

# GunBot : A Semi-Autonomous UGV

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**Abstract** — Now a days the firefights during military operations in the have resulted in a high number of casualties and wounded soldiers because of the exposure of deadly attacks. However, those highly dangerous activities are unavoidable for military operations. Unmanned robots will give rise to a new era of reduced casualties. To perform such menace activities without those casualties, unmanned robotics is a worthy approach. We have developed a semiautonomous Unmanned Ground Vehicle, named GunBot, which is designed for military operations as well as police patrol. GunBot has two superior features; Omni-directional mobility based on the mecanum wheel mechanism which enables Gunbot with quick reaction to movement in any direction and a Target Tracking system based on which enables one operator to drive GunBot and to track a target manually. We supply a model of GunBot in this paper and show the practicability of the design of GunBot.

**Index Terms**— UGV, Robotics, Autonomous Target Tracking

## I. INTRODUCTION

Gun mounted robot (GMR) is being developed with defensive capabilities. The armaments will be mounted on the platform with movement in two axis, precise control of azimuthal and elevation of the armaments is a necessity for accurate aiming of the weapons. The aiming has to be provided for the stationary as well as moving targets. This requirement also necessitates for target locking mechanism. The GMR will be controlled by remotely placed master controlled station. In this project, an embedded control mechanism will be developed to control the movement of two actuators of the weapon mount. The embedded controller will accept the commands from the master controller through wireless communication. It will then forward these commands to the motor drive. Sensor will be interfaced to the drive and to the controller for accurate feedback. Feedback from the different sensor will be obtained and continuous error correction will be made to maintain the position of weapon axis aligned to the target. Two precise servo motors will be utilized to position the actuator at their desired location. The instance of arm position will be transmitted back to master control station for better understanding to the user.

## II. LITERATURE REVIEW

As said, these vehicles are used in wars and Anti-terrorist activities. So the main AIM has to be a precise control of the guns and the grenade launcher. Since these are programmed, so this gives a more restriction and loads with a high degree of assurance of the vehicle, since even a slightest undesirable action of such things can lead to a great disaster.

There are many vehicles made by military of different nations:

- A. BLACK KNIGHT is an Unmanned Ground Combat Vehicle designed by BAE system.

- B. M728 Combat Engineer Vehicle.
- C. The CENTURION tank (UK)
- D. T-54 and T-55 tanks by Soviet Union.

The List goes on. All these have a same feature, i.e they all are combat vehicles, but manually controlled. Our GMR has a special feature, it will be programmed to work autonomously also, with the advantage of having a manual control. Even the manual control wont be fully manual. You just have to pass the point to shoot or target, the rest of the work is done by our programmed microprocessor. This is the main advantage of this GMR which makes it unique from the group.

## III. SYSTEM BLOCK DIAGRAM

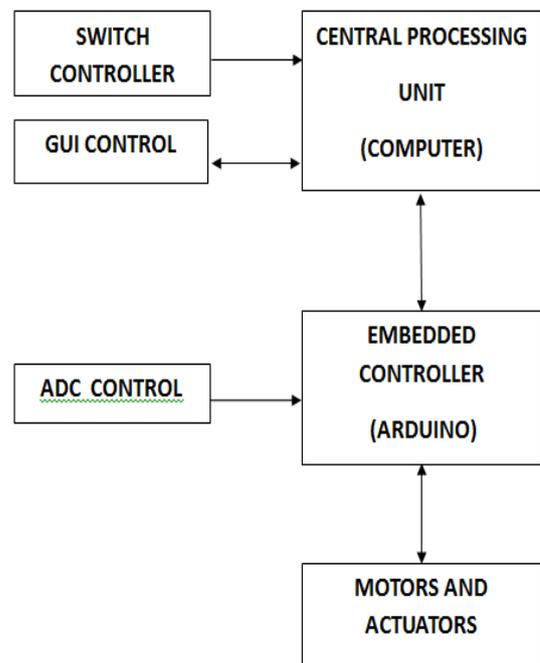


Fig. 3.1 Block diagram of Gun Mounted Robot

## IV. JOYSTICK CONTROLLER



We are using Logitech gamepad as a controller to control the motion of gun arm and other function. The gamepad has two analog sticks which gives continuous values in certain range corresponding to stick movement. It also has a mode



select switch to choose between analog mode and digital mode. It also has 10 buttons (push buttons) which can be used to give certain commands.

#### A. Interface

The gamepad is an usb gamepad which is interfaced to Visual Basic GUI interface by using DirectInput library of Direct X. Due to use of DirectX it provides plug and play features. The sensitivity of the analog sticks is also set during initialization of gamepad controller

#### B. Functions of gamepad

**Analog Stick 1:** The function of analog stick 1 is to control the motion of gun arm in horizontal plane. It provides analog angle for motion in horizontal plane

**Analog Stick 2:** Second analog stick is used to control the motion of gun arm in vertical direction. It gives the analog angle I vertical plane

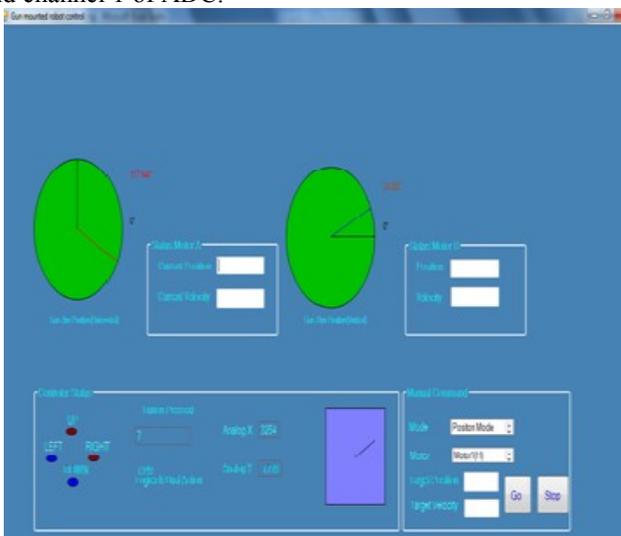
**Button 1:** Button 1 is used for clear all error flags of motor which may be required at the start of gun motion

**Button 2:** Button 2 is used for stopping the motion of both motor immediately

### V. TEST AND RESULT

#### A. POTENTIOMETER CONTROL

The motion of gun arm can be controlled by two ways. First by using the gamepad controller which is interfaced with gui and second by using two potentiometer. These two potentiometer are interfaced directly to microcontroller and provide analog voltage corresponding to angle which has to be moved in horizontal and vertical plane. The analog voltages are converted to digital value by ADC conversion inside microcontroller. Then this value are properly scaled to give corresponding angle. Two 10k pot are used for above purpose. These potentiometer provide manual method to control the gun arm and provide precise control of gun arm motion. The two potentiometer are connected to channel 0 and channel 1 of ADC.



#### B. GUI DISPLAY AND CONTROL

The GUI user control lets the user to control the gun arm from pc. It also display the current status of motors like current velocity and position. It also act as interface between gamepad controller and motor. It acts as a command center for the system Platform Used:- The GUI is developed in visual basic 10 which provide elegant user interface along with necessary library for easy interfacing with gamepad and serial communication. It is based on .NET framework

### VI. FEATURES

1. Status Display: There are two status display section which display the current status of both horizontal and vertical direction motor. The status include the current velocity and current position of motor. The current position is also displayed graphically. The graphical description also display the target angle analog stick of controller is moved

2. Gamepad Status:- This section display the status of Gamepad controller like values of analog stick 1 and stick 2, current button pressed, status of direction button. Also it displays a graphical representation of analog stick

3. Manual command: - This section provides option for entering the target position and target velocity. it also provide option for selecting between position and velocity mode. It also provide option for stopping motion

4. Status: There is a status bar which display current activity going in application and some other useful information like time etc.

### VII. APPLICATION

Since the robot is remotely controlled and has offensive capabilities it can be used in various applications like

1. Combat against terrorist
2. War against an enemy where risk of losing life is high
3. Surveillance
4. Security applications.

### VIII. CONCLUSION

Aim of this paper is to develop a real time system which takes data in real time and act accordingly without delay. The paper also indicates how feedback and error control is required for precise control and is an example of how technology can save many lives.

### IX. REFERENCES

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