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Unmanned Grounded Vehicle for Surveillance and Infiltration

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Abstract*: Surveillance in remote areas can prove to be a difficult task due to the risk of safety. Therefore, this project is aimed to develop a robot that can be used for both surveillance and infiltration purposes. It is a land-based system where rear and front wheels are used as a form of locomotive control. It is an unmanned vehicle where it is controlled with the help of Bluetooth through either phone or laptop. This robot can also differentiate between friend and foe mainly with the help of image processing. By implementing this robot, one can substitute military personnel on the battlefield which can save many lives. It can also reduce human effort and error during war times.

***Keywords*: image processing, autonomous robot, dc motors, servo motors, Bluetooth module (HC-05)**

I. INTRODUCTION

Wars have always occurred during the entire human history. Every war that has occurred, has brought great devastation to human life and property[1]. In order to reduce the loss of human life, robots have been developed to assist humans on the battlefield. This has further advanced to the usage of autonomous machines, which do not need the interference of human beings, to achieve the required goal. There have been many attempts to realize this. While there have been a few successful cases, an automatic machine that is capable of firing while it is moving is one of the challenging goals. Our project aims to make a prototype of such a machine. There have been a lot of human causalities during many military conflicts that have occurred around the world. This could have been reduced with the use of advanced technology. There has been a lot of work to enhance the defence sector[2]. Some of the work include autonomous systems. These autonomous systems have been used to reduce human error and human causalities in the field of defence. Different technologies like SONAR, LIDAR, radar, etc. have been used for the purpose of tracking in defence[3,4]. Many of these systems developed are mainly in the field of aerial drones and anti-aircraft vehicles with the help of visual tracking. By using only sensors, there have been attempts to automate the defence systems[5].

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Recently, image processing has been used to detect the colour patterns so as to aid the colour-blind people[6]. Similar technology like image processing for the purpose of tracking objects has not been implemented yet. Our project mainly emphasizes on land-based autonomous mobile defence system which can be used for surveillance and infiltration purposes by mainly using image processing. A robot capable of firing and moving at the same time has not been realized. Movement of our robot has been achieved using the Bluetooth module so that it can be viewed and controlled using a laptop simultaneously[7,8]. A composite outer level of protection has been provided around the surface of robot so as to protect it from external damages.

II. CAD DESIGN OF THE PROPOSED MODEL

The proposed model was designed using CAD software (Solidworks). The robot has been designed so as to optimize the space, reduce wastage, to distribute weight evenly around the base.

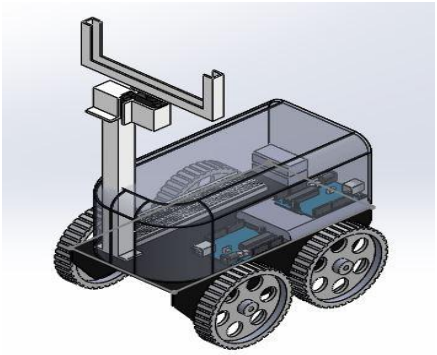

Figure 1 Isometric view of model

III. PROPOSED MODEL FOR INFILTRATION

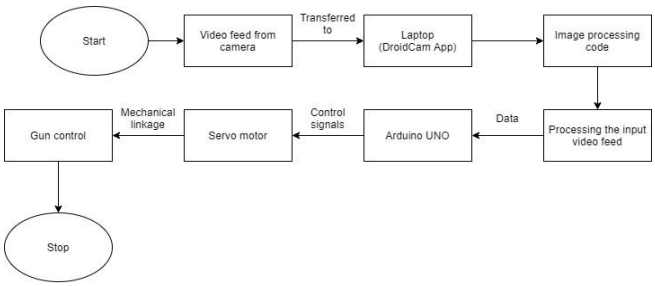

Figure 2 Flowchart of infiltration model

The main purpose of this model is to efficiently differentiate between allies and enemies and shoot accordingly. A video feed from the camera is transferred to the laptop to get a live video feed.

The image processing code will process the live video feed. The output of the image processing code is transferred as the input to the microcontroller (Arduino UNO) which gives subsequent commands to servo motors. These servo motors which are connected to Arduino Uno also acts as the mechanical linkage for gun control. In our case, we are differentiating enemies and allies with the help of the dress pattern.

A. ALGORITHM FOR INFILTRATION MODEL

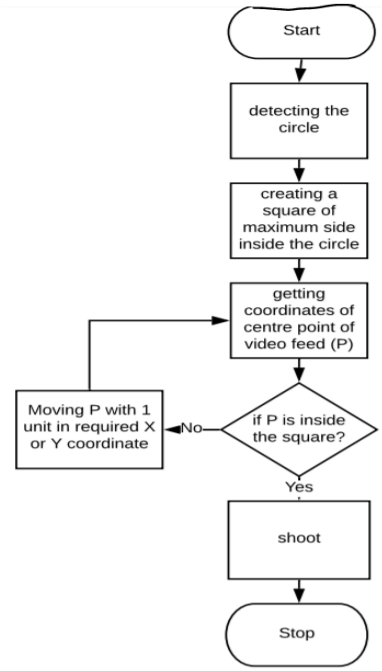

Figure 3 Algorithm of infiltration model

The working process of the infiltration model can be divided into 3 major steps. They are:-

1) First, we are identifying the circle(which acts as a target) and the central pixel of the video feed coming from the phone camera.

2) Then, we are creating a rectangle of maximum length inside the circle. This rectangle helps us to divide the overall workspace into 5 regions. One region is inside the rectangle and the other four are outside of the four sides of the rectangle.

3) After creating the rectangle, we are trying to align the central pixel of video feed (red dot) towards the rectangle (inside of rectangle) so as to align the gun towards the target and when the red dot is inside the rectangle, the gun triggers

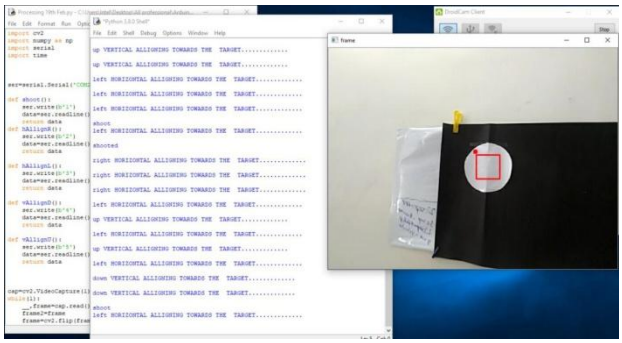

Figure 4 image shown in laptop

IV. PROPOSED MODEL FOR CONTROLLING THE VEHICLE

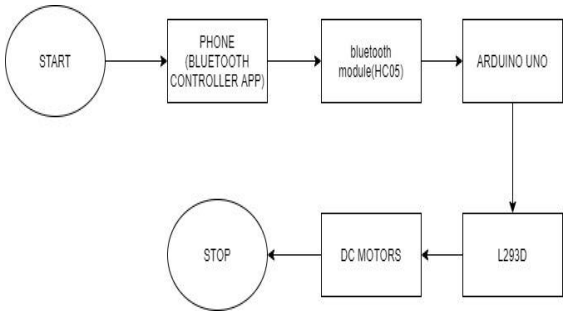

Figure 5 Flowchart of Bluetooth module

Wireless technology is one of the important needs of the modern world. The vehicle is controlled through software (Bluetooth controller app), which sends the appropriate command to the Bluetooth Module (Hc-05) connected with the Arduino. The Arduino receives these commands and sends signals to the Motor Driver from the digital I/O pins of the Arduino. The motor driver has four DC motor connected to its output terminals and it amplifies current to run the four motors according to the commands sent by the Arduino Uno

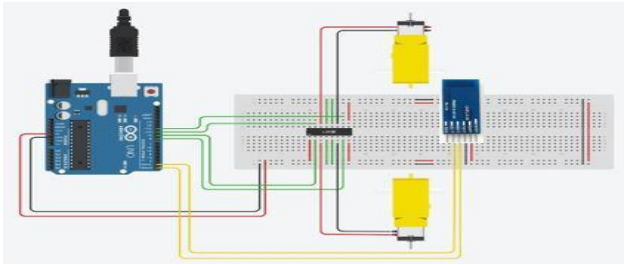

Figure 6 Circuiy diagram of bluetooth operated car

V. COMPONENTS REQUIRED

Hardware components

Table 1 List of parts required

components	Quantity
Chassis and wheels	1-set
power source	3 batteries
3D printed parts	1 set
Arduino UNO	2
Servo motors	3
Dc motors	4
Motor drivers(L293D)	2
Bluetooth module (HC-05)	1
Phone Camera	1
Jumper wires	30
Breadboard	1
Black chart	1

Along with the hardware components, some of the software like python 3.8 and Arduino are also used.

A. 3D PRINTED PARTS

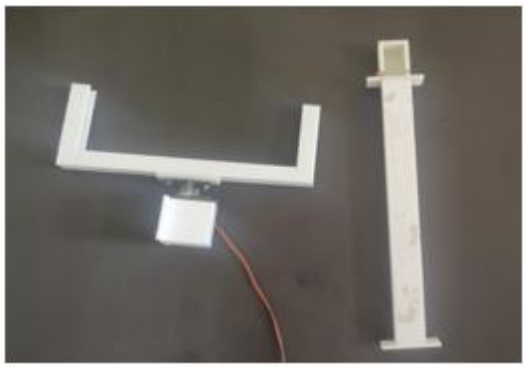

Figure 7 3-D printed parts

Some of the parts like mounts for motors stand are not accurately available in the market due to which they are designed and 3D printed using Duplicator. The material used for manufacturing is PLA (polylactic acid) which is readily available.

VI. RESULTS

The proposed model can be easily engineered by all the hardware components mentioned in Table, here the chart acts like the dress pattern, whenever the camera detects the circle in the chart, the servo motors try to move the gun towards the circle with corresponding inputs from Arduino, and when the gun is inside the circle, a servo motor will trigger the gun.

A. WORKING MODEL IMAGE

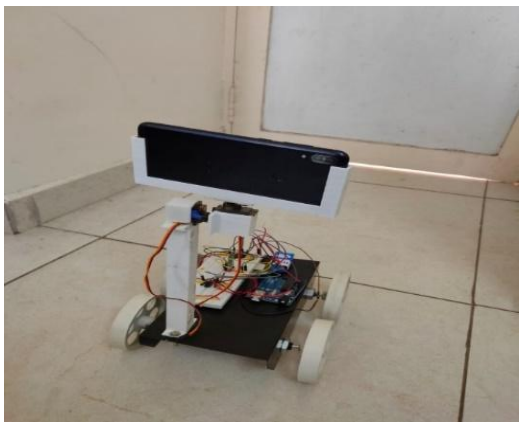

Figure 8 Image of working model(a)

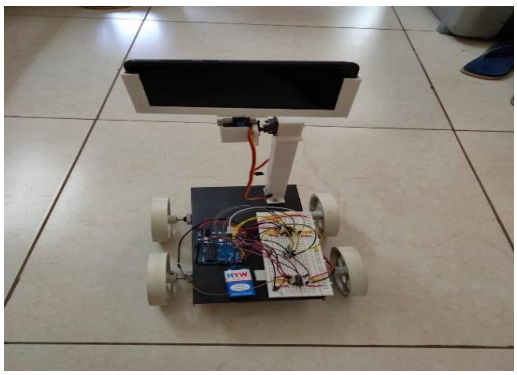

Figure 9 Image of working model(b)

VII. CONCLUSION

The main purpose of this project is to improvise the efficiency of the allies and to save lives during the battlefield. It is a low-cost unmanned ground vehicle. This robot can be used for surveillance and infiltration purpose. The robot is controlled with the help of the Bluetooth module. And dress pattern has been selected as a primary source for differentiation between friend and foe. This has been achieved with the help of image processing. Therefore, this model is successfully designed and tested. The unmanned grounded vehicle will be a new era in the defense sector if implemented.it ensures the safety of our personnel and resources

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