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IOT based Firing System in Defence

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Abstract: IOT based firing system is an automatic and manual firing system that shoots the laser when motion is detected in front of the camera. The hardware module rotates 360 degree in clockwise direction and the platform on which the laser and camera is placed, moves in vertical direction; this ensures 360 degree protection. The whole system is programmed using python programming language and motion detection is performed using OpenCV python library.
Keywords: Motion detection, Defence, Firing System, Raspberry Pi Project

I. INTRODUCTION

India is having one of the longest land and ocean borders and its protection is one of the major concerns for security forces. Each year many of our Army personnel lose their lives on borders and it is important that we do something about it.
India has fought many battles and won many of them with glory but one thing that is persistent in battles is loss of life. India fought its war after independence in 1947-48 against Pakistan for the princely state Kashmir. During this war, India lost 1500-2000 army personnel and around 80,000 people were displaced during this war.
India's second biggest war was against China in 1962. India lost about 43,000 Kms of land and 3,250 Indians were killed [1]. This war is also aliased as Sino-Indian war and is one of the biggest wars India has fought.
India has won many battles but also has lost more number of army soldiers. We being part of the internal India have to bring up new technology and improve the line of defence. Our idea revolves around motion detection in areas such as no man's land can help in acting as the first personnel and shooting based on detection of motion on the other side. Once, there are any movements, our model will detect it using OpenCV libraries and fire based on the location. The advantage of such a model is sleek and compact design that can be placed in locations such as line of crossing. The model is automatic but can also be controlled by an army person at a distance. The design is sleek enough to be camouflaged with bushes in dense forest areas where it is difficult to keep an eye.

A. Problem Statement

Security is one of the major concerns in today's scenario where it is important that lives of army personnel and other individuals concerned with security forces. We have seen a sequence of war over 73 years along the borders of Pakistan and China (Sino – Indian war). The battles ended up with a cease fire agreement each time but we have lost lot of our men and faced lot of casualties.
Loss of life cannot be compensated but we can improve the task forces and security on border areas using such a technology. Such technology can stand as a frontline warrior against the enemies and deal with the impact.

B. Existing System

A computer controlled firing system is used for surveillance of borders, either of a country or areas requiring high security. The system not only detects intrusion but also provides a video-coverage of the suspicious areas. It is computer controlled unit for monitoring the control. The system uses thermal camera for detection of intrusion.
Smart border surveillance system which can prove to be helpful for our border security forces. It is able to provide round the clock video surveillance at the places where human deployment is not possible due to geographical, climatic or some other reasons. Multiple pyro-electric infrared sensors (PIR) are disguisedly installed on the border fencing which monitor the border area for any intrusion. A security system designed to help in the safe-guard of important materials and also to alert the appropriate personnel's about unauthorized access to the room. This paper outlines the important factors to be considered in developing a security system. This system is however limited by certain factors and the possible solutions to these limitations are also discussed. A special type of human sensor is PIR(passive infrared) used to detects the human being around 20 feet distance. If anyone tries to cross the border means the sensor detects and it sends a signal to the microcontroller switch on the camera which captures the image of the human beings and it transmit the signals to the near security station. The station monitors and send the signal to microcontroller to activate the alarm or gun system.

An intelligent framework for detection of multiple events in surveillance videos. Based on the principle of compositionality, the surveillance problems can be modularize into a set of variables comprising regions-of-interest, classes attributes and a set of notions associated to each of the attributes to construct a knowledge based understanding of the environment.

The final output from the reasoning process, which combines the definition domains of the various variables, can allow a broader and integrated understanding of complex pattern of activities in the scene by this they detect any intrusion and illegal activities and alarm the system.

The device consist a Camera as a sensor for the purpose of monitoring the Area under surveillance and sending image as input to the Pc which is running using MATLAB coding, send the particular quadrant value to the Microcontroller which will actuate and control the Stepper motor. If the Area under Surveillance is occupied by unknown person, then a transmitter is given to activate the intrusion detection and automatic gun control mechanism and eliminate the target.

A new method is purposed to detect motion using the subtraction algorithm. Project proposes the sampling by calculating the intersection of number of background subtracted frames which are sampled over a period of time .A video monitoring & detection system was thus developed successfully. The system mainly provides an efficient method for surveillance purpose and aimed to be highly beneficial for military.

C. Proposed System

The hardware system is something that needs to be sleek and compact but also powerful. We planned to design a model that rotates 360 degrees clockwise to cover the maximum area to impact.

The hardware unit, raspberry pi is used as the logical unit that will be programmed using python programming language and associated library OpenCV. This library is used because we are using the camera to detect the motion of the enemies and then fire in accordance to the line of sight.

The camera first sends continuous live feed of images to the raspberry pi which then used OpenCV functions to compare the vector images. When there are huge noticeable changes in vector images, a motion is detected which triggers the relay connected to the laser module to fire towards the motion. The platform is automatically adjusted to the level of the motion and can also be manually adjusted.

II. LITERATURE SURVEY

A. Some Supporting Research Papers

Venkatapathi pallam, p.bheerendra kumar, [October-2014], An computer controlled firing system is used for surveillance of borders, either of a country or areas requiring high security. The system not only detects intrusion but also provides a video-coverage of the suspicious areas. It is computer controlled unit for monitoring the control. The system uses thermal camera for detection of intrusion. [2]

Nishad T.N, Akhilesh V Ramachandran, [June 2014]. The intrusion detection system is used for border security forces and highly secured areas which are done using thermal cameras and digital signal processing unit. The system is used for monitoring situations which are highly sensitive. The paper also describes the mode of controlled operation by an authoritative personnel in both manual and automatic mode. The thermal image processing is the input for the whole firing system. [3]

Amit Kumar, Harish Chandra Maurya, Rahul Misra [April 2013], The intrusion detection system is based on intrusions in networks this system governs security policies, documenting existing threats and deterring individuals from violating security policies. Different methods can be used to detect intrusions which make a number of assumptions that are specific only to the particular method .The purpose of an intrusion detection system is to detect attacks. However, it is equally important to detect attacks at an early stage in order to minimize their impact. I have used Dataset and Classifier to refine Intruders in Networks. [4]

Neha Bhadwal, Vishu Madaan, Prateek Agrawal, Anuj Kakran, [Nov 2016] Smart border surveillance system which can prove to be helpful for our border security forces. It is able to provide round the clock video surveillance at the places where human deployment is not possible due to geographical, climatic or some other reasons. Multiple pyro-electric infrared sensors (PIR) are disguisedly installed on the border fencing which monitor the border area for any intrusion. [5]

Gajanan Shete1, Sushant Chavan, Kanchan Bhosale, [May 2018], In this design the automated security system in order to detect, track and destroy the target for surveillance operations. The system can be operated in two modes, in which the target can be tracked automatically by using microcontroller based system. On other hand, the system can also be controlled manually in which the user has right to select the target and performs shooting if necessary. The image processing algorithms are implemented in Python. [6]

Munmun Das , Mayur Khairnar , Pavan Bansode , Prashant Kadam, Mayur Bhagat , [May 2019], The automated security system in order to detect, track and destroy the target for surveillance operations. The image processing algorithms are implemented in Matlab. The process starts by processing the video signal on computer by using the video camera, then the target is selected which can be tracked further by using different image processing techniques. After the selection of target, the micro-controller unit takes the decision to shoot any unauthorized person or activity within its range. The gun is mounted on a tripod stand and its movement is controlled by using the stepper motor. [7]

R.Sureshkumar, D.Vijendra Babu, [2016], This paper certify that In the model, the device consist a Camera as a sensor for the purpose of monitoring the Area under surveillance and sending image as input to the Pc which is running using MATLAB coding, send the particular quadrant value to the Microcontroller which will actuate and control the Stepper motor. If the Area under Surveillance is occupied by unknown person, then a transmitter is given to activate the intrusion detection and automatic gun control mechanism and eliminate the target. [8]

Shivani & Dr. Lakhwinder Kaur, [2016] An intelligent framework for detection of multiple events in surveillance videos. Based on the principle of compositionality, the surveillance problems can be modularize into a set of variables comprising regions-of-interest, classes attributes and a set of notions associated to each of the attributes to construct a knowledge based understanding of the environment. The final output from the reasoning process, which combines the definition domains of the various variables, can allow a broader and integrated understanding of complex pattern of activities in the scene by this they detect any intrusion and illegal activities and alarm the system. [9]

Shoaib Mughal, [2014], Design the automated security system for surveillance operations. The system is designed by using image processing algorithms in order to select, track and hit the target. In this work, the image processing algorithms are designed and implemented in computer based system whereas for future development, Once the target is selected, the microcontroller controls the movement of the gun by using the stepper motor. After the object is tracked, the decision to shoot the target is achieved manually or automatically by using microcontroller based system. [10]

Awodele Oludele, Ogunnusi Ayodele, Omole Oladele, Seton Olurotimi ,[DECEMBER 2009], A security system designed to help in the safe-guard of important materials and also to alert the appropriate personnel's about unauthorized access to the room. This paper outlines the important factors to be considered in developing a security system. This paper discusses design of a security system using already existing security devices. This system is however limited by certain factors and the possible solutions to these limitations are also discussed. [11]

Virendra Panchal, Harshal Dimble, Sandesh Nikam, Shivraj Kamatgi , [May – 2018]. This project implements a new defense mechanism which has a detecting and an aiming unit. The main objective is to help the armed forces to catch intruders. The targeting unit has a microcontroller along with sensors to detect the presence of humans in the targeted area and processes various atmospheric parameters electronically. LASER pointer is used to determine if the desired target is hit or missed by tracking the path of the Laser and determining the point of intersection with the LASER. Once the parameters are obtained are obtained the targeting unit automatically positions the gun using its special mechanism.[12]

Karthikeyan.a, sarath kumar.v , [July – 2012], This paper provides the security in Indian military. A special type of human sensor is PIR (Passive Infrared) used to detects the human being around 20 feet distance. If anyone tries to cross the border means the sensor detects and it sends a signal to the microcontroller switch on the camera which captures the image of the human beings and it transmit the signals to the near security station. The station monitors and send the signal to microcontroller to activate the alarm or gun system. [13]

Lavon Rebello, Pranav Premkumar, Saish Sankhe , [March 2018],This project aims at creating an Autonomous Targeting System using OpenCV that detects human hostile intruders and takes capable measures to prevent them from compromising homeland security. The system is based on Raspberry pi 3 model b, pi camera and uses OpenCV. The autonomous targeting system detects and points a laser towards a human inside its visual range. The existing technologies utilize high end machinery, opt electric technology and radar to target hostile. [14]

Peyman Kabiri and Ali A. Ghorbani , [Sep. 2005], This paper cites that advances in network based technology and increased dependability of our everyday life on this technology, assuring reliable operation of network based systems is very important. During recent years, number of attacks on networks has dramatically increased and consequently interest in network intrusion detection has in-creased among the researchers. provides a review on current trends in intrusion detection together with a study on technologies implemented by some re-searchers in this research area. Honey pots are effective detection tools to sense attacks such as port or email scaning activities in the network. Some features and applications of honey pots are explained in this paper. [15]

Prof.A.B.Wani,Bhagwan Pawar, Ashish Deshpande, Tushar Kaul, [March 2019 ,] In this paper, a new method is purposed to detect motion using the subtraction algorithm. Project proposes the sampling by calculating the intersection of number of background subtracted frames which are sampled over a period of time .A video monitoring & detection system was thus developed successfully. The system mainly provides an efficient method for surveillance purpose and aimed to be highly beneficial for military. [16]

III. REQUIREMENTS

A. Hardware Requirements

1) Stepper Motor
2) Stepper Motor HAT
3) Relay Module
4) Laser Module
5) Raspberry Pi Cam
6) Raspberry Pi 3B+

B. Software Requirements

1) Raspberry pi Raspbian
2) OpenCV
3) Python IDE

IV. PROPOSED ARCHITECTURE

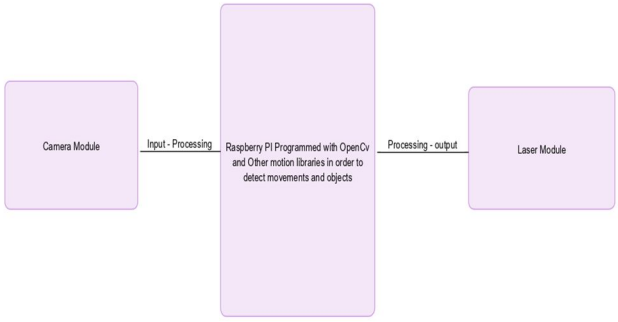

Figure 1 – Proposed Architecture / System Design

There are three main units of the hardware architecture; input, processing unit, and output. The input is the camera module that captures the live video of the view in front of it. This live feed is sent to the processing unit Raspberry Pi that is programmed with OpenCV library and stepper motor configuration using python programming language.

The raspberry pi first detects the person in the frame and directs the stepper motor hat to adjust the platform to the level of the person. Once the adjustment is done, the raspberry pi scans for motion detection and when found, it directs the relay module to activate the laser. To detect the motion and person in the security feed, OpenCV first converts the feed into sequence of vector and images and compares each of the vector images for the change. If there are bigger tangents of change, OpenCV confirms the motion detection. Laser is the output unit of the hardware architecture which is connected to relay module and is activated when the raspberry pi commands it.

V. EXPERIMENTAL RESULTS

We prepared the hardware system and programmed the raspberry pi to first control both the stepper motors in steps. We can control the movement of the platform and the rotation of the stepper motor using the keys on the keyboard for manual movements, automatic movement of the hardware is dependent on the motion detection. When the object is captured, the platform is adjusted based on the position of the object which was successful. We then set up the security feed and configured OpenCV to detect the motion of the person. At the final step, we set up the relay module to activate the laser on detection of the object. We successfully activated the relay on object detection and fired the laser.

VI. CONCLUSION AND FUTURE SCOPE

The automatic firing unit will be one of the most efficient ways to save our soldiers lives and also it is a best option to monitor highly secured areas.

Firing unit can be camouflaged in areas such as dense forest due to its sleek design and compact nature. This can help armed forces to set up these artificial soldiers in areas where enemies are mostly expected; one good example is dense forests of West Bengal where Naxalites are expected.

In future, this system can also be used to monitor intrusion and secure the perimeter area; this can be done by replacing the laser module with a buzzer. When the motion is detected, the buzzer will alarm the security personnel's for breach of security.

For more advance use of this firing unit, it can be integrated with quad copters and converted into drones and act as attacking unit. This will help army to perform operations like surgical strike and complete the operation without the army personnel having to risk their lives.

Also, this firing unit can make tanks more powerful by integrating it on the top of the tank. We can design much smaller tanks and integrate this unit; this can be then sent to the camp of the enemies and destroy their camp. For this, we can add two such units, one with missile technology and other with machine guns. At the risk stage, these small tanks can also destroy themselves when stuck in enemy base.

This unit can be made harmless by replacing the laser module with a buzzer and then be used by highly secure areas of corporate to prevent intrusions and alarm the security.

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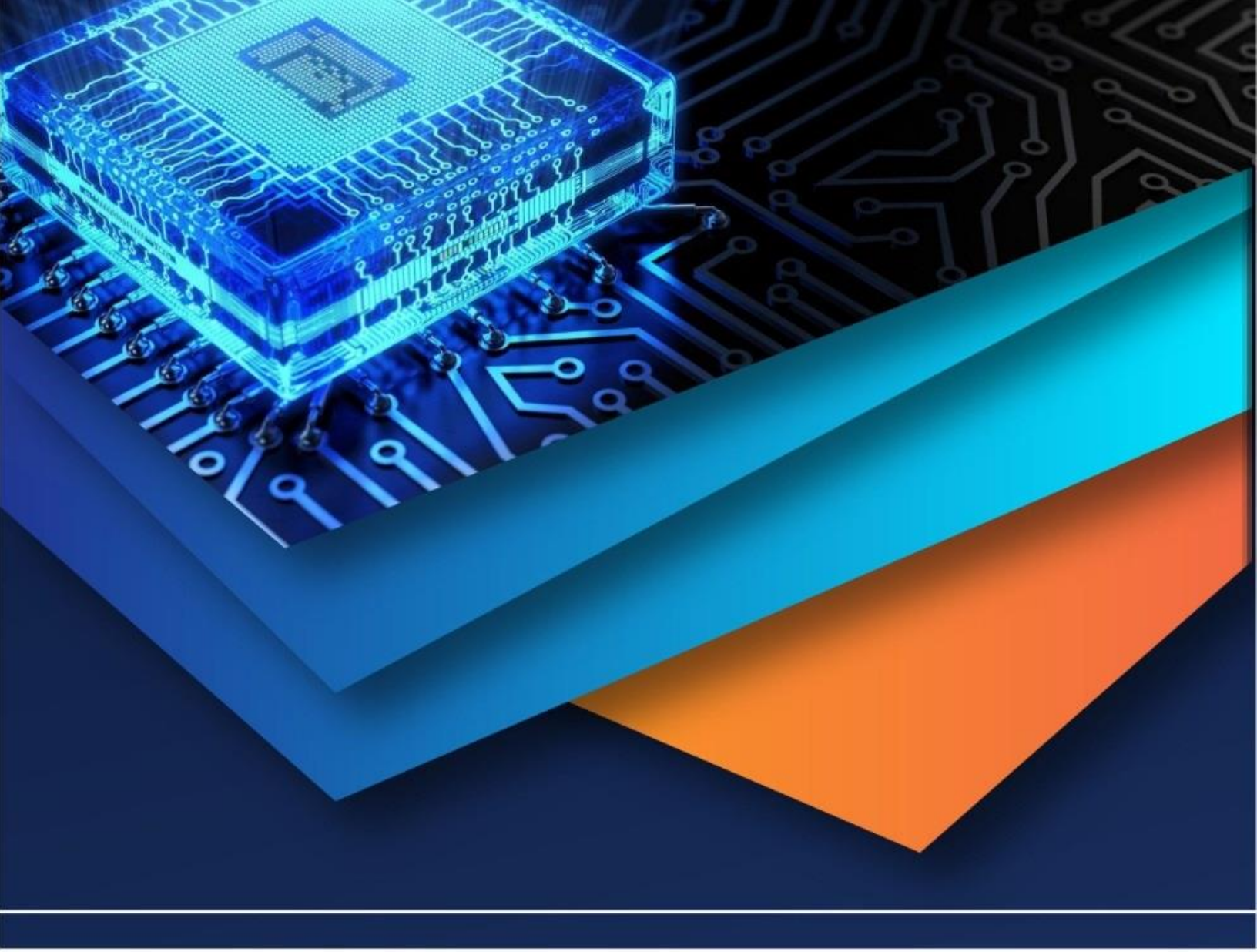

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