

Review: Autonomous Detection and Shooting of Moving Objects at Borders with Arduino and Stepper motors

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Abstract - The major threat to the today's world is the terrorism in most parts of the world. Terrorist mostly enter the enemy nations through the borders. The borders are guarded by electric fences and security guards. In Indo-Pakistan border the extreme climatic condition is the challenging aspect in safe guarding the borders. So, something which withstands extreme climate and which is cost effective is needed for our nation so that the loss of soldiers will also be avoided. In order to support this, a stationary gun is fixed which detects the moving object. The borders are captured with web cameras and are given as the input to the system. The moving object is eliminated by means of gun. It detects the moving object by background subtraction method with OpenCV and sends the location of the objects to Arduino. The location is calculated by means of pixels angles. These angles are sent as the input to the Arduino. The Stepper motor which is interfaced with the Arduino rotates according to the position of the moving object. A single gun cannot guard the whole border, so a series of guns are fixed at borders at certain intervals so that the intrusion of enemies will be detected in many guns and the enemies will be eliminated. This method will reduce the use of soldiers at borders and can safeguard the borders all time. It integrates the usage of technology by infusing smartness to suit the current needs and encouraging smart usage of available resources.

Key Words: Image Subtraction, OpenCV, Motion Detection.

I. INTRODUCTION

Motion Detection can be done in many ways. There are many solutions available for this. But it seems to be more complexity and ineffective on real time application. To make the system handle in easier and with more security, this proposal impends cheap and more effective technique for Moving Object Detection. Many techniques have been proposed from time to time to improve the efficiency of motion detection and tracking such as Mean-shift and Optical flow algorithms. Background subtraction is fundamental algorithm and most effective for detecting and tracking the moving objects. Background subtraction is a process of detecting any changes in the current frame by subtracting pixels from a fixed reference frame. The gun proposed in this paper has two degrees of freedom to shoot the interference, one degree allows to move on horizontal axis, while the other degree allows to move on vertical axis.

Both of these movements make the gun to aim the target in 3D world.

II. LITERATURE SURVEY

Autonomous shooting system paper have been previously created and implemented in the past. The system as a whole is not a new technology. Various aspects of the system have been done previously for a variety of reasons, such as the motion tracking and a gun-based system that executes incoming targets. These were the original and unique technologies that when integrated together will help in building our autonomous shooting system. The influence of these existing technologies has widened the range for the growth of different prototypes for future solutions. The previous projects failures and successes are determined by the researching them for the design of this project which will help to improve our system. [1]

By researching on all the similar existing technologies implemented successfully in the past, the designers of this system intend to integrate several of them to make a specific design. The system will have several functions, mainly as a defense gun to guard. This system can also be further optimized depending on its use but initially it can be used for local security by businesses or home owners. It can even be used in battlefields in order to protect a military base from incoming enemies and can also have the ability to successfully detect and intercept incoming planes, helicopters, and missiles. The system's concept does have several uses and one can use it according to his needs. [2] In the recent years, object detection and tracking has become an integral part of various applications such as Surveillance system, Vehicle navigation, and autonomous robot navigation. Especially in the field of surveillance system it has gained greater significance than ever before due to the recent terror activities taking place all over the world. Many efforts have been made to make the system automated in order to decrease the complexity and to increase the ease with which it can be implemented. The paper describes the implementation of Object Detection and Tracking for the surveillance system on Arduino act as standalone system and it is programmed in embedded C language. The design is successfully implemented to detect and track the object with a minimum time delay. [3]

III. PROPOSED SYSTEM

This system is fully secured by our own soldiers, no other person without the higher officials cannot access the system. This system is secured by a PIR sensor, so that if intruder tries to approach the system, he will be threatened by a warning buzzer which is installed in control room. This system is also secured by a Vibration Sensor, so that if the intruder tries to manipulate the system through underground means the system will give a warning buzzer in control room.

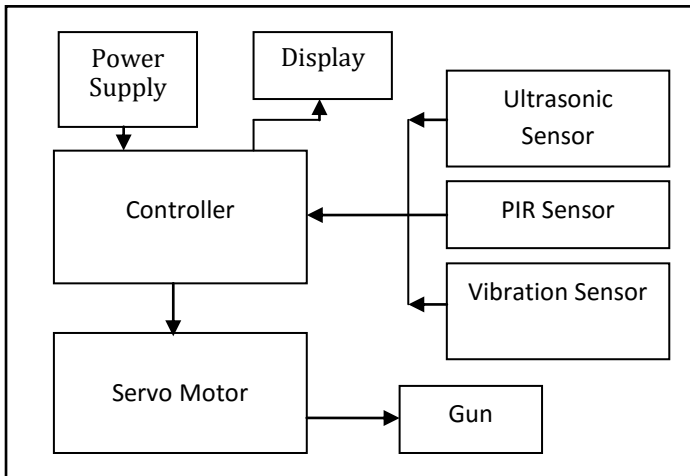


Fig 1: Block Diagram

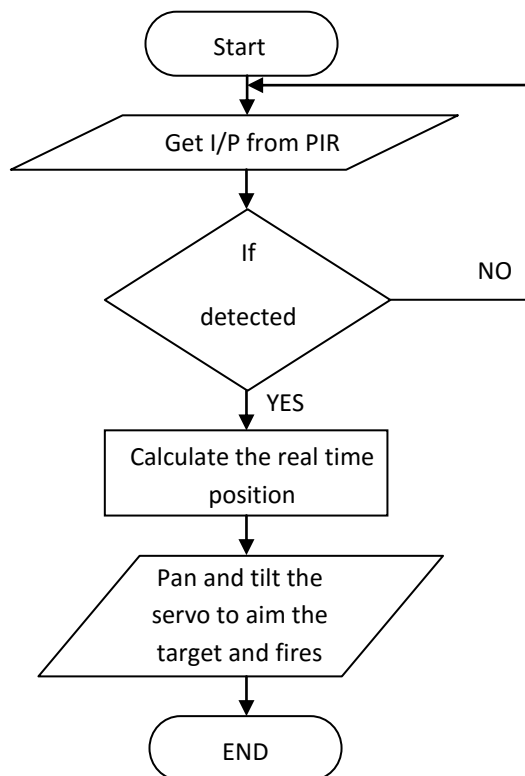


Fig 2: Flowchart

When program start executing, initially PIR=0. PIR continuously scan for object, if there is nothing to detect then program run in loop as shown in flowchart or if any hot body object like human detect, PIR gets 1 and triggered the I/P of controller, so program go for next step of flowchart. In this step, the program calculates the real time position of object. According to position of object motor rotate to aim the target and controller triggered the I/P of gun.

IV. Working:

IV.I. Detects moving object using

The scanning of moving object is done easily by using PIR sensor. The PIR sensor detects or accepts passively incoming InfraRed radiation coming from object.

The PIR has two slots in it, each slot is made of special material that is sensitive to IR. The lens used here is know as Fresnel lens. When the sensor is idle, both slots detects the same amount of IR, the ambient amount radiated from the object. When a warm body like human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When warm body leaves the sensing area, the reverse happens.



Fig 3: Working of PIR

IV.II. Calculating real time position of the moving object

The ultrasonic sensor calculates the actual distance between the gun and the moving objects, and decides its real time position. This moving object is our target to be aimed and fired. Ultrasonic sound vibrates at a frequency above the range of human hearing. Transducers are the microphone used to receive and send the ultrasonic sound.

Our ultrasonic sensor, like many other, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.

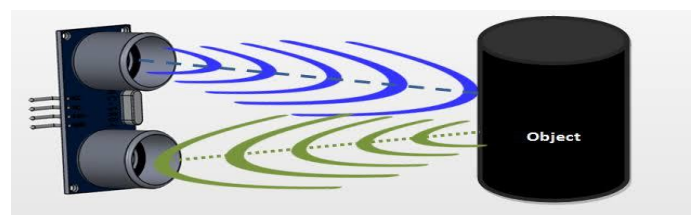


Fig - 4: Calculating real time position of the Moving object using

$$Distance = \frac{(Time \times Speed\ of\ Sound)}{2}$$

Speed of sound in air is consider as approximately 340 meter/sec.

The above formula is used to find the objects in real time position from the ultrasonic detector by the moving object. This formula runs in a loop so, many numbers of echo waves are processed in a second. In the way, the detected moving objects are traced in the next upcoming loop. This moving object is our target to be aimed and fired.

HC-SR04 Ultrasonic Sensor Features

- Operating Voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

IV.II. Shooting

This is done with the help of Electro-magnetic gun. A railgun is a device that uses electromagnetic force to launch high velocity projectiles, by means of a sliding armature that is accelerated along a pair of conductive rails.

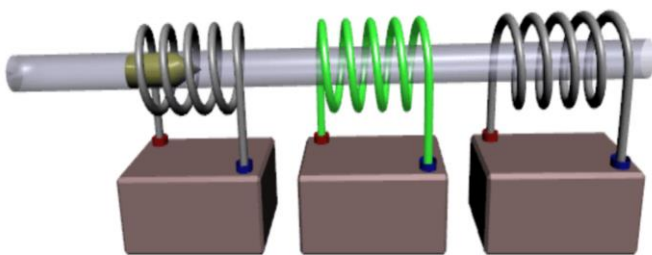


Fig – 5: Electromagnetic Gun

V. CONCLUSIONS

From this paper we conclude that, it provides a better security as well as more security features. The proposed system prevents the entries of antisocial person trying to cross the border without prior permission, hence this system will reduce the causing of rioting as well as prevent terrorist activities. We will design a tracking system that is able to detect and track moving objects in outdoor environment. After setting up a basic system, we were able to bring significant improvements in the tracking by use of new algorithms.

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