Portable Sentry Gun

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Abstract - *The Project is based on defensive application using technology & automation. In this paper, design and development of a portable sentry gun is presented. Professional robotic assemblies which are generally developed for security purposes are targeted toward high efficiency & are based on extensive control algorithms. This makes them quite expensive and infeasible for low budget applications. One important component of such systems is that of motion detection. Motion detection also plays a key role in security applications installed at banks, offices & vulnerable areas. An efficient motion detection system has been developed using embedded micro-controller and Program codes. The proposed system can also be set into an autonomous mode of operation, in which the system tracks and engages targets & destroy them without any human intervention. The hardware employed in the proposed system is based on easily accessible materials. Motion detection and image processing was implemented using Open Computer Vision image processing & detecting toolbox & periodic background estimation subtraction was used for the detection of motion. In typical situations like surgical strike or terrorist attack where soldier's life is at risk, this autonomous system can be used.*

Index Terms- Automation, Micro-Controller, Open CV, Sentry Gun, Motion Detection, Defensive, Terrorist, Visual image processing.

1. INTRODUCTION

In the border areas, mostly in Kashmir due to the increasing terrorist attacks on our defense installments lot of soldiers are martyred in line of duty or get injured. To reduce this we came up with this Portable Sentry Gun which will automatically track and shoot the target. And in increasing urban warfare scenario the portability in a battlefield is a key winning point. This gun can be pre-programmed to track a certain target and placed strategically to take down the enemy.

1.1 REASONS TO USE AUTOMATED SYSTEMS

One question many people ask is why a Portable sentry gun which will automatically shoot the target instead of a human sentry. Well this is to reduce the immediate loss of life if in case of an incoming attack. The portable sentry gun is not there to replace the human soldier but to act as a tool in its arsenal. It would be a first line of defense.

1.2 PORTABLE SENTRY GUN

Portable Sentry Gun or it can also be called as Automatic Sentry Turret is a portable weaponry system that can be carried by the soldier anywhere in the battlefield and place it wherever required. This gun basically uses a camera with a motion tracking program run via a micro-controller to track enemy/target and engage it by shooting at it. The portability of this gun is such that unlike traditional sentry guns which are fixed at a place this weaponry system can be carried by 1 or 2 Soldiers easily anywhere into the battlefield.
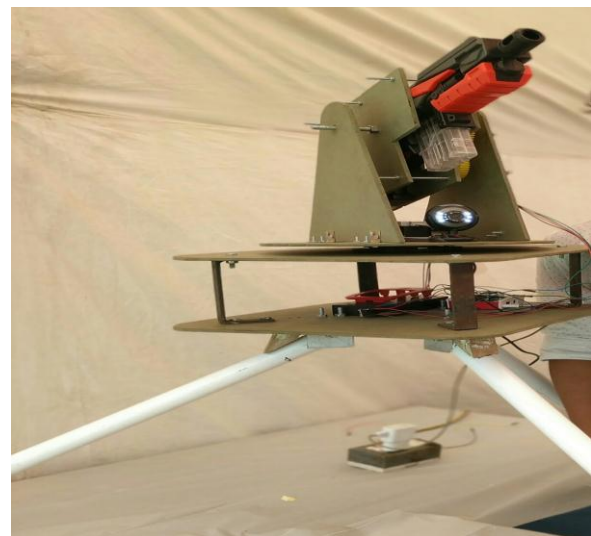
1.3 HISTORY

The first automatic sentry gun system which used motion tracking and was used in actual military use was SGR A1. SGR A1 is an automatic sentry gun designed and manufactured by Hanwha Techwin, Samsung and is used by the South Korean Army for border security. The whole system is very bulky and it's a stationary type of gun, with a foundation to fix it. The range of that gun is approx. 3 Km. It guards the DMZ (De-Militarized zone) separating North & South Korea. But the main issue with the gun is portability & high initial and maintenance cost.

1.4 Working

The Portable Sentry Gun tracks the targets with the help of a camera running a object & motion tracking program using a raspberry pi to track the enemy and shoot it by controlling pan & tilt motion of the gun with steppers & a motor to control the trigger.

1.4.1 Pan & Tilt motion

The pan & Tilt motion are controlled with the help of two stepper motors which are capable of handling high loads. One servo motor is fixed on the gun support which drives a spur gear which drives the tilt motion of the gun. The other motor is below the circular disc which also has a spur gear which drives the bearing inserter which also is toothed to give the pan motion to the gun. The steppers are high torque motors so they can give smooth pan & tilt motion.

1.4.2 Object detection

The pan and tilt motion of the gun is controlled via the data received from the camera mounted on the gun which gives the data to the Raspberry pi (micro-controller) which is running a Motion tracking & object detection program. The program code uses python language & uses libraries from Open CV, Open CV is open source computer vision library, which has over 2500+ motion tracking & object detection algorithms.
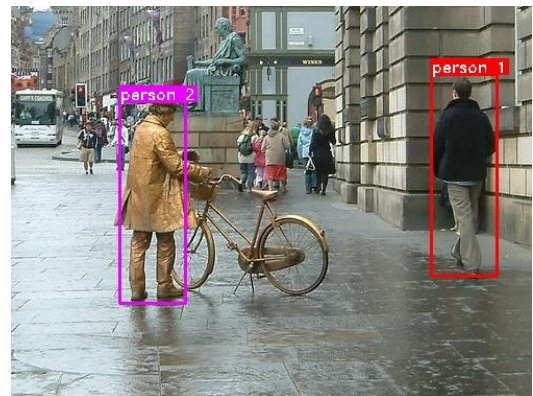
1.4.3 Engaging the Target / Triggering mechanism.

The triggering mechanism uses direct wired connection to the airsoft gun which will be used in prototyping stage. The wires are connected to the inside electrical circuit of the gun. But if guns are to be interchanged a servo can be used for triggering

2. METHADOLOGY

1) After the overall idea of the project was decided the designing stage began with sketching of basic design & then the main design was started in Autodesk Inventor. A total of 3 design prototypes were made.

2) After design was ready and materials were decided, we went for procurement of required materials, parts and components. The Acrylic sheets were bought pre-cut for required dimensions.

3) All the electronic components were bought and checked to see if in working order

4) Assembly of the main structure was done & checked for the sturdiness of all components and checked smooth for movements of all the rotating components.

5) All the electronics were put in place the wiring was done.

6) While above tasks were carried out the main program code was being written on python.

7) The program code was uploaded into the Raspberry Pi and the first run was carried out. During the first run if any problems faced were noted down & rectified immediately.

8) Few more test runs were carried out before finalizing the project.

3. CONCLUSION

The Portable Sentry Gun will be a portable automatic sentry system which will use object detection & motion tracking to track enemy/target and shoot it. It will work in as minimum time as possible. The soldier casualties faced during wars/counter-terrorism will reduce. The overall system cost is also reduced.

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