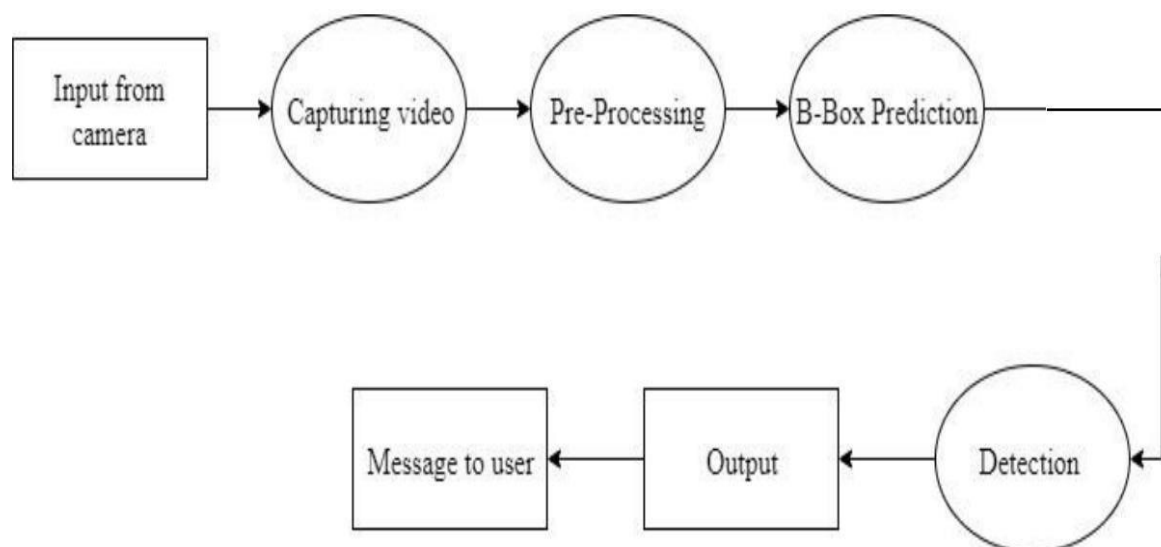   **3) Alerting via call**

7.2 Sequence Diagram

Figure 7.2 Sequence Diagram for the system

Description:

1. Camera is used to capture the video and each frame is processed.

2. A single neural network is applied to the full image. This network divides the image into regions and predicts bounding boxes and probabilities for each region.

3. These bounding boxes are weighted by the predicted probabilities.

4. It looks at the whole image at test time so its predictions are informed by global context in the image, thus model has several advantages over classifier-based systems.

5. As the object is detected an alert message is sent to the user.

7.3 System Flowchart

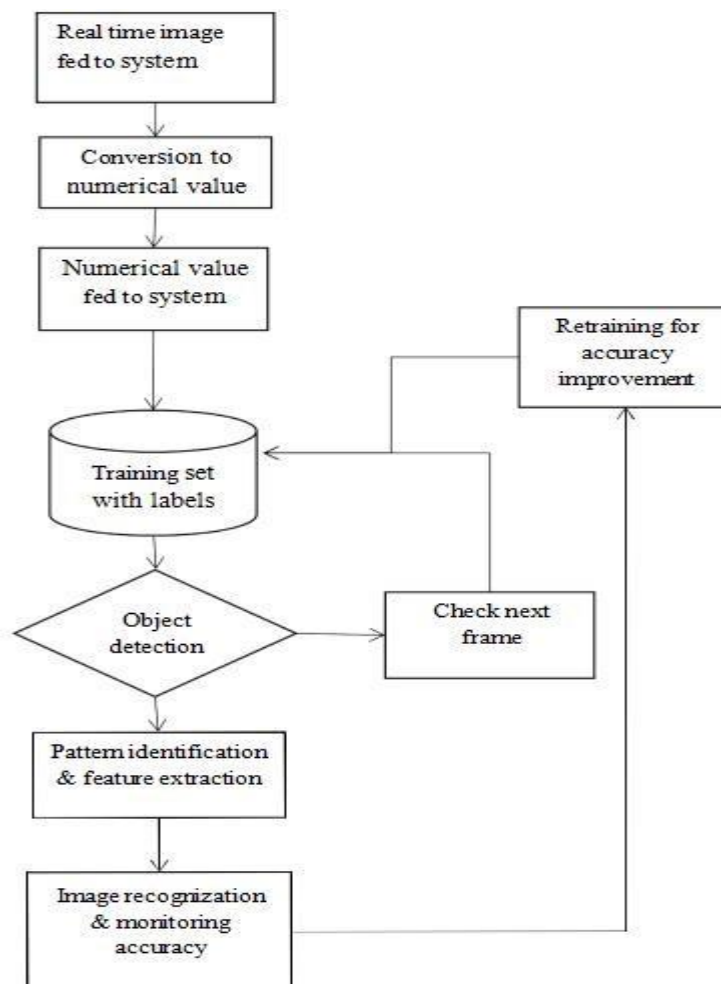The flowchart of the proposed system is depicted in figure 7.2 shown below:

Figure 7.3: Flowchart of the proposed system

Chapter 8

APPLICATIONS & CONTRIBUTION
TO THE SOCIETY

- This project helps to detect various weapons using object detection algorithms which can have various real time applications.

- It can be integrated into surveillance cameras which can be installed in banks, airports and commercial places, sensitive areas etc.

- It is a system that helps in reducing the crime rate by providing the proper surveillance and notifying the corresponding user.

- This will result in reduced response time which will in turn help us to take faster action during a compromised situation.

- The proposed system that we plan to implement is a prototype that would help reduce ongoing crimes by detecting suspicious objects in real time and alerting the user on time.

- It also eases the work on officials and makes their work and response much more agile and quick to such crimes.

- To achieve a sense of added security and safety.

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