Hand Gestured Controlled Combat Vehicle

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Abstract

Weapon targeting system is applicable for military and other applications. Weapon targeting system can be utilized by the pilot of the Unmanned Air Vehicles (UAV) to direct the weapon to point towards the target based on the data received from the orientation of pilot's hand movement. The weapon-targeting combat vehicle system includes a flex sensors controlled hand gestures for controlling of vehicle movement and weapon firing. It does not require a gun operator for weapon firing. The direct line of sight target is provided by pointing the laser towards the target. This will allow the user to view in real time effect of firing by adjusting the distance from the weapon to the target. The control logic is developed to make the combat vehicle to move in forward and reverse movement. The control of combat vehicle is achieved by the hand gestures. The range of gun rotation in x-axis is 180 degrees and triggering gun rotation angle range is 120 degrees. The approximated distance that gun can fire exact target position is 1meters. The error in firing is increasing as the distance is increasing.

Key Words: UAV, Combat Vehicle, Hand Gesture, Flex Sensors

1. INTRODUCTION

The technology has advanced rapidly in the 21st century; it has become very easy to perform various tasks and manual invocation has been keenly reduced to a large extinct. The research work is being carried out in every field to come up with new techniques and methods. Many reflects the developments that are being done in the armed security forces, to safeguard the country. Discoveries and development have also been made for increasing the military power of the country [1]. The project 'Gyroscope Based Targeting Combat Vehicles' focuses on the targeting system. The main objective of the system is to reduce the manual intervention and effectively handle the aiming phenomena, which is one of the major tasks performed by the combat vehicles.

This system also saves time as it eliminates the need of fixing aim each time by replacing it by gyroscope on hand gestures. The following report outlines the process involved in conceptualizing, designing and prototyping the weapon targeting system on a combat vehicle. This prototype of combat vehicle is made keeping in mind that the person is present inside the combat vehicle to guide the vehicle and weapon movement [2]. There are two parts to this designed project; firstly, the transmission side and secondly, the reception side; which is connected via a wireless link and programmed on Arduino. The military power needs to be increased and different techniques are being adapted for the same.

Different combat vehicles are being designed with high-end technologies and minimum manual intervention or fully automatic. It is done to increase the security needs of the country and to establish military superiority. Interfacing of microcontroller ATMEGA328 with flex sensors for two dimensional gimbals platform with fuzzy logic control has been done, here the raw data will received, analysed and processed by microcontroller and display it on LCD display [3]. The sensor is placed on the gimbal structure, which will sense the disturbance caused by tilted movement [4]. Here the tilt angle is measured from 120 to 240 degrees and keeping 180 degree as reference. DC geared motors is controlled by H bridge driver circuit. The control of moving on the ground in performed on aerial vehicle [5].

1.1 Structure and Description

Arduino Uno is the most commonly used Arduino, because of its various features, which make it easy to use and better than others. It has a microcontroller AT mega 328 on the board. It also has 14 digital input/output pins and six of them can be used as PWM outputs, 6 analog inputs, and a 16 MHz crystal oscillator, port for USB connection, a power jack, an ICSP header, and a reset button. It can be powered through the battery or connecting it to the computer.

The L298N H-bridge motor driver is used for driving the DC motors. The H-bridge is designed such that it can drive two DC motors at the same time. While the speed and direction of each motor can be controlled independently. Each side of the bridge has output connection for each of the motors A and B. The four gates drive the bridge circuit; the inputs are In1, In2 for Enable A and In3, In4 for Enable B. It also has a cooling flange that prevents the L298 from overheating.

The DC Geared Motor is of high quality and low cost which makes it suitable to use. 45 RPM 12V DC geared motor is used for the purpose here. It has steel gears and pinions for better wear and tear properties. The gears are fixed on steel spindles. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease. The motor is screwed to the gearbox from inside. Although motor gives 45 RPM at 12V but motor run smoothly from 4V to 12V and gives wide range of RPM, and torque. Geared motor has low high torque and low speed. The prevalent reason behind use of a servo is it provides perfect cross precision, i.e. it will rotate only up to a certain amount and then stop and wait for the next signal for further action. It has gears attached to its shaft, which limits the movement of the motor. Three servomotors are used for the purpose of the movement and triggering of gun, which are as follows.

MG995-MG995 servomotor is the motor, which has metal shaft and is used for lifting the gun in the y- axis. This motor is used, as the lifting process requires more

power. Provides the torque ranging from 9.4 Kg-cm to 11 Kg-cm. It has rotation of 180°.

The battery used in this project is rechargeable lead acid battery. If the battery is overcharged, it may produce hydrogen and oxygen. The positive plate is made up of lead dioxide and negative plate is made up of lead. The terminals are of aluminum. Electrolyte is used in this battery is sulphuric acid. Nominal voltage is 12V, number cells are 6, and nominal capacity for 20 hour rate is 7Ah at 25°C. Internal resistance is 28milliohms. It employs constant voltage charge. Length in mm/Inch is 151/5.94, width in mm/Inch is 65/2.56, Height in mm/Inch is 93.5/3.68, total height in mm/Inch is 100/3.94, and weight in Kg/lbs is 2.32/5.12.

1.2 Working of the Prototype

The Figs 1 and 2 show the visual representation of the hand gestured controlled combat vehicle. As the figure itself shows us that we can control the vehicle using the robotic arm i.e the hand gloves the movement of fingers in the gloves helps the vehicle to move in the backward and forward direction respectively as we have listed above materials using them we can construct the structure as shown in Fig 1. The Fig 2 shows the circuit of overall prototype.

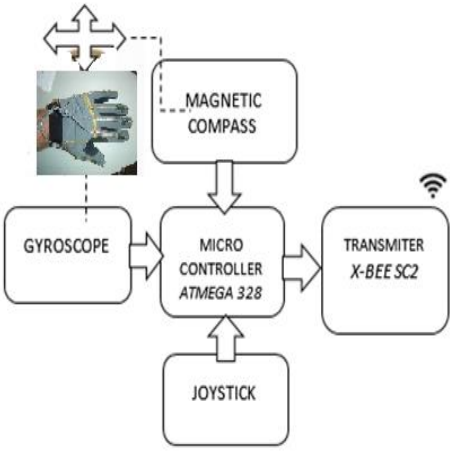

Fig. 1 Functional block diagram

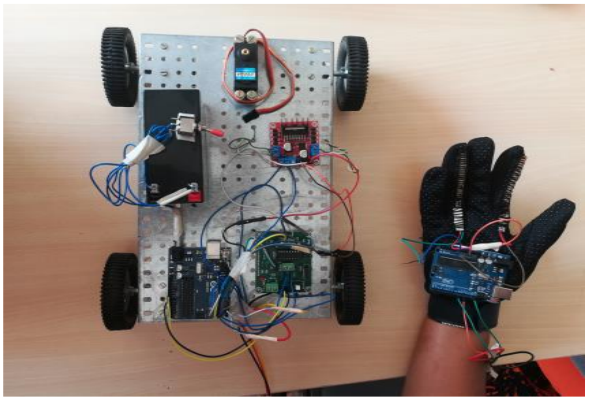

Fig. 2 Functional prototype

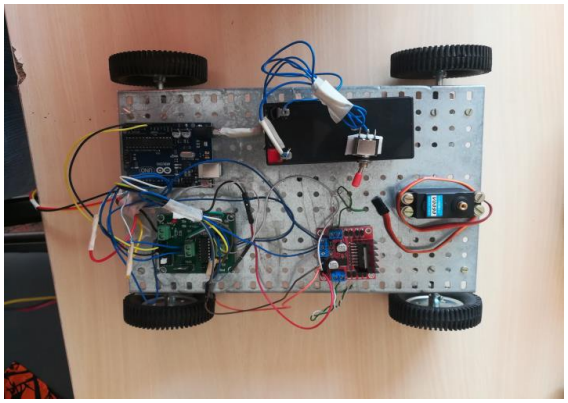

Fig. 3 Functional vehicle prototype

Table 1. Components used in project

Si. No.	Component	Specification
1	Arduino Uno	Atmega328, 5V
2	L298N	7V, 2.5A, Ptotal 25W
3	Geared DC motor	12V, 45rpm
4	Servomotor	MG995 S3003 SG90
5	Chassis	30cm×15cm
6	Gyroscope	MPC6050, 2.3-3V, ± 250 range
7	Wheels	7.7dia
8	Air gun	M-2068A (toy gun)
9	Magnetic Compass	HMC5883L 100μa Output rate 160Hz
10	Battery	12V 45rpm
11	Wires	Connectors, miscellaneous
12	L-clamp	-

2. SUMMARY

Although there are many command controlled robots, the need for self-controlled robots are on rise for military purposes, which in general called as Unmanned ground vehicles (ugvs). These robots are used to augment the soldier's capability in an open terrain. In the last decade, enormous efforts is put in developing robots for war fields and extensive research is carried out in various parts of the world. This motivation helped us build a prototype hand gesture controlled robot (called as UGV) to undertake missions like border patrol, surveillance and in active combat both as a standalone unit (automatic) as well as in co-ordination with human soldiers (manual). Likewise, command controlled mode, we use another specific mode called, hand gestured mode.

There are huge applications, they can be used by physically challenged people to navigate their robot around space. The accelerometer is also used in IMU (inertial measurement unit) for stabilizing drones and ROV's in 3D space, along with a Gyro scope [6]. E.g. balancing robot, robot arms etc. As they are easy to operate they consume low power they are much user

friendly as one can extend further in the hardware section. Team has proposed a fast and simple algorithm for hand gesture recognition for controlling robot. And demonstrated the effectiveness of this computationally efficient algorithm on real images we have acquired. In our system of gesture controlled robots, we have only considered a limited number of gestures. Our algorithm can be extended in a number of ways to recognize a broader set of gestures. The gesture recognition portion of our algorithm is too simple, and would need to be improved if this technique would need to be used in challenging operating conditions. Reliable performance of hand gesture recognition techniques in a general setting require dealing with occlusions, temporal tracking for recognizing dynamic gestures, as well as 3D modelling of the hand, which are still mostly beyond the current state of the art.

3. RESULTS

DC Geared Motor Operating Output:

The L298 H bridge driver circuit and joystick control the DC geared motor. The L298 driver circuit consists of two separate MOSFET bridges. For each operating combination of switch, the motor will rotate at different direction. The operating combination of two switches is as shown. This is the output of DC geared motor.

Table 2. H Bridge operating table

S1	S2	Operation
0	1	Forward
1	0	Reverse
0	0	No operation
1	1	No operation

Gyroscope Output:

The three axis gyroscope is used to measure the tilt angle of the head. It will measure the tilt angle in all the axis shown in Fig. 4. Here only one axis data is used i.e. Y axis data for the control of weapon in Y axis. These also includes accelerometer data.

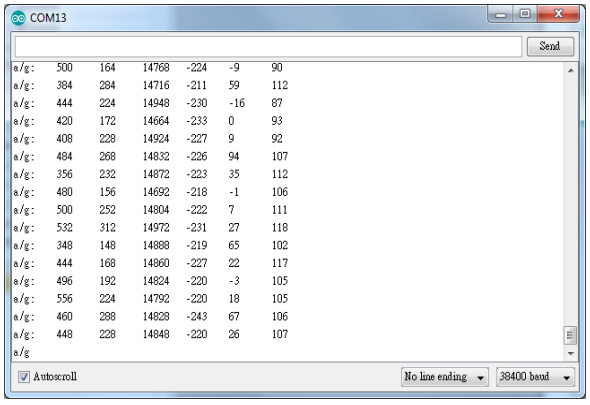

Fig. 4 Gyroscope output

Accuracy Prediction of Weapon Targeting System:

The accuracy prediction for the weapon targeting system is achieved in this section. From the recorded data, it is observed that, for same distance the error is increasing. From Table 3 it is evident that as the distance between the target and the gun increases, error between the actual hit point and the laser point increases.

Table 3. Gun Firing Recorded Table for Same Distance from Weapon to Target

Sl. no.	Laser Point	Targeted Point	Distance from the weapon in feet	X Distance	Y Distance	Error (z)
1	5,4	6.2, 2.2	1.75	3	4.8	5.6
2	6,3	4	1.75	4	0.75	4.0697
3	2,2	3.3, 2	1.75	3.6	3.7	3.64367

Bar chart for accuracy prediction of weapon targeting system for different distance is shown in Fig 5.

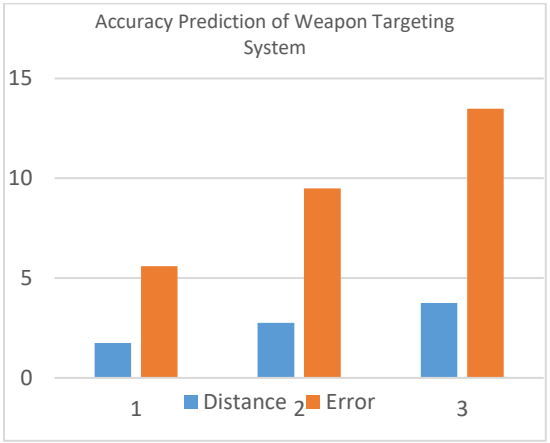

Fig. 5 Bar Chart for Accuracy Prediction of Weapon Targeting System for Different Distance

4. CONCLUSION

The purposes of the work is to control a toy car using accelerometer sensor attached to a hand gloves. The sensors are intended to replace the remote control that is generally used to run the car. It will allow us to control the forward, backward, and left and right movement, while using the same accelerometer sensor to control the throttle of the car.

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