THE TERMINATOR

(MTR-MULTI ROLE TACTICAL ROWER)

18MHP109L - MAJOR PROJECT REPORT

Submitted by

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Certified that this project report titled "**THE TERMINATOR (MTR-MULTI ROLE TACTICAL ROWER)**" is the bonafide work of "**ARUN KUMAR R (RA1811018010133)**", who carried out the project work under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

Defense of a country is the very important part in securing the economic ,political and internal security .so it is important for every country to maintain its border and prevent any unauthorized person from entering its sovereign territory .but given the size of land borders it is impossible to guard the whole territory with human resource and we can expect enemy from every side so the soldiers life would be at stake given a human can’t be active on his entire shift so a autonomous border management system has to be used to track unauthorized border intrusions the autonomous robot should have a ability to swiftly relocate to a new location and start its tracking operation there

The autonomous robot should possess the ability to neutralize the incoming enemy threats with devastating offensive weapons And if the rowers position is compromised it should posses countermeasures to save itself and in the event of capture it should destroy itself to avoid the sensitive systems from getting into enemy hands.

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ARUN KUMAR R

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ABBREVIATIONS

A	Amperes
DIA	Diameter
V	Volt
W	Watt
Mw	Milli watt
°	Degree
Wh	watt-hour
GND	Ground
GHz	gigahertz
HZ	Hertz

CHAPTER 1

INTRODUCTION

1.1 introduction

A sentry gun is commonly used in military ships and military installations as line control and a close range defence system against incoming missiles.

As of now most of the international borders are manned by humans, it is impossible to keep a soldier on entire line of actual control on the border 24/7. Because of this both the soldier's life and the internal security of the country are at stake. Automating the border is a better ways to deal with insurgency and terrorism.

It is also used for security purposes around the world in high value vaults, secret governmental facilities to keep the intruders out at the bay, as it reduces human loss at the operator's side during the operation.

The sentry gun models which are present right now doesn't have any mobility and security features , so it makes it hard to send the sentry gun to remote area ,so a soldier must carry it to the required place ,which puts the soldier carrying it and installing it at high risk

The existing sentry gun models are hard to use as they involve complex assembly method so I tried my best to reduce all the complex things using easy to use connectors and easy to use nuts and bolts and

I decided to create rower for the sentry gun which gives it mobility up to a km in range and unlimited signal range if telecommunication networks are used for the receivers

This rower will be powered by a custom made lion battery pack and house two fpv cameras which has high frame rate and low latency , a rear mounted wireless sonar , and a gps module for location access.

The raspberry pi or the gun computer which is used to run the autonomous program on it as it will be hard to mount a laptop on the rower a 8 ch relay which will manage all the switching and triggering operations the rower house powerful counter measures and offensive weapons like smoke bomb and unguided rockets

1.2 Features

1.2.1 Real-time use case

- This completed drone can be used for the following applications
- Surveillance in military and civilian operations
- Disaster management operations
- Disaster management inside radioactive zones and chemically attacked zones
- Counter insurgent operations
- Border protection
- suicide missions and special operations

1.2.2 Technical Capabilities

The technical capabilities of the rower are as follows:

- The top most characteristics of the rower is ease of usability
- The modularity enables it for faster deployment
- Every component is fitted with a quick connect for a swift service and repair
- The rower has an long endurance of 15.5 hrs
- The rower is powered by a high torque dc geared motor which boasts a carrying capacity of 20 kg's
- The rower carries a sentry turret which houses a high speed fpv cameras which assist in targeting
- The rower has an autonomous track and shoot function when enabled the on-board computer takes over the turret and obliterates the incoming threats
- The rower has an fingerprint sensor which prevents unauthorized access
- The rower has been equipped with a rear sweeping sonar which provides us with situational awareness
- The rower houses countermeasures and offensive weapons such as smoke screen
- And carries unguided rockets for fast hit and run function
- The rower has an operational range of 1 km and
- it has been interlinked over 4g connectivity which enables us to track and lock this rower anywhere from the world
- The rower has a self-destruction to prevent sensitive technologies in enemy hands

CHAPTER 2

Methodology

2.1 Project Phases

The whole system is divided into two separate systems which operate independently the sentry gun part and the rower part the sentry gun can be easily dismounted from the rower and still sentry gun can works independently (assisted by a laptop) the design and development of the sentry gun on the rower is separated into two parts in the first phase the sentry gun has to be developed and should be tested using a laptop as its computing source

In the second phase the rower has to be developed such that the sentry gun can be mounted over it and it should be in such a way that the rower should work without the sentry gun and the sentry gun should be easily dismounted from the rower
The rower should contain all the wireless equipment for receiving the signal from the transmitter to transmit video over a 5 GHz race band and a 4g modem for the raspberry pi to stream the data to a remote station

2.2 Movement of the Rower

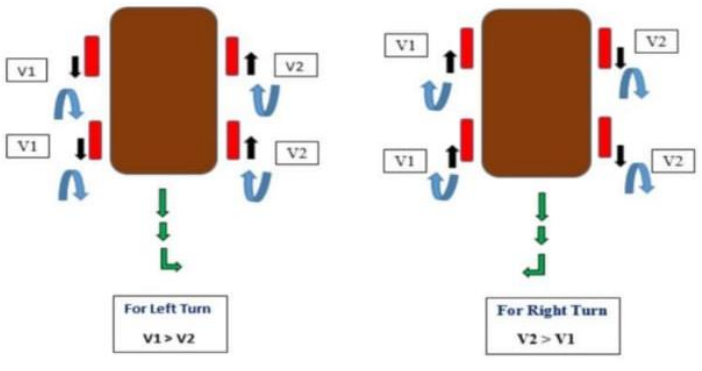

Fig2.1 movement of the rower

The rower has four fixed wheels which won’t be able to turn so we used tank steering in our rower with active steering which means the rower can turn slightly left or right while on the move and a neutral turn where both right and left side wheels will move in opposite direction such that the rower will rotate in the same place

CHAPTER 3
LITERATURE REVIEW

3.1 Existing Systems

3.1.1 Sentry Turrets

A Sentry Turret or Sentry Gun is a weapon that automatically aims and _res at targets that are detected with sensors. Where Sentry means to guard, and Turret means tower, i.e. a guard tower.

Many sentry gun models are available on the internet which are complex to use and not easily portable and has a fixed gun in which the whole y axis components has to be changed

In the following sections we will see the available or existing sentry gun models

3.1.2 Project sentry gun:

Project Sentry Gun is probably one of the most popular sentry guns on the internet today due to its open source code. The Gladiator 2 (Figure 3.1) uses a dedicated PC controlling an Arduino, along with a webcam as visual input. The software consists of two parts: The Computer Vision code and the Microcontroller code.

The Computer Vision code (GUI) is written in Processing and is a JAVA based application that sends commands to the Arduino via a serial interface. The GUI comes with extensive features including anticipation and smoothing, as well a colour tracking and calibration.

Figure 3.1: Example of Gladiator 2

3.1.3 Low-Cost 2-DOF Sentry Gun

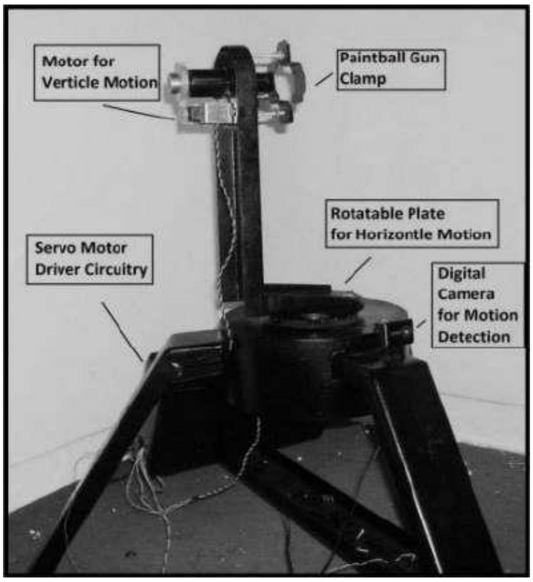

Figure 3.2 Example of 2-DOF Sentry Gun

Figure 3.2 shows a low-cost solution to a sentry turret that is not military grade. The system tracks motion using an embedded microcontroller and MATLAB interface. Motion is detected using periodic background estimation subtraction

3.1.4 Hybrid Defence System

Figure 3.3: example of hybrid defence system

Figure 3.3 above has excellent software and electronic features. Not only does it have motion detection, but also face detection and recognition. They had two versions, one with a Rasp-berry Pi 2 and one with a mini ATX desktop. The two versions are to enable the software to run on an SBC and high-end computer.

The Arduino Uno was used as the microcontroller to move the servos . Their hardware included a Nerf gun that could be used semi-automatic. They had the very innovative idea of current induction which transfers power so that they do not have cables limiting the rotation .They also used the Asus Xtion Pro Live, which has a 3D sensor, which takes stereoscopic images. This incorporates distance into the motion tracking .They used is the OpenCVMOG2 algorithm. They also had a web interface that alerted users if there are intruders.

3.1.5 Sentry Turret with Dlib

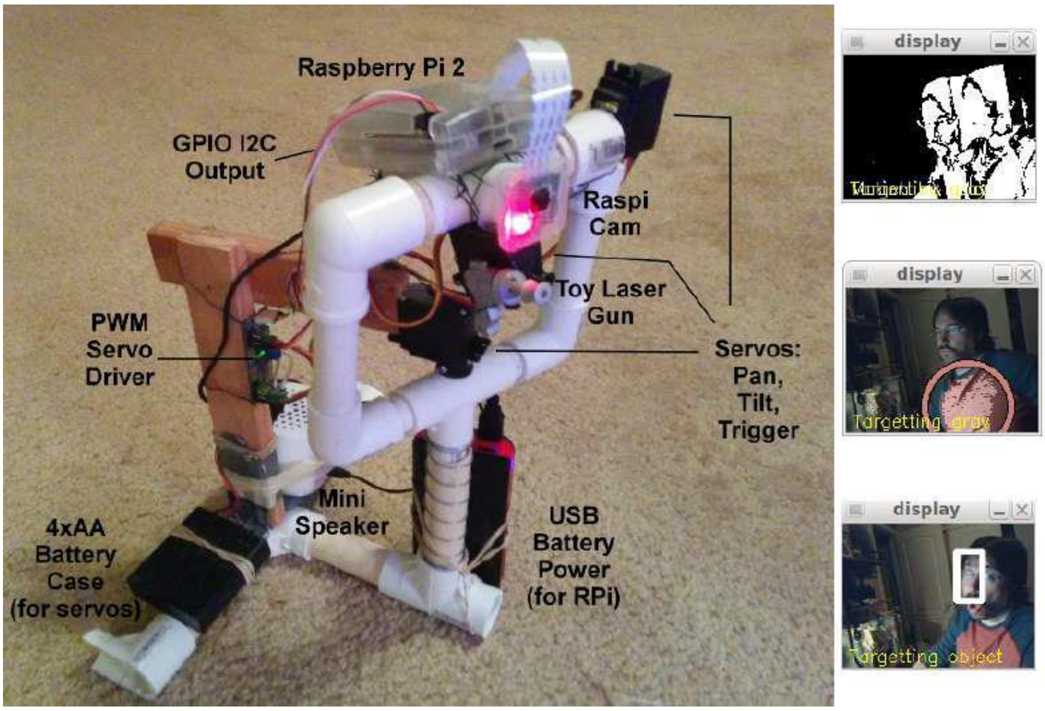

Figure 3.4: Example of Sentry Turret with Dlib

Figure 3.1.5.1 is another great example of a sentry turret with open source code. It uses a Raspberry Pi, OpenCV, Python and Dlib. Dlib is an additional library that includes pre-trained neural models for facial recognition and motion tracking for humans.

3.1.6 Giant Robot Car

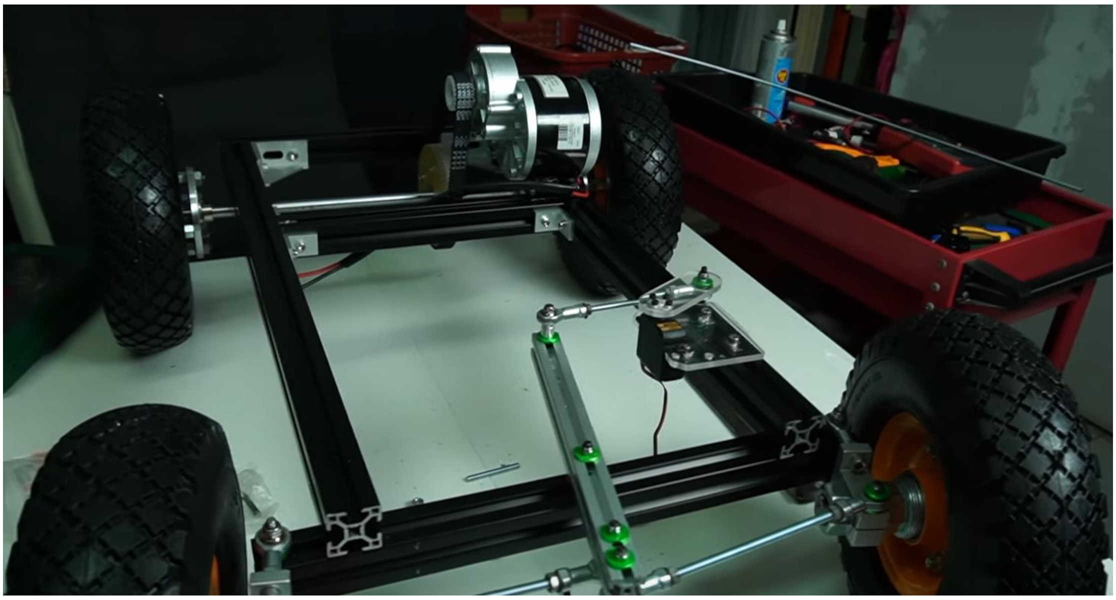

Fig 3.5 Giant Robot Car

Fig 3.5 represents a Giant robot car is a car is fully made from aluminium extrusion and it is a front wheel steered car with a 10 inch Wheel with the dimension of size : 80cm x 56 cm. It is powered by a DC Motor 250watt 24Amp 310 rpm. The steering is controlled by a servo

3.1.7 Arduino RC tank

Fig 3.6 rc tank using arduino

Fig 3.6 shows the the RC tank can be controlled by a similar RC transmitter which is used in this project

Disadvantages of this robot :

- No active steering and

- No speed control

3.1.8 Arduino Radar

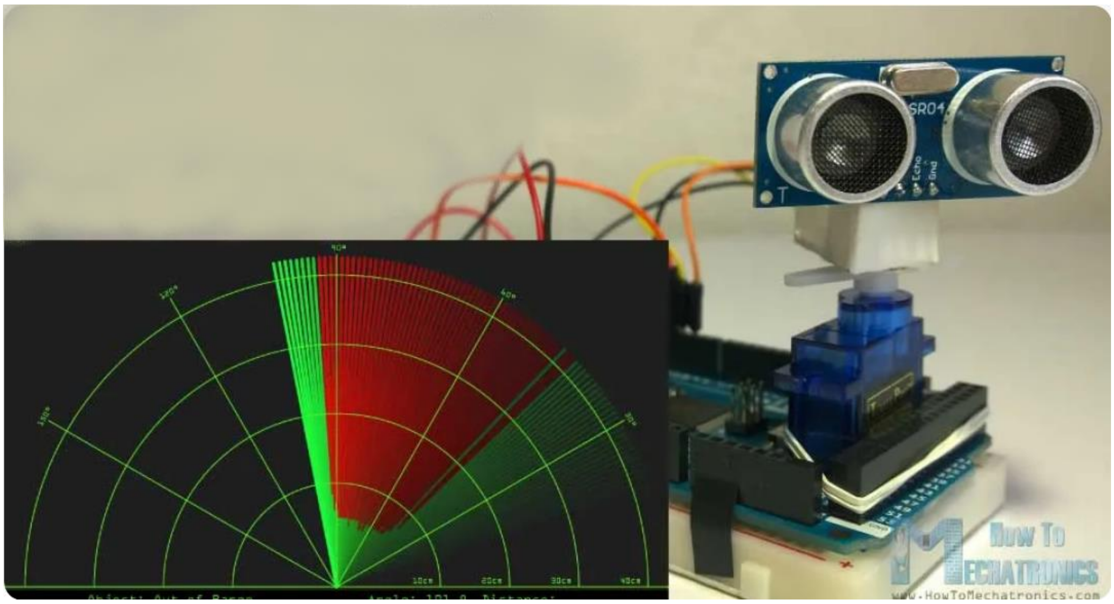

Fig 3.7 arduino radar

Arduino radar project (fig3.1.8.1)which uses a servo and ultrasonic sensor to measure the angle as arduino sends each angle to the servo by a increment of 1 the servo moves to that position and measures the distance and the ultrasonic sensor sends a sound wave and the sound wave win hit by an particle bounces back to the initial location and iscaptured by the reciver part of the ultrasonic sensor these two datas are sent to the arduino.

The arduio calculates the distance by comparing the time the sound wave was sent and the time it was taken to recive the signal back and the arduono sends the angle and the distance to the computer the processing software which is running on the computer will print the data on the screen in a radar format therby visualizing it

Disadvantages :

- It wont work wirelessly

CHAPTER 4

Problem Statement

4.1 Problem Statement

The problems which is found on the existing systems

- The sentry gun models available on the internet at the present time can't be easily disassembled and assembled
- The guns are fixed to the sentry gun in a complex manner
- The whole system is costly and too space consuming
- The existing systems are not secure enough
- And it's too big for easy transportation by a single soldier
- Existing models don't have mobility and wireless connectivity
- They Don't have countermeasures and
- They will be a sitting duck for an enemy from the behind
- The existing rowers don't have active steering and speed control
- The existing rower frames are fixed and hard to disassemble and reassemble

4.2 Objectives

For the sentry gun, the following aspects need to be covered:

- To develop a model sentry gun which can detect movements and fire assisted by open source tracking software
- To improve the security of existing sentry gun models available on the internet
- To make the gun housing easily accessible
- A physical frame that can holster a airsoft gun needs to be constructed

For the rower the following aspects need to be covered:

- To integrate the sentry gun on the rover
- Electronics to control the gun should be integrated into the frame
- To try and find a way to run the autonomous program on the sentry gun
- To make a fpv camera mount without affecting the accessibility to the gun
- To make it simple to build and disassemble the sentry gun along with the rower
- To design the whole model with easy accessibility and make it modular To make servicing easier

CHAPTER 5

TURET

5.1 Electronic Components

5.1.1 Servo Actuators

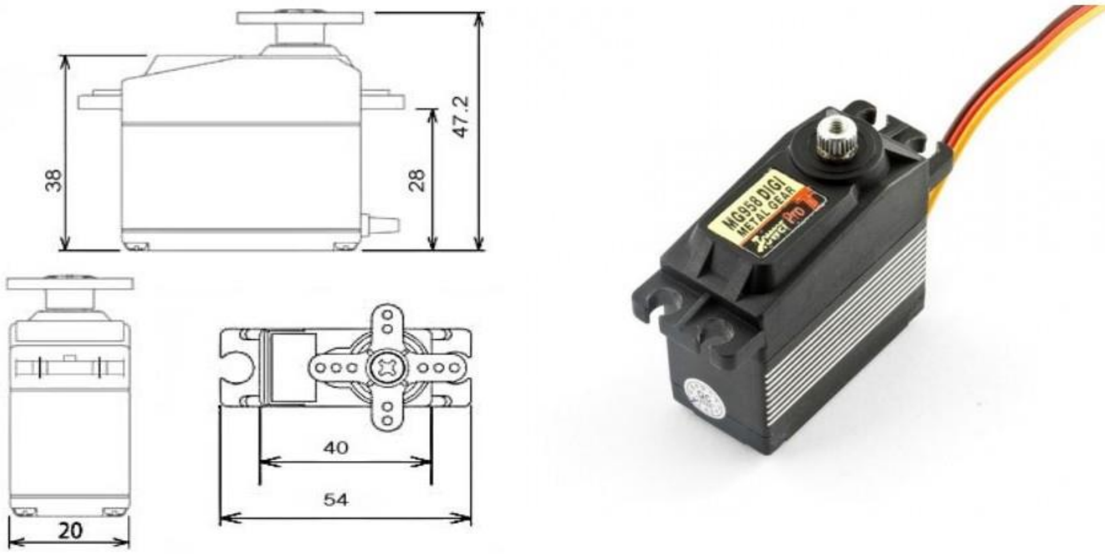

Figure5.1MG958 High Speed Servo Actuator

Description	specification
Working voltage	4.8 - 6.0V
Motor	Coreless engine
Stall Torque (4.8v)	18.0kg.cm
Stall Torque (6.6v)	20.0kg.cm
Gear Type	Metal gear
Bearing	Double ball bearing

For the turret part mg958 servo (fig 5.1) has been used for pan (x-axis) and the tilt (y-axis) movements.

This servo has a stall torque of 20 kg /cm .the reason for choosing higher torque servo is to reduce the inertia and jerking motion thereby to increase the smoothness of the x axis and y axis movements previously mg 995 servo has been used which has a lower torque which resulted in jerk when suddenly stopped and moved due to inertia so I replaced it with this servo

5.1.2buck Converter

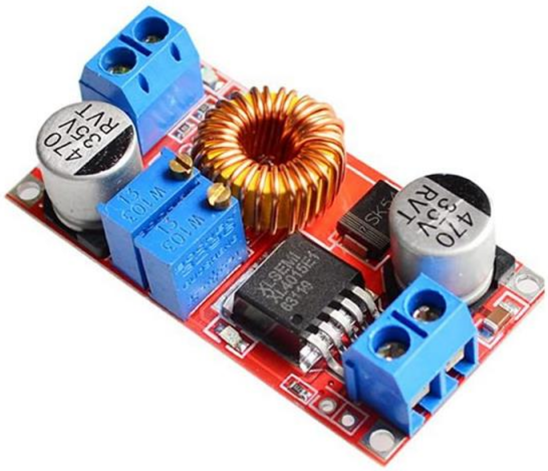

Figure 5.2 buck converter

XL4015E1 (fig 5.2) Constant Current/ Constant Voltage 5A Power Supply Module

Description	specification
Input Voltage	4V-38V DC
Output Voltage	0.8V -36VDC
Output Current	5A adjustable
Maximum Output Power	75W
Maximum Efficiency	96%

Lm2596 buck converter has been tested with the turret part it worked fine but it doesn't allow us to set a constant voltage and constant current output, Thereby giving us less options to set the servos torque and speed.

By adjusting reducing the current to to the servo we can precisely control the torque of the servo thereby producing smooth turret movement.

And by controlling the voltage given to the servo we can control the speed at which the servo moves.

5.1.3 Power Distribution Board

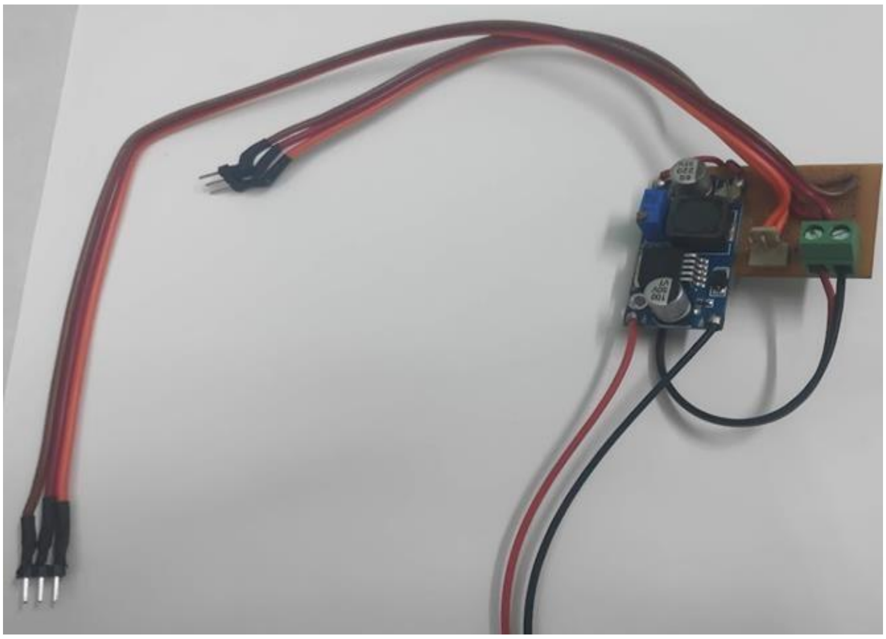

Figure 5.3 Power distribution board (top view)

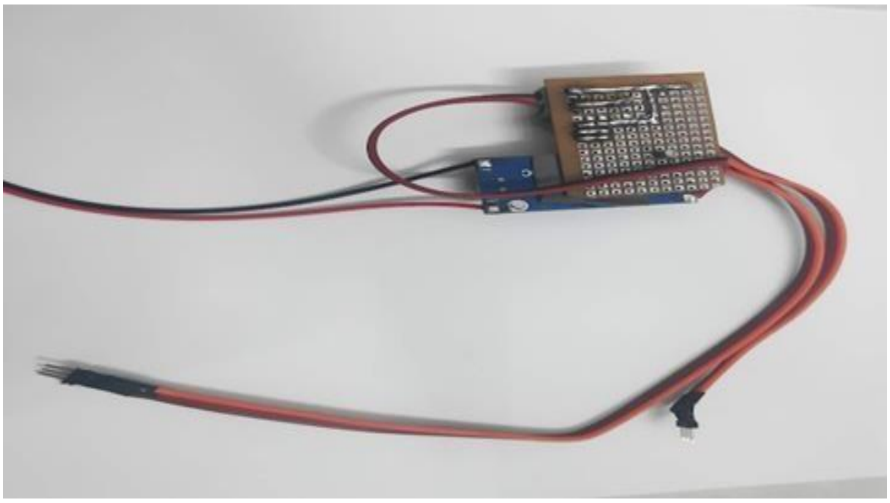

Figure 5.4 Power distribution board (bottom view)

We are using a power distribution board sown in (fig 5.3 and 5.4) to keep the model for modularity and fast deployment.

XL4015E1 (fig 5.1.2.1) Constant Current/ Constant Voltage 5A Power Supply Module Has been integrated in the power distribution board, as it reduces lots of confusions as its simple to use with easy plug and use connectors.

Instead of 6 wires I have reduced it to 4 wires all equipped with quick connectors for faster deployment ,Which can be connected in only one way thereby reducing human errors by a great extent

*buck converter has been updated to xl4015

5.1.4 Pwm Speed Controller

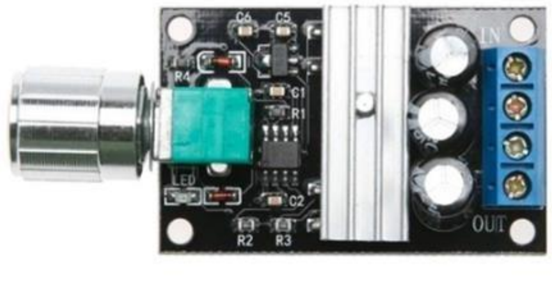

Figure 5.5 PWM speed controller

We are using a PWM speed controller (fig 5.5) to maintain the correct shooting speed of the gun, if gun shoots too fast the fast movement of the piston causes the silicone bullets to break inside the gun.

So it is necessary to set appropriate speed of the gun for smooth operation of the gun. Advantage of using this is that any electric automatic gun can be used with this speed controller because we can set appropriate speed to match different guns.

5.2 Mechanical Components

5.2.1 Castor wheel

Figure 5.6

Description	Specifications
Base plate diameter	38.2mm

Wheel height	23mm
Mounting hole	Three, 120 Degree apart, 3.4mm diameter

castor wheel is used to reduce the friction and to support the pan assembly

5.2.2 Gears Used

Figure 5.7 25 teeth gear

Description	Specification
No. of Teeth	25
Diameter	40 mm
Center Shaft Diameter	6 mm
Teeth Face Width	12.5 mm

Fig 5.8 15 teeth gear

Description	Specification
No. of Teeth	15
Overall Diameter	25mm
Center Shaft Diameter	6 mm
Face Width	12mm

As fig 5.7 and fig 5.8 shows the 25 teeth and 15 teeth gears they are used to position the turret accurately with small movements the gear ratio and torque conversion chart is given below.

5.2.3 Gear output calculation

Input gear teeth number	15
Output gearteeth number	25
Gear ratio	0.6:1
Input rotational speed	0.5 rpm
Output rotational speed	0.3 rpm
Input torque	20 Nm
Output torque	33.333 Nm

According to this table we will get the following angle of rotation

0.5=180 degrees

0.3 =108 degrees

Angle of rotation =180-108=72 degrees

So the turret can move 72 degrees in x axis and 72 degrees in y axis which means turret can pan 32 degrees right and left The gun mount can tilt 32 degrees up and down

5.2.3 Bearing

Figure 5.9

description	specification
Width	7 mm
Inner Diameter	8 mm
Outer Diameter	22 mm
Weight	12 gm

Totally 3 bearing were used in the turret for tilt shaft and the pan assembly to reduce the friction between the wood and the shaft

CHAPTER 6

EXPERIMENTAL INVESTIGATION

6.1 Prototypes

Mostly the model was tested then and there during the building process for stability and smooth operation and necessary changes were made

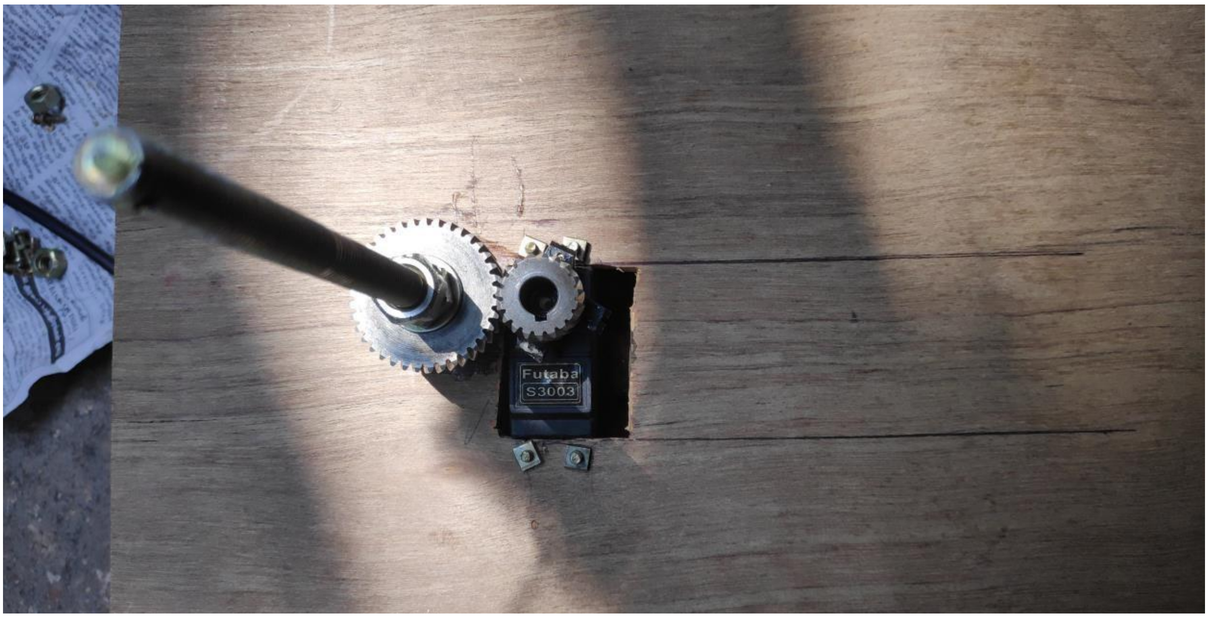

Figure 6.1 Gear assembly using helical gear (top view)

Figure 6.2 Helical gear assembly (side view)

During the initial phase of the project helical gears (figure 6.1, 6.2) were used in the model Instead of spur gear as those gears had more back lash or slipping rate than the spur gear it was discarded and more stable spur gear was used

Figure 6.3 pan disc directly mounted on the servo

Fig 6.13 shows 6 castor wheels were mounted and the inner diameter of the pan disc doesn’t coincide with the base circle and it was very hard to mount supports for it. So the idea was totally discarded and instead a square shaped base was used to mount all the components of the sentry gun within it such that it can be easily fitted on the rower.

Figure 6.4 servo control arm mounted on the pan disc

- At first I tried to fix the pan assembly directly to the servo with multiple supporting castor wheels (Figure 6.3, 6.4) to support the weight but it caused more stress on the servo so the idea was dropped.
- And a fiber geared servo where also used but it was not able to handle that much load and the gears broke so I switched to metal servos.

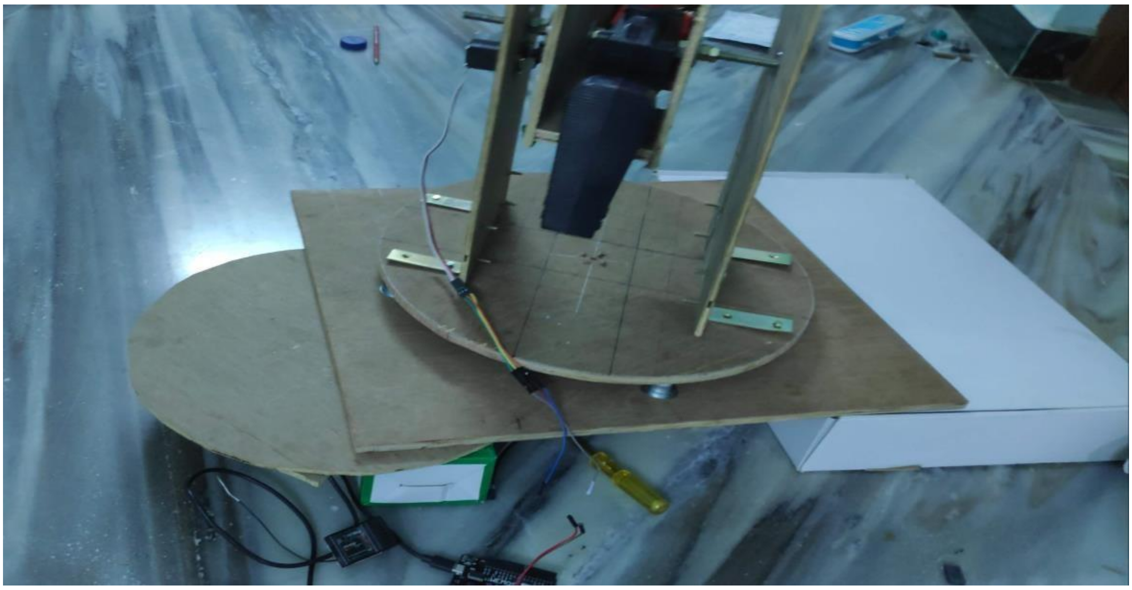

Figure 6.5 L Clamps (1ST prototype)

The L clamps (Figure6.5) used were not sturdy enough and produced vibration and swinging motion and jerked when suddenly stopped due to inertia

Figure 6.6 L clamp

I used this l clamp (Figure 6.6) for sturdiness and stability but even with this when the tilt motion was happening this whole vertical structure would move right and left so i used another alternative.

CHAPTER 7

TESTING THE TURET

7.1 Testing the Turet

Figure 7.1 pan disc gear assembly

The gears are placed very closely to avoid slippage and backlash and to prevent overload from servos

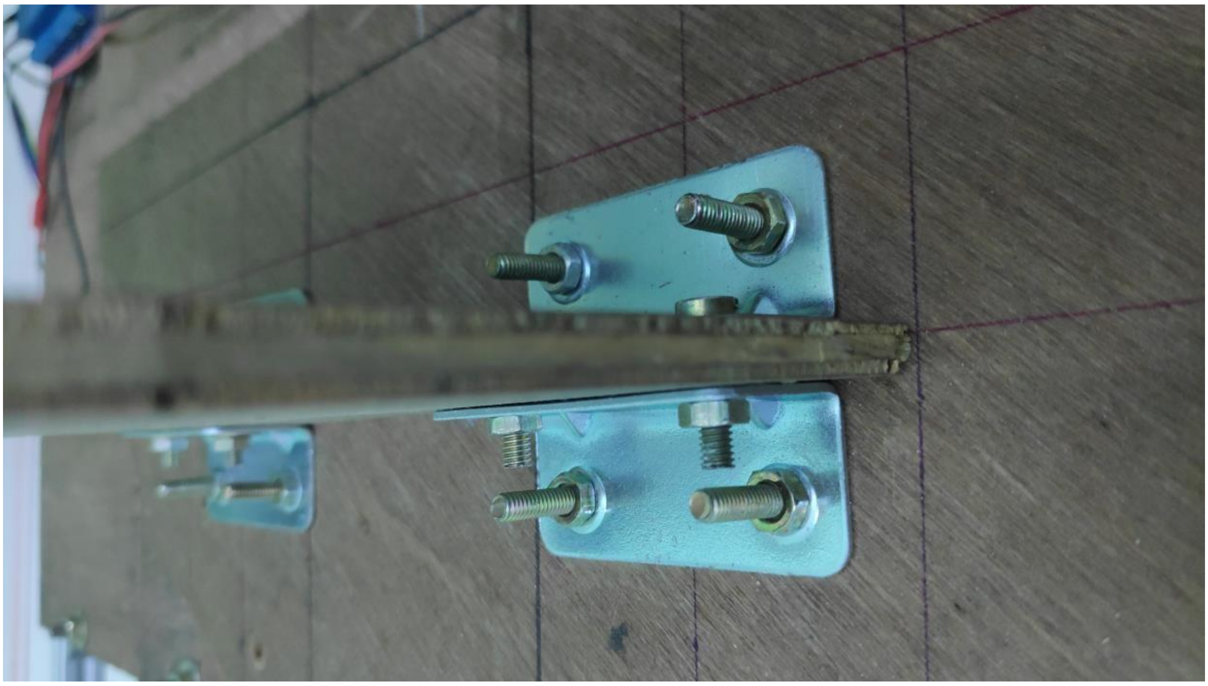

Figure 7.2 The new L clamps used

These stronger L clamps (Figure 7.2) are used on both the side of the vertical structure to restrict any motion during operation of the tilt motion .

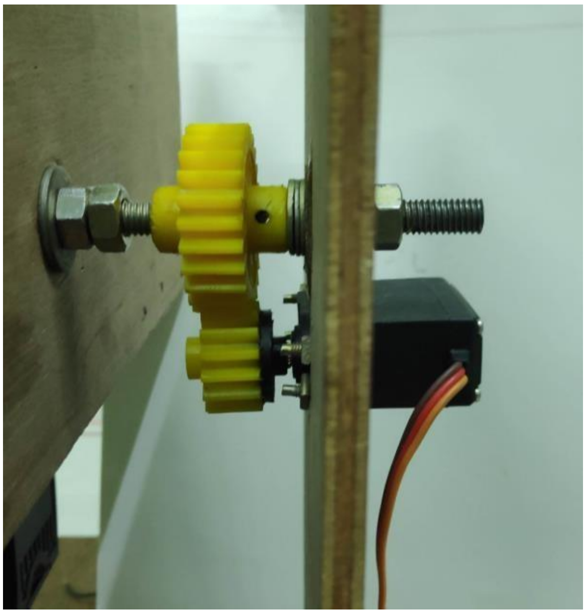

Figure 7.3 Tilt gear assembly

This is the tilt gear assembly (figure 7.3) where the shaft of the gun holster is mounted on the bearings and the gear of the shaft is coupled with the gear of the servo.

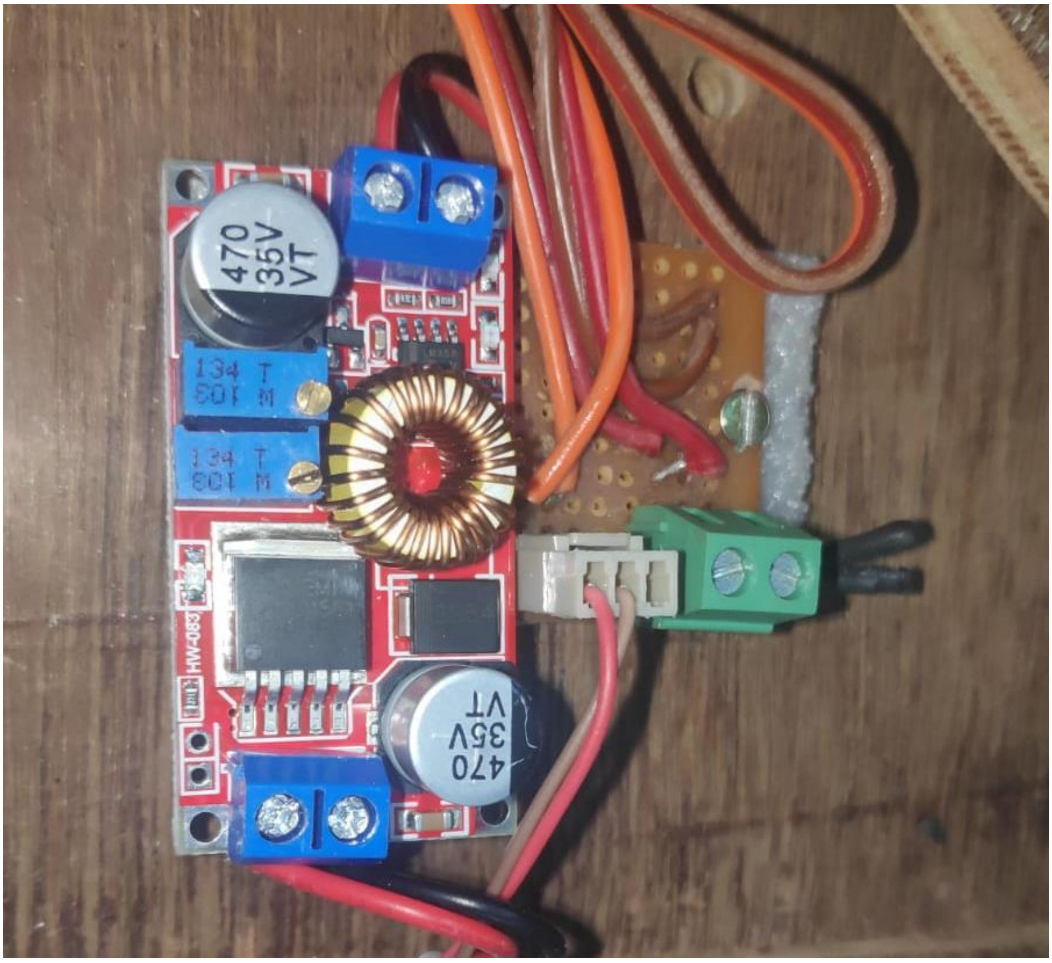

Figure 7.4 power distribution board

As seen in (Figure 7.4) the main purpose of using this is to make the process of assembling easier. Normally 6 wires from servo 3 wires from the Arduino and two wires for the power supply will be used and will be connected with jumper wires or directly to the Arduino .

As the sentry will always move in x axis and y axis the wires should move along with it   we have to use this board in the sentry gun turret as a buffer the movement in no way will break the pins in Arduino and it is easy to connect this board as it has a three pin connector which is not reversible.

Figure 7.5the gun holster shaft mounted on a bearing

The bearings (Figure 7.5) are fixed in the plywood with compression and epoxy so that it won’t easily fall off and the shaft (Figure 7.5) is inserted and secured with bolts to reduce further horizontal movement.

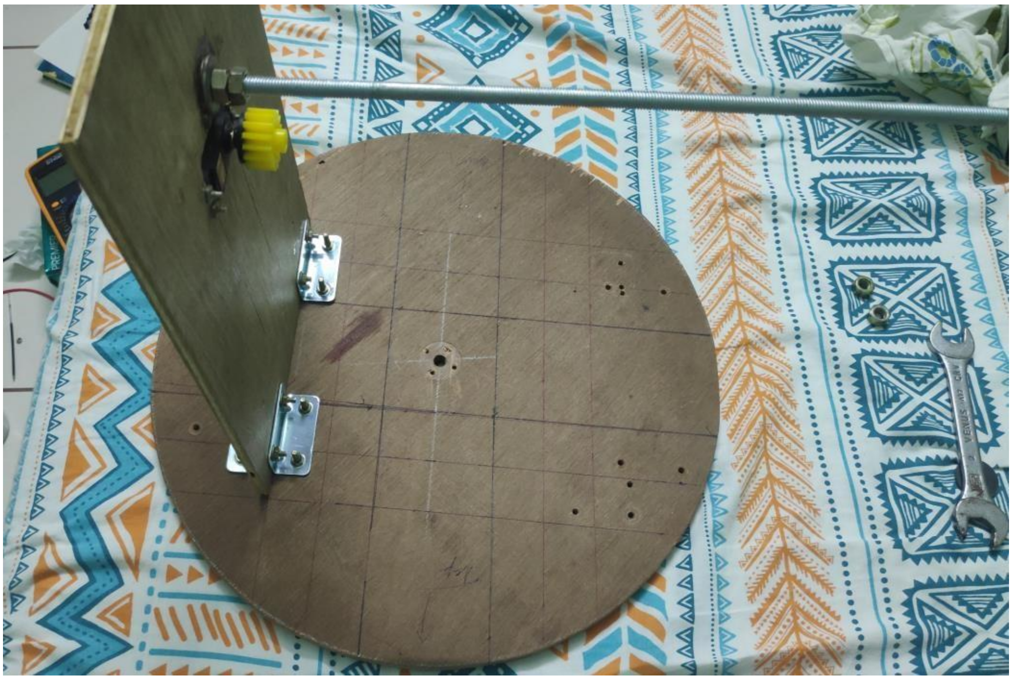

Figure 7.5 the shaft is inserted and secured with bolts

7.2 Completed Sentry Gun

During the first phase the sentry gun has been developed and the all the parts has been put together in a way which will enable the user ease of accessibility so that the repair and up gradation will be much faster.

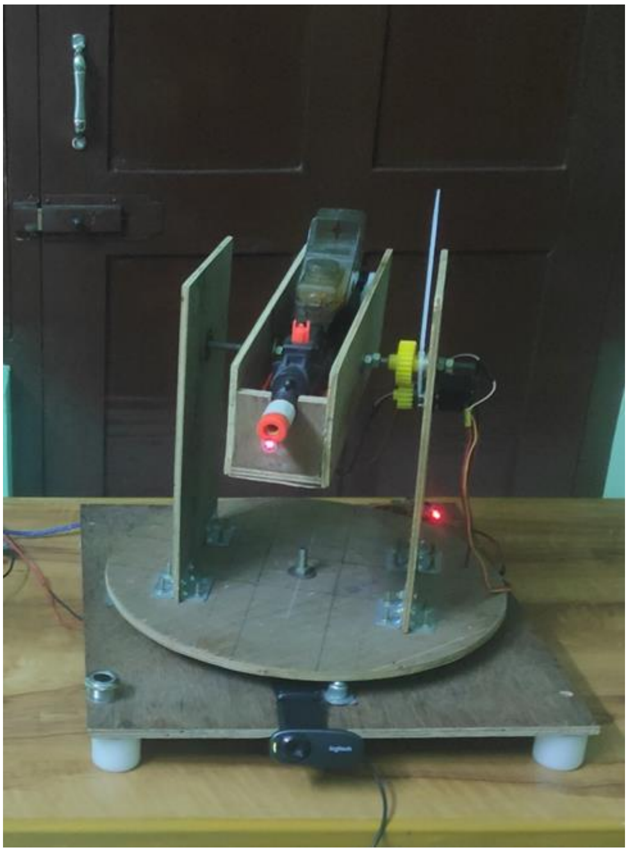

Figure 7.6 completed sentry gun

In figure 7.6 you can see the fully completed sentry gun which is supported by four legs when the rower is completed in the future second phase the four legs can be easily removed and mounted on the rower all the servo wires can be routed through the rowers relays to change the source between the gun computer and the wireless receiver.

CHAPTER 8

ROWER PARTS

8.1 Materials Used

8.1.1 Powertrain of the rower

100RPM 12V DC motors with Metal Gearbox

Fig 8.1dc geared motor

Description	Specification
weight	180gm
base motor rpm	18000RPM
Motor speed at output shaft	100RPM
Nominal voltage	12V
No-load current	800 mA
Load current	upto 7.5 A(Max)
Holding Torque	27kgcm

8.1.2Dual DC Motor Driver 20A

Fig 8.2 20 amp motor driver

description	specification
voltage	6V-18V
Peak current	50A
pwm freq	20Hz to 400Hz)

8.1.3Wheel

Fig 8.3 plastic wheel

description	specification
material	Abs plastic
Wheel pattern	tracked
Wheel diameter	10 cm
Wheel width	4.4 cm

Tracked plastic wheel (Fig 8.3) was use in this rower to get more traction in rough and smooth surfaces and this tracked wheel makes it easier to climb steeper slopes

8.1.4 Rower Frame Material Selection

Materials of the frame	cost	strength	usability	Weight	score
	20%	20%	40%	20%	100%
Steel bar	70	80	50	50	60
Aluminum bar	60	60	50	80	60
Aluminum extrusion	50	70	90	90	78

The above table shows the selection criteria for the material for the construction of the frame for the rower as our main motive is modularity and easy usability we gave more preference to the usability while selecting the material.

8.1.5 Aluminum Extrusion

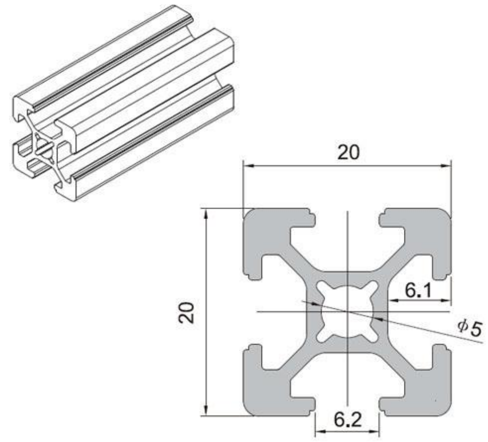

Fig8.4 Fig8.5

Fig 8.4 and fig 8.5 shows the dimensions of aluminum extrusion used in the making of the frame for the rower.

8.1.6 Pictures of the Drive Train

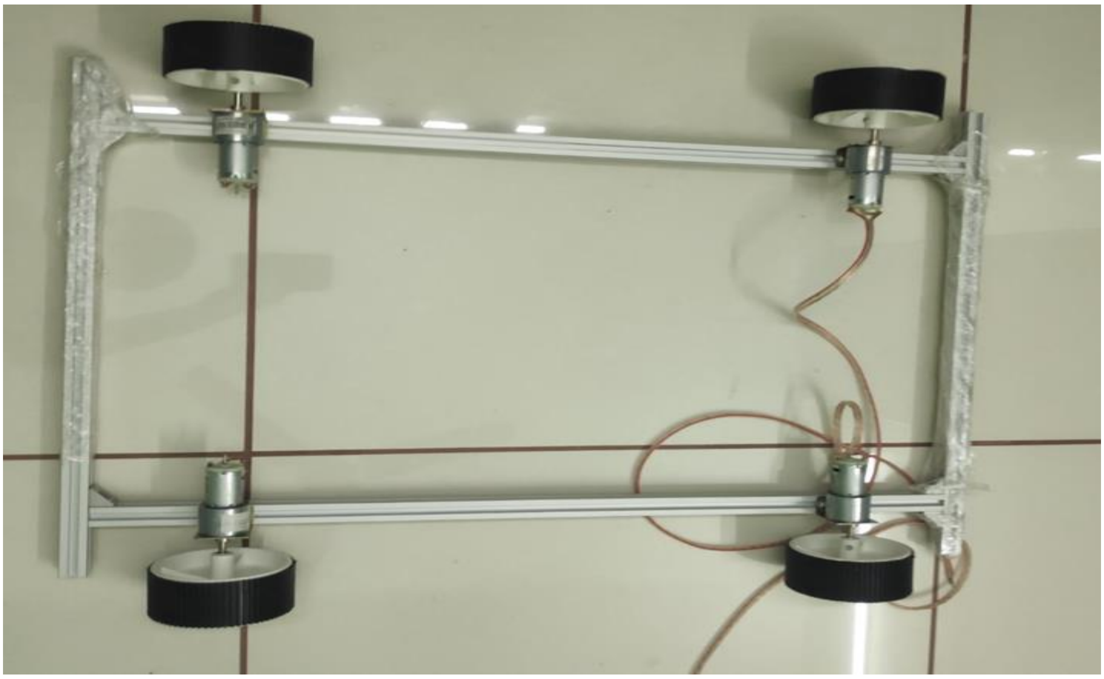

Fig8.6

Fig 8.7

The above pictures (Fig8.6, Fig8.7) shows the completed rower frame made with aluminum extrusion.

The motors were mounted under the frame with a motor mount and the base plywood attached on the frame

8.1.7 Torque Calculation

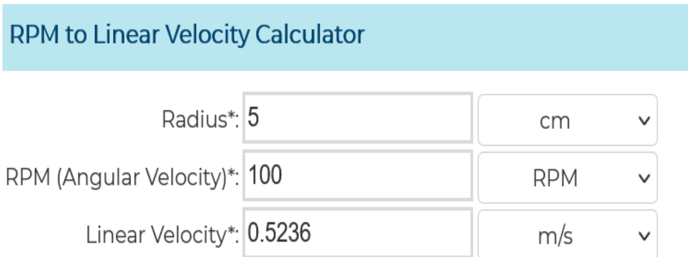

Fig 8.8 speed calculator

Fig 8.8 show that the rower will move at a speed of 0.5 m/s

Load carrying capacity= stall torque /wheel radius

Wheel radius = 5 cm

Stall torque =27.18 kg/cm

Force =27.18/5

=5.436kg per motor

Force *5 = 5.46*5 = 21.84kg torque

Which means out rower model can carry a load of 20kgs safely without stalling

8.2 Power Supply Units

8.2.1 Battery Pack

Fig.8.8 18650 4.2 v 2600mah cell fig.8.9 16.88v 4S 30A Bms

When considering about battery I ended up choosing a voltage potential above 12 volts so that it can run the motor driver.

The buck converters will work efficiently and supply enough current when the voltage potential is above 12 volts.

When researched about what type of battery to use I ended up with 3 batteries lion li po and lead acid battery. As lead acid battery was too heave as much as 2.1 kgs it was ultimately eliminated. Lipo batteries were too costly so it was eliminated

Lion batteries were the ultimate choice for this rower so it was chosen and it was assembled.

8.2.1.1 Battery pack design

An online tool was used to calculate the capacity and voltage potential of the battery pack and the order in which it has to be placed.

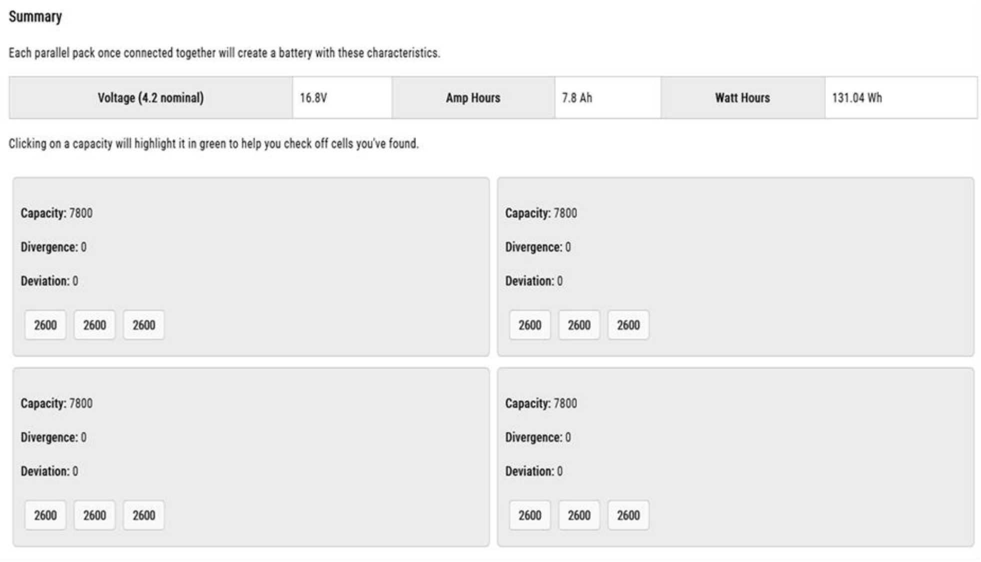

fig 8.10 18650 cell battery pack designer

Batery type	cost	Life span	Power density	Weight	score
	20%	20%	20%	40%	100%
Lead acid	80	30	40	20	38
Li ion	60	80	80	80	76
lipo	10	70	70	90	66

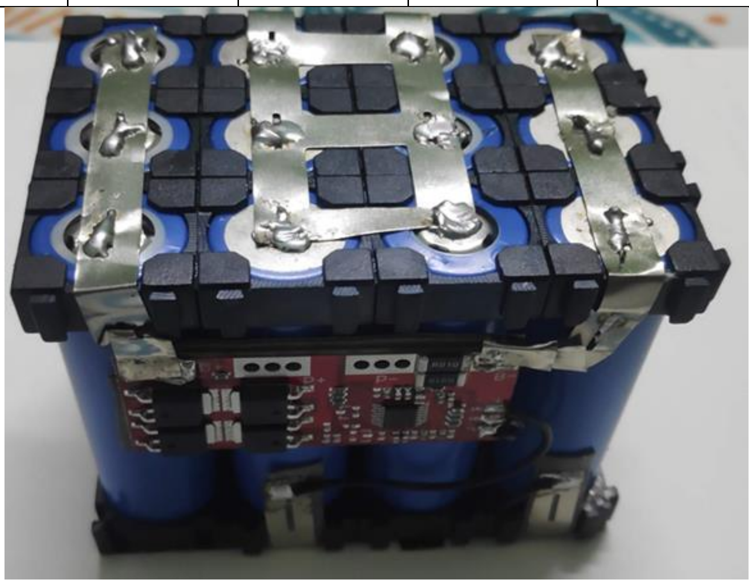

Fig 8.11 li ion battery pack 14.8 V 7.8 A

- This (figure 8.11)shows the completed battery pack , where each cell has a voltage potential of 3.7 Volt with a capacity of 2.6 A
- A fully charged battery pack will have a capacity of 7.8 amps and a output voltage of 16.8 volts

DESCRYPTION	SPECIFICATION
Single cell voltage	4.2 V
4 cells in series	4.2*4=16.8V
Single cell Capacity	2600 mah
3 cells in parallel	2600*3=7800 mah
Wh	131.04Wh
Weight	540 gm

8.2.2 Mini 360 buck converter

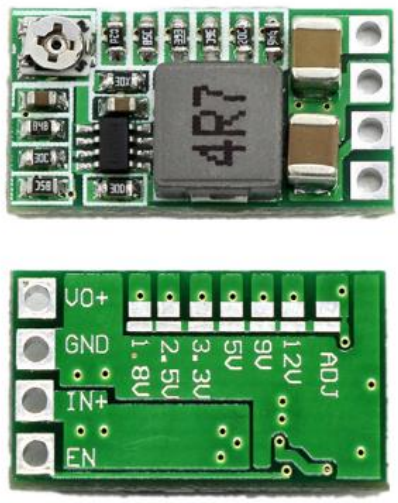

Fig 8.12 mini 360 buck converter

DESCRYPTION	SPECIFICATION
Input Voltage	DC 4.5-24V
Adjustable Range	0.8-17V
Output Current	3 A at 5 V

- Fig 8.12 shows the mini 360 buck converter
- This is the smallest buck converter I was able to find on the internet
- It has a conversion efficiency of 97%

- And this has been used in multiple places all over the rower and the sentry gun where different voltage levels is required as this is tiny it saves lot of space
- Places where this buck converter is used:
    - For the laser diode
    - For fpv transmitter

8.2.3 300W 20A Step-down DC-DC Converter

DESCRYPTION	SPECIFICATION
Input Voltage:	6-40V DC
Output Voltage	1.25-36V DC
Max. Output Current (A)	20A
Maximum Power	20 amph 300W

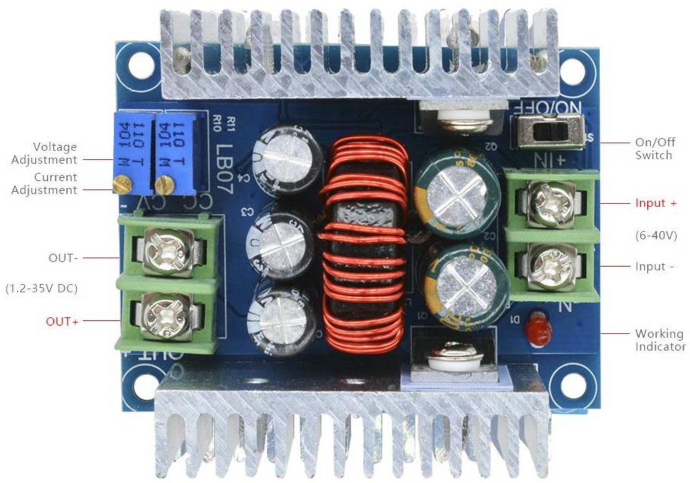

Fig 8.13 :300 watt 20 amph buck converter

- As I tried using lm2596 and the mini 360 buck converter to power all the components in this project they didn't provided much needed current and heats up a lot so
- I switched to this constant current constant voltage buck converter which provides enough current to power the following devices:

Description	Specification
Node mcu	2
Arduino nano	2
gps module	1
8ch relay module	1
2 ch relay module	1
Fpv camera	2
Mg 958 servo	1
ultrasonic senor	1

8.3 Working of the Electronic Parts

8.3.1 Node mcu (esp8266)

Fig 8.14 node mcu (esp8266)

description	specification
Microcontroller	Esp8266(Tensilica 32-bit CPU)
Input Voltage:	7-12V
Operating Voltage	3.3V
Clock Speed	80 MHz
Digital, Analog I/O Pins	(DIO): 16, (ADC): 1

8.3.2 Transmitter and Receiver

Fig 8.15 channel flysky transmitter and receiver

Figure 8.15 shows the 10 channel transmitter and receiver used for our rower 2 channels are used for the drivetrain of the rower and remaining 8 channels are used for the switching applications and triggering applications

8.3.3 Working of the Drivetrain

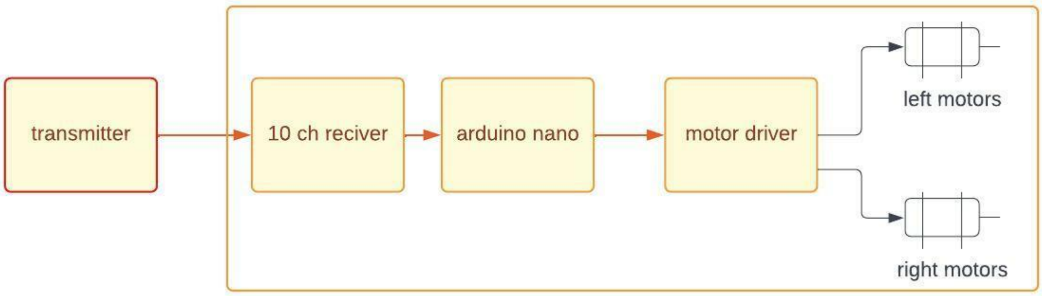

Fig 8.16 Flowchart of the working of the drivetrain:

Fig 8.16 sows the flowchart which depicts the working of the drivetrain A fly sky 10 channel transmitter and receiver is used for wireless control when the signal is received by 10 channel receiver as a rc pwm signal it has to be decoded and sent to the motor driver and the motor driver will power the motors .

8.3.4 Fingerprint Control Unit

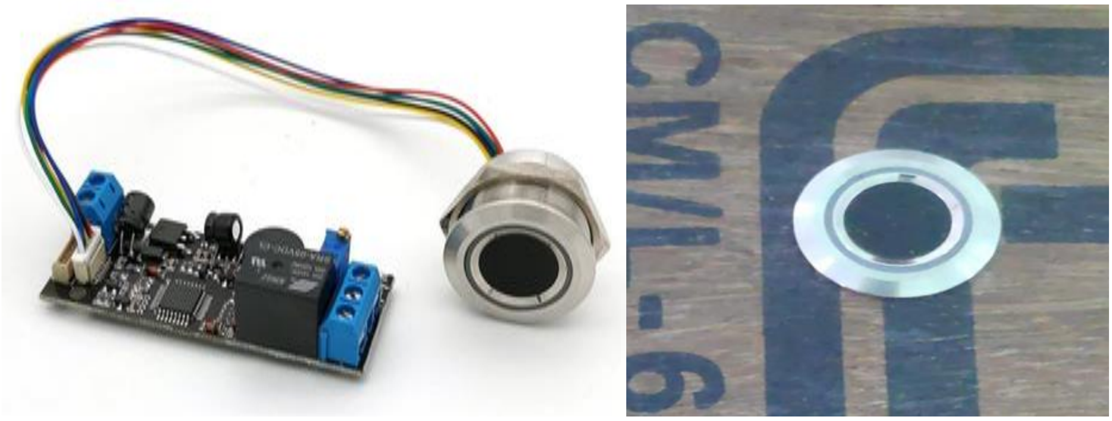

Figure 8.17 Grow K202 finger print system

The following sequence describes how the security system works:

- The finger print sensor and control board(Figure 8.17) when correct finger print is authenticated the relay triggers for 2 seconds
- so it won't be useful if we directly power the whole sentry gun system through this relay
- so we need to code an node mcu (esp82666) to receive that two second negative pulse and trigger another relay and act as a detent switch until further 2 second pulse is received when it should disengage the relay

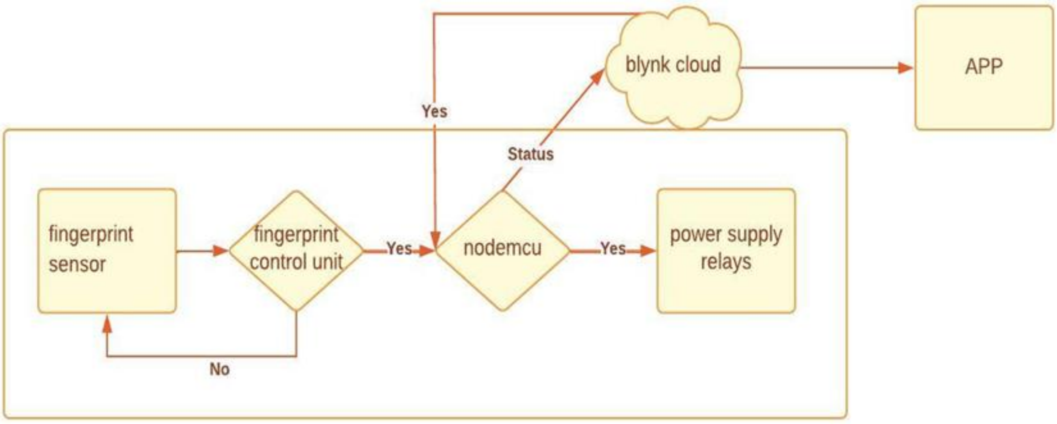

Fig 8.18 flowchart of the fingerprint security system

- As shown in fig 8.18Nodemcu will continuously syncing over to the blynk cloud and as a security feature node mcu won't turn on the whole system if it is connected to the internet and
- For the system to work the node mcu should be connected to the internet and the fingerprint sensor should be authenticated for the whole system to power on
- another way to power the whole system is through the mobile app through which we can turn on and off the whole system

8.3.5 Switching and Triggering System

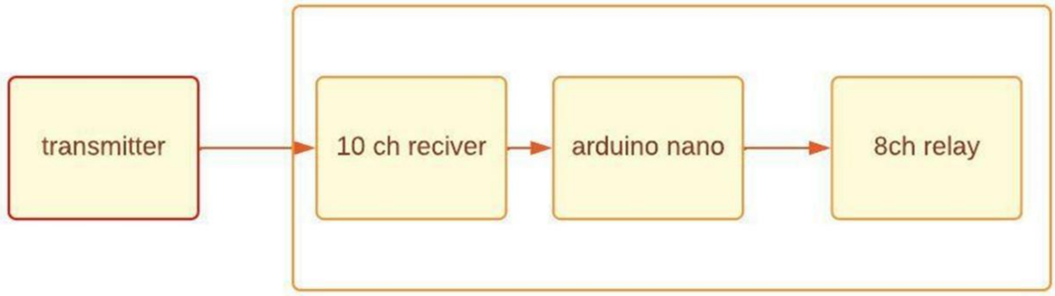

Fig 8.19 PWM to relay decoder board flowchart

As the 10 channel fly sky receiver can't be directly connected to the 8 channel relay board as the signal sent out by the receiver are PWM or ppm signal ,but the relay can only be triggered by a low level trigger which means a ground signal must be sent to the particular relay pin to turn that relay on.

So we need a decoder board which will sense the PWM signal and decodes it into a low level trigger signal, this can be easily made using a Arduino nano.

Plug and play connecters should be used to make it modular so that if the board gets damaged it should be easy to throw it away and install a new board.

I have used jst xh 10 pin connectors which makes it easy to connect the board to the receiver instead of connecting 10 separate wires.

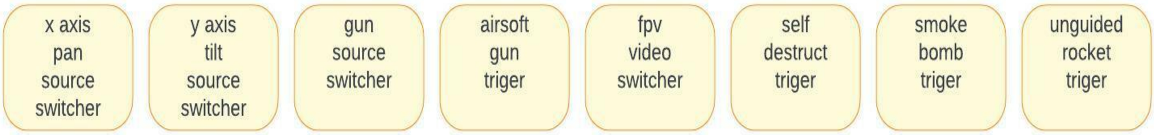

Fig 8.20 channel relay distribution chart

Fig 8.20 shows the switching application of the 8 channel relay module. The diagram represents each task assigned to each relay.

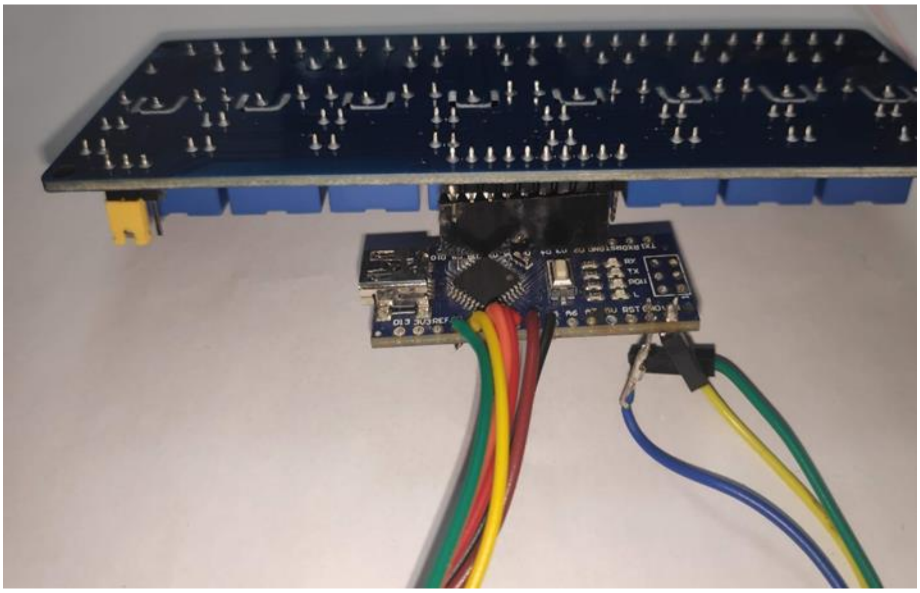

Fig 8.21 bottom view of PWM to relay decoder board

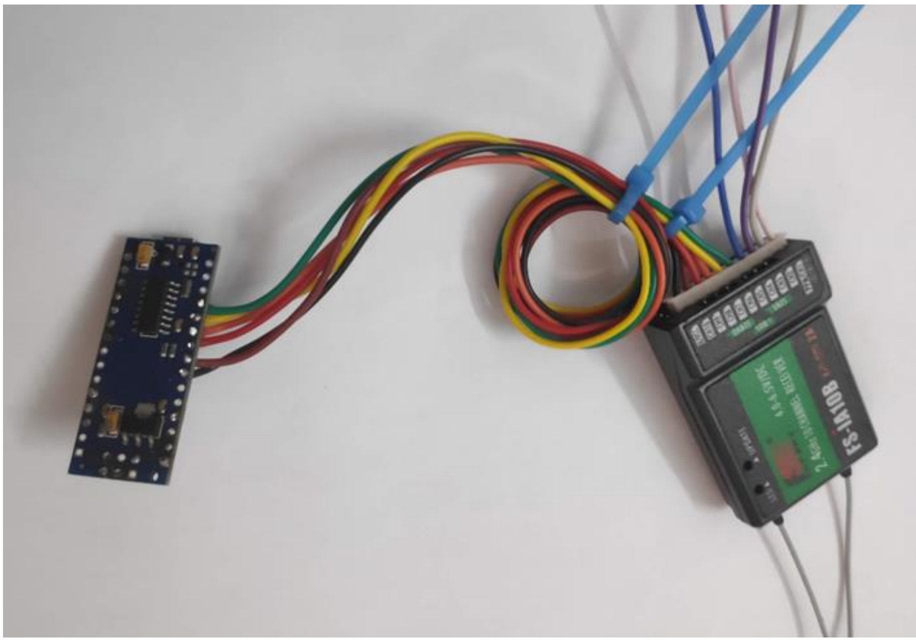

Fig 8.22 top view of the PWM to relay decoder board

As we can see in fig 8.21 and fig 8.22 if the nano module gets damaged it can be simply plugged out and disposed along with the connector and a new nano module with the same connecter can be installed with ease

So there won't be any delay in servicing

8.5 Sensors and Modules

8.5.1 Voltage Sensor

Fig 8.23 voltage sensor

Voltage Detection Sensor Module is a simple and very useful module that uses a potential divider to reduce any input voltage by a factor of 5.

The voltage circuit consists of a voltage divider circuit of two resistors in which R1 is 30K and R2 is 7.5K.

8.5.2 Neo 8m GPS Module

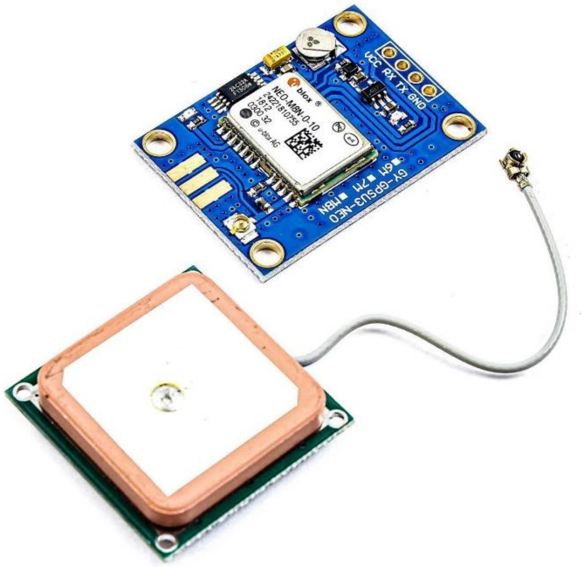

Fig 8.24 neo 8m GPS module

Before using the neo 8m GPS module I first used neo 6m module which is a cheaper version of neo 8 module but it can only track two type of satellite the (GPS, SBAS) but when tested with u center app the module was able to pick up signals from very few satellites and was less accurate .

So I switched to neo 8 m module as it has a capability of working with many type of satellites (GPS, SBAS, QZSS, GLONASS, BeiDou , Galileo)the positional accuracy will be far better compared to GPS.

Description	specification
Input Voltage	3V ~ 5V
Receiver type	72-channel u-blox M8 engine
Satellite	GPS , SBAS, QZSS, GLONASS, BeiDou, Galileo .
Horizontal Positional accuracy	2.5m
GPS update rate	5Hz
Antenna gain	28dB

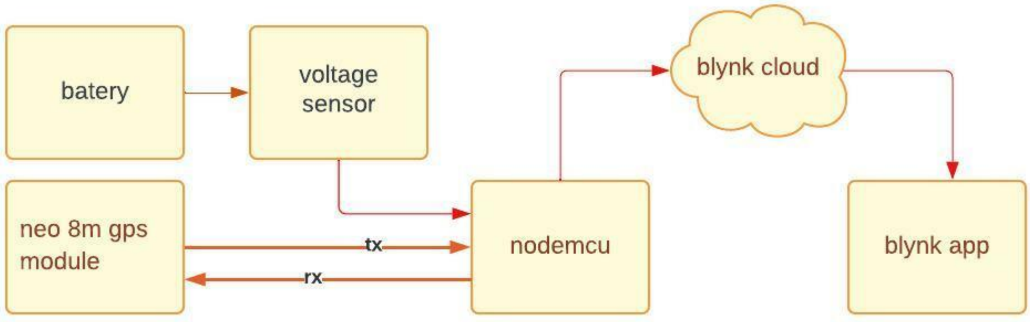

Fig 8.25 flowchart for voltage sensor and GPS

This flowchart (fig8.25) represents how the process of sending data to the mobile app works.

The battery voltage is measured by the voltage sensor and the output of the sensor is given to the adc0 of node mcu as it is a analog signal.

Now the GPS once set a particular location as accurate, it sends the signal over to the node mcu .

The GPS sends the following information:

- Latitude longitude
- GPS speed
- Satellite orientation
- Device speed
- No of satellites the module is connected to at present

8.6 Blynk App

Blynk is a new platform that allows us to quickly build interfaces for controlling and monitoring our hardware projects from our IOS and Android device.

We can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen.

Using the widgets, we can turn pins on and off or display data from sensors.

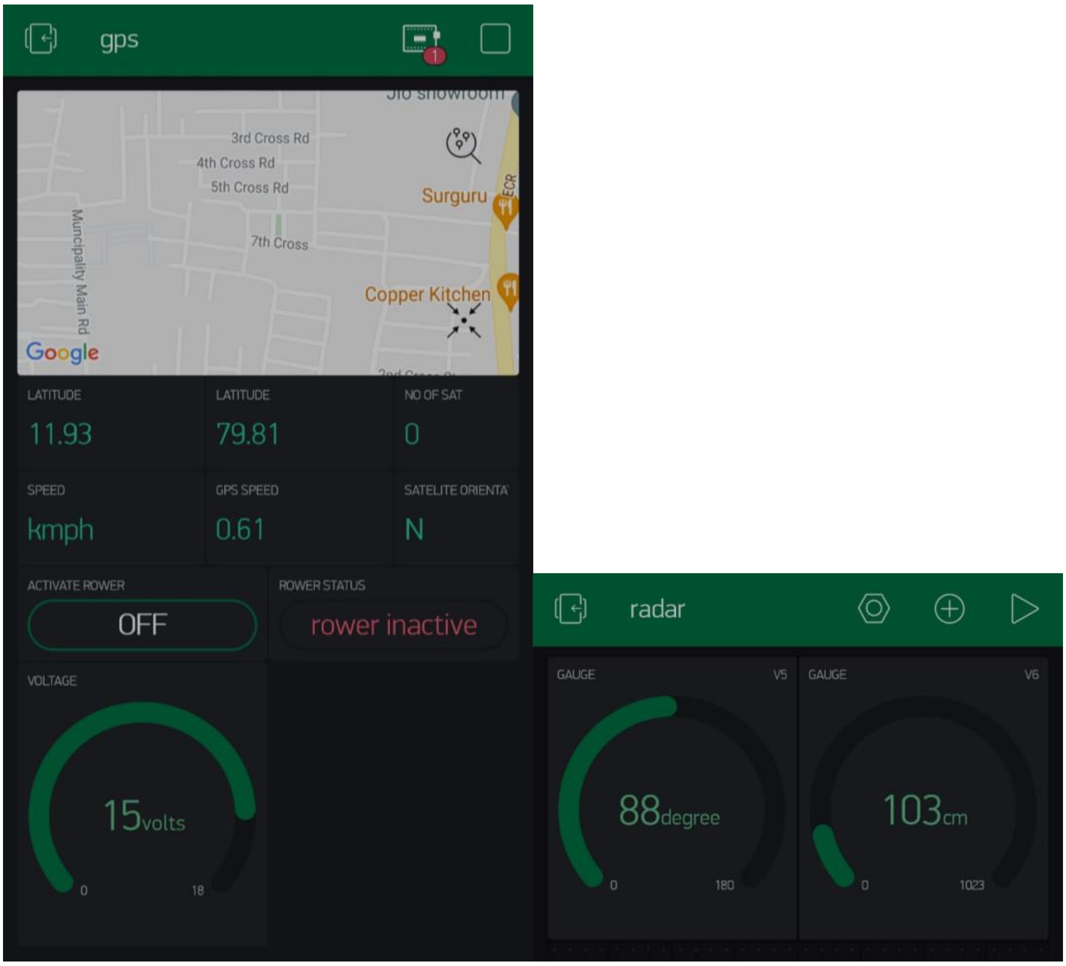

Fig 8.26 visualization of sensor data in blynk app

We can easily create widgets in blynk android app which will be connected to the blynk server. As the nodemcus calculates the sensor data and writes the value to a virtual pin on the blynk server .Then We can create a widget in the app and assign that virtual pin to a widget to print the incoming values and the widget will react to the incoming values

Fig 8.26 shows the visualization of the sensor data in the blynk app.

CHAPTER 9

WIRELESS SONAR

9.1 Working of the Sonar

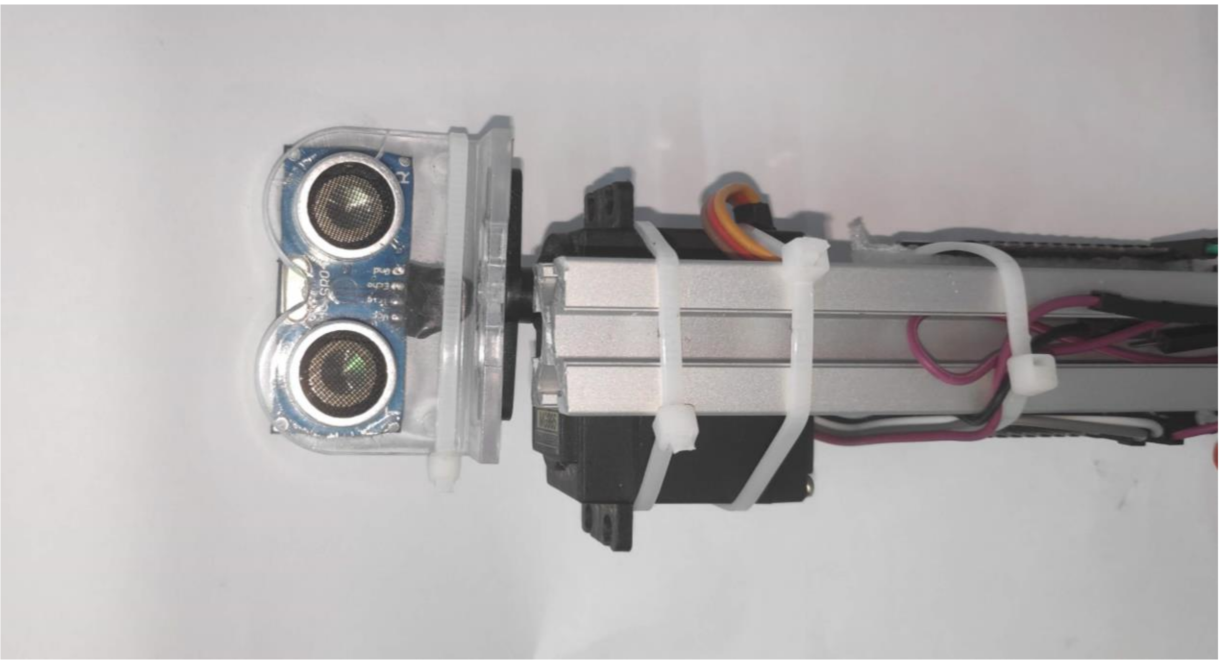

Fig 9.1 front view of the sonar

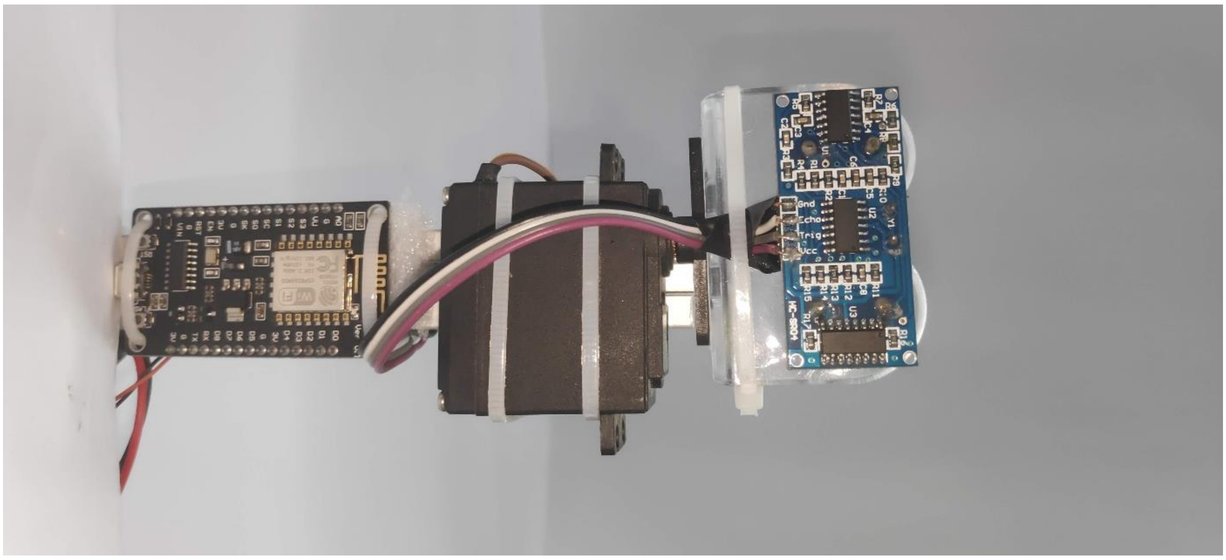

Fig 9.2 back view of the sonar

- Fig 9.1 and 9.2 show the front and back view of the sonar mounted on the rower
- .As the image sows the whole sonar system in mounted on a single block of aluminium extrusion making it for easy disassembly and reassembly as by

removing a small jst plug and a nut from the extrusion the whole sonar system can be dismantled from the rower

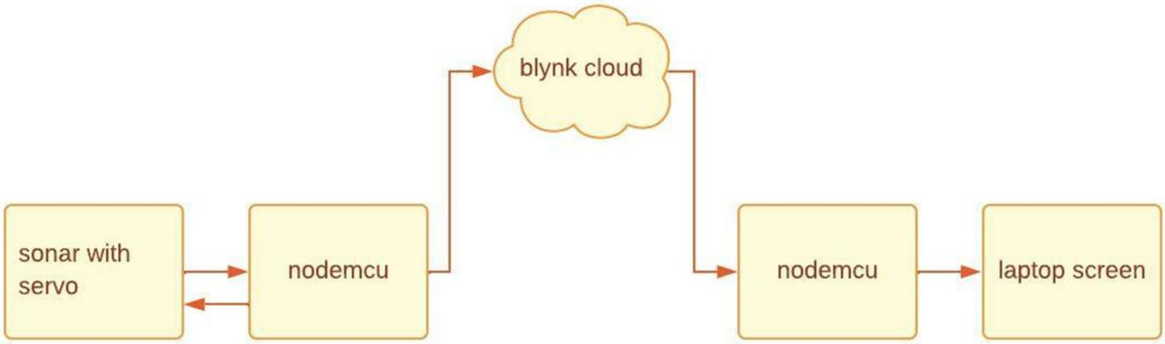

Fig 9.3 sonar flowchart

I modified the existing sonar system by using two node mcus instead of Arduino

The sequence in which the wireless sonar works are as follows:

- The sonar code will run in the first node mcu and it continuously moves one degree and calculates the distance from the ultrasonic sensor and sends the data over the internet to the blynk server
- Now the 2nd nodemcu is connected to the same server so it receives the data sent by the 1st nodemcu and sends it to the laptop over serial port.
- The code written using processing ide runs and visualizes the data received through the serial port as a radar on the screen

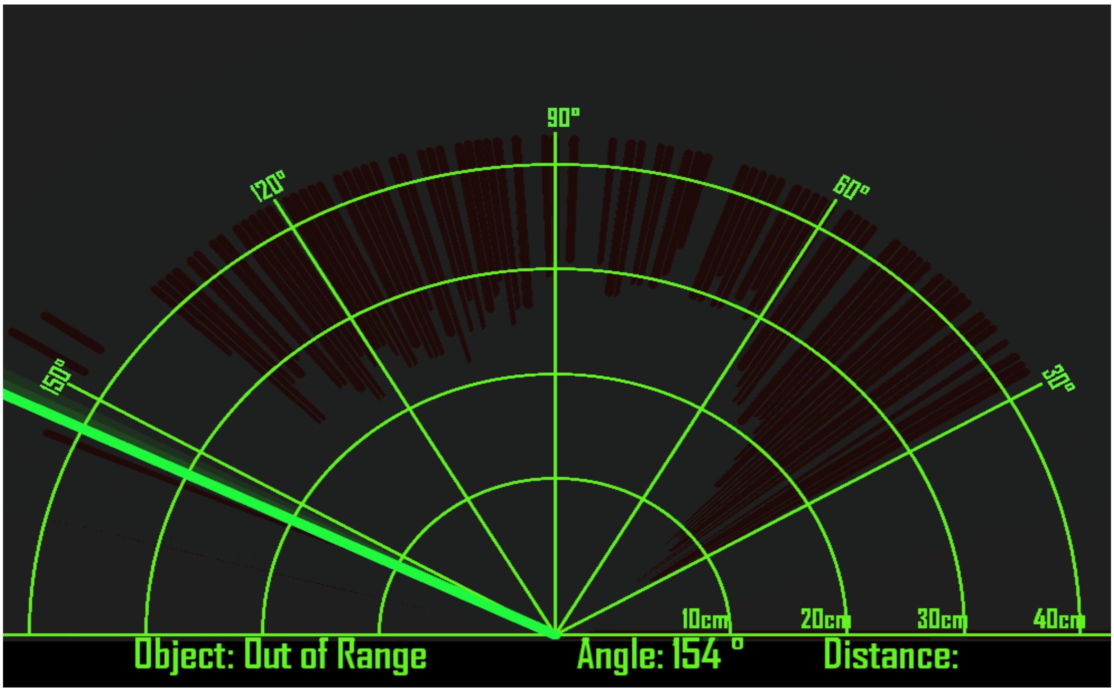

Fig 9.4 visualized sonar data

CHAPTER 10

COUNTERMEASURE AND OFFENSIVE SYSTEMS

10.1 The Detonator

Fig 10.1 detonator circuit

The detonator circuit is made up of two diodes in forward bias such that when the detonator is activated no reverse current goes into other components in the rower

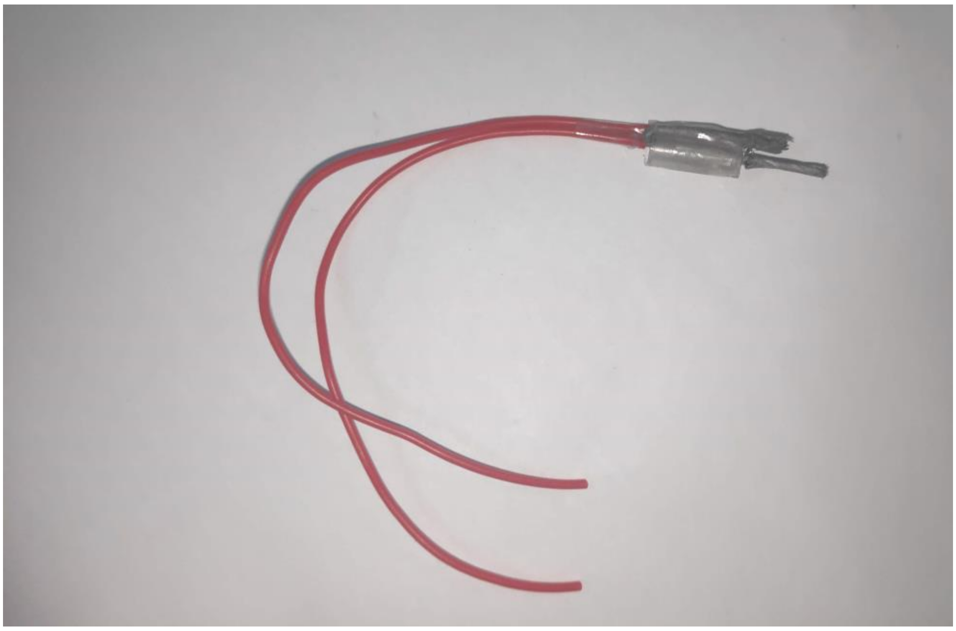

Fig 10.2 detonator

The detonator is made such that it is easy to plug and fire.

The detonator is self-made by revolving a thin iron wire over a gunpowder fuse and securing it in place and keeping the whole thing inside a small tube

This works when a high current passes through a thin wire it glows thereby lighting the gunpowder fuse on fire.

As this detonator deals with fire it poses a serious fire hazard in the rower as its made of wood so fire resistant wire has to be used

So Silicone wires are used as it is flexible and will withstand extreme heat of up to + 250°C

10.2 Smoke Countermeasures

Fig 10.3 smoke bomb

Fig 10.4 testing the smoke bomb

Fig 10.4 shows the smoke bomb which can be used for hit and run tactics as it can be triggered wirelessly

The following represents the sequence of triggering

- When the signal is given from the transmitter the relay closes the circuit of the detonator .so the detonator is triggered and lights up the secondary fuse
- And as a chain reaction the primary fuse gets ignited and fires the smoke bomb thus releasing large amount of smoke.

The smoke bomb is mainly made up of dye coloring dye, potassium nitrate and Sulphur

10.3 Unguided Rocket

Fig 10.5 rocket mounted on the sentry gun

Fig 10.5 shows the unguided rocket mounted on the rocket mount

The rocket mount is mounted on the right side of the sentry gun on the same shaft which houses the gun mount. as the rocket and holder is mounted on the same shaft as that of the gun mount it moves along with the gun in x axis and y axis

Fig 10.6 testing the unguided rocket

The rocket engine is mainly made up of coal powder, potassium nitrate and Sulphur

The unguided rocket detonation sequence:

- When the signal is given from the transmitter the relay closes the circuit of the Detonator. So the detonator is triggered and lights up the secondary fuse
- And as a chain reaction the primary fuse gets ignited and fires the unguided rocket engine thus sending the rocket forward

CHAPTER 11

TARGETING SYSTEM

11.1 Fpv Camera

11.1.1 Mini FPV AV Camera

Fig 11.1 600tvl 170degree camera

description	specification
Operating voltage	3.7-5V
Power consumption	100mA
resolution	1280 x 960 600TVL
Frame rate	50fps
Lens	Wide-angle 1.8mm
Field of view	170 degrees

The main purpose of using analog fpv cameras were lower latency then compared to web cameras

11.1.2 Eachine 1000tvl fpv camera

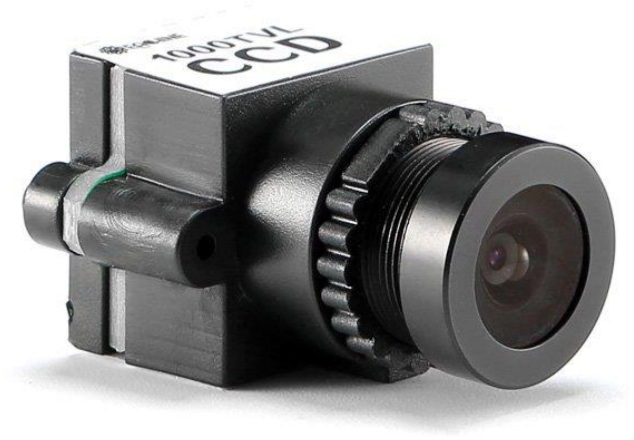

Fig 11.3 1000tvl ccd camera

Description	specification
Operating voltage	5V
Power consuption	135mA
resolution	1000TVL
Frame rate	50fps
Lens	2.8mm Lens
Field of view	110 Degree

Fig 11.2 and Fig 11.3 shows the camera which I have used in my sentry gun for situational awareness and targeting .The 170 degree camera is used in the back and a 1000 tvl 110 degree camera is used in the front for clear targeting.

11.2 Mount For The Cameras

The camera came with no mount so i decided to make a mount for it as the front camera is very important for targeting . we should be able to adjust it in x axis and y axis .

So Two separate camera mounts were made to hold the cameras in their place and the front camera can be adjusted in x axis and y axis and the rear camera is fixed in y axis and it can be rotated and slided only in in x axis.

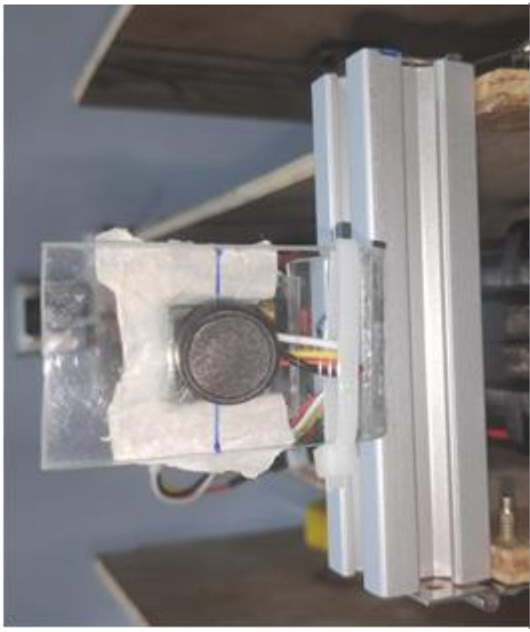

Fig11.4 front view

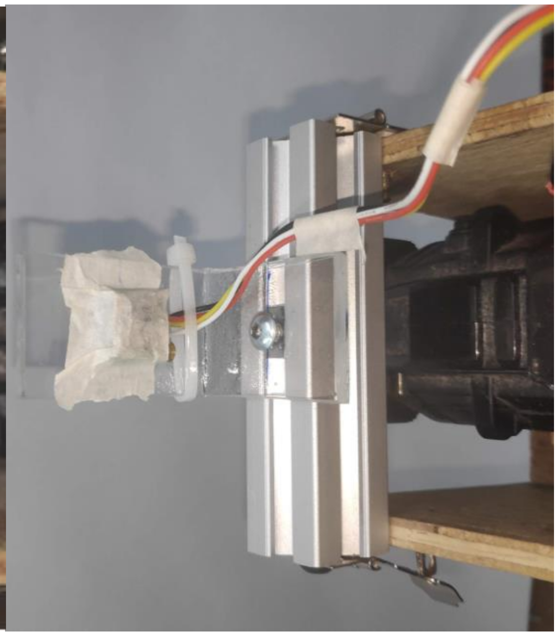

fig11.5back view

Fig 11.4 and fig 11.5 show the back and front view of the fpv camera

The rear camera mount was made using a acrylic sheet bent 90 degrees and fixed on the aluminum extrusion rail and it can be rotated only in x axis.

And all of the mounts are mounted over a piece of aluminum extrusion rail as it gives us option to move the camera in the x axis.

Front camera mount was made using pvc plastic and the camera is fixed on the pvc plastic fixed with bolts on both sides between a u clamp made from a steel scale and


Fig 11.6 front view of the camera mount

The PVC plastic which is mounted in between the u clamp can be easily moved in y axis and the u clamp can also be moved horizontally along the aluminum extrusion in x axis

The rear camera mount was made using a acrylic sheet bent 90 degrees and fixed on the aluminum extrusion rail and it can be rotated only in x axis.

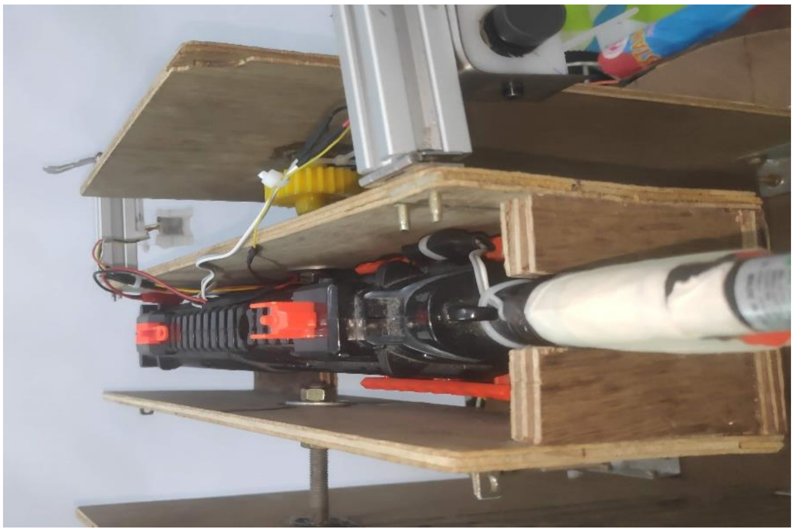
Fig 11.7 two camera mounts in open state

Fig 11.7 shows the two aluminum extrusions (over which two cameras are mounted) is fixed with a hinge and a lock

The following are the features of the mount:

- Easy accessibility to the gun
- Easy calibration of the camera
- If we want to inspect the gun for any issues it can be easily done by simply unlocking and opening the aluminium extrusion

11.3 Laser Module :

Fig 11.8 green laser diode

description	specification
Operating voltage	5V
Power consumption	135mA
output	Green 532nM
Output Power	50mw

Fig 11.88 shows the green laser diode used on the sentry gun for targeting it is mounted at the end of the gun barrel .The fpv cameras can see the green lasers more clearly than the red lasers so the green lasers were made use of for targeting purpose. When the autonomous mod is on the laser cannot be used as the software thinks that the green laser is a moving object.

So when using the autonomous mode the green laser should be turned off. So the laser is routed through the relay such that when the autonomous mode is needed to be turned on the laser can be wirelessly disabled.

11.4 Fpv Transmiteer

Fig 11.9 fpv transmitter

description	specification
Operating voltage	7-24V DC
Power consumption	280mA
Transmission range	1~2km with stock antenna
RF Output Power	600mw
Frequency	5.8 Ghz

Fpv transmitter which we made use in this project is TS5828 switchable transmitter(fig 11.9) with stock antenna it has a range of about 1 to 2 kms and it works in race band ie.5.8ghz with very low latency rate

It has a power output of 600 mw and the video signal wire of this transmitter is connected to a relay’s center pin

The two cameras ie .front and rear camera are connected to the normally open end and normally closed end.

If we want to switch between two cameras we can simply trigger the relay using our flysky transmitter and the relay will switch over to the other video signal.

The fpv transmitter produces lot of heat so once a particular temperature is reached the transmitter goes into a thermal shut down so to solve this issue the transmitter is directly glued to the aluminum extrusion with a thermal glue which will act as a heat sink and reduce the heat produced by the fpv transmitter .

11.5 Fpv Receiver

Fig:11.10 eachine fpv receiver

description	specification
Operating voltage	5V DC
Power consumption	200mA/mA
Channel	150CH
Frequency Range	5645~5945 Hz

Eachine ROTG01 UVC receiver is a new type of FPV receiver which we can connect to our smart phone directly via otg port

This fpv receiver is used to receive the video signal transmitted by the video transmitter and sends it through the usb cable to the mobile phone's otg port where it can be viewed using the fpv app

And we can shift between multiple channels using the button given in that fpv receiver

CHAPTER 12

AUTONOMUS SECTION

12.1 Parts

12.1.1 RASBERRY PI

Fig:12.1 raspberry pi 4

description	specification
Processor	Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
RAM	8GB LPDDR4 SDRAM
Connectivity	2 × USB 2.0 Ports 2 × USB 3.0 Ports
Operating Power	5V 3A DC via USB Type-C Connector

We are using a raspberry pi 4 4 gb version

The developmental sequence to make the raspberry pi work:

- The actual sentry gun (with project sentry gun software)will run on a single laptop with a web cam but the problem there was the laptop was too big and space consuming on the rower
- so I searched for a mini pc o run the software which is compact and mountable on the rower then I decided to use raspberry pi but

- At the initial stages of the project I tried many ways to run the program on Linux OS in raspberry pi but I ultimately failed and I searched for other ways to run the program
- As the program already runs well on windows 10
- I searched for a unofficial version of windows 10 written for arm cup’s
- And I tried running the program after many failed attempts I successfully ran the program on windows 10
- But the clone Arduino Nano driver and Wi-Fi drivers were not present
- So I ended up using a bigger Arduino Nano
- And getting network access by directly plugging the Wi-Fi dongle over the usb port

12.1.2WEB CAMERA

Figure 12.2 web camera

We are using the camera (Figure 12.2) it has a

description	specification
Max Resolution	720p/30fps
Camera mega pixel	0.9
Diagonal field of view	60°

12.1.3 ARDUINO UNO R3 (microcontroller)

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

fig :12.3 Arduino uno

I am using Arduino Uno (fig12.3)for the autonomous program disadvantages of the Uno is its too large but there is no other way for running the program as the driver for the clone Arduino has still not been written for Arduino. The raspberry pi only recognises the Arduino with a Atmel serial tll. So I searched for a Arduino nano with a atmel serial converter. But the original Arduino nano was very costly and there was no Arduino nano clone with a atmel serial converter. So I found a Arduino uno clone with a atmel serial tll and mounted it under the rower for the autonomous program

12.2 Software

The software is responsible for locating a moving target with some visual/sensing input and then issue the right commands to aim the paintball marker in the direction of movement. The software is the largest contributing factor to the efficiency of the turret. This is due to the time it takes processing these large chunks of data and then calculating where the gun should move to and then compensate for the time lost.

The software we use to control the sentry gun is an open source software called as “project sentry gun”

12.3. System Design

Systems design is the process of defining the architecture, product design, modules, interfaces, and data for a system to satisfy specified requirements. The project is divided into two phases in the initial phase the sentry gun has to be made and tested using a laptop and in the second phase a rower should be made to accommodate the sentry gun over it and it should carry all the wireless equipment like 10 channel receiver video transmitter and 4g modem

12.4 .Preliminary Design

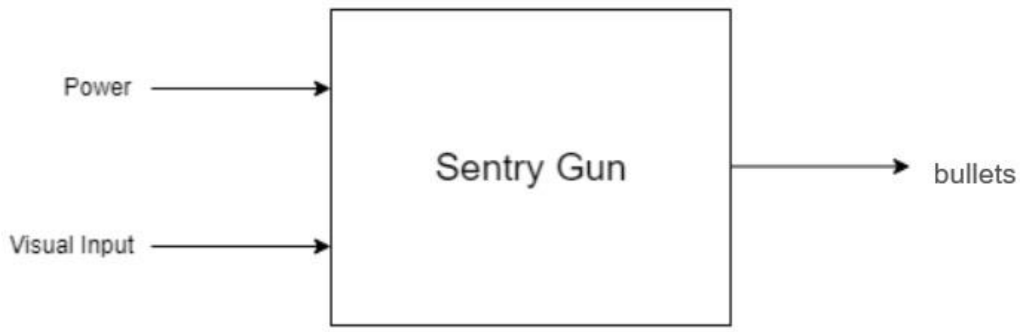

Fig 12.4basic working of the sentry gun

Preliminary system architecture shows the most basic input and output of the system as seen in Figure 12.4 .

Power is given to the system, motion is detected and bullets leave the system . The intruder was left out of this level of the architecture.

12.5 Final Design

12.5.1 Design of Unit 0

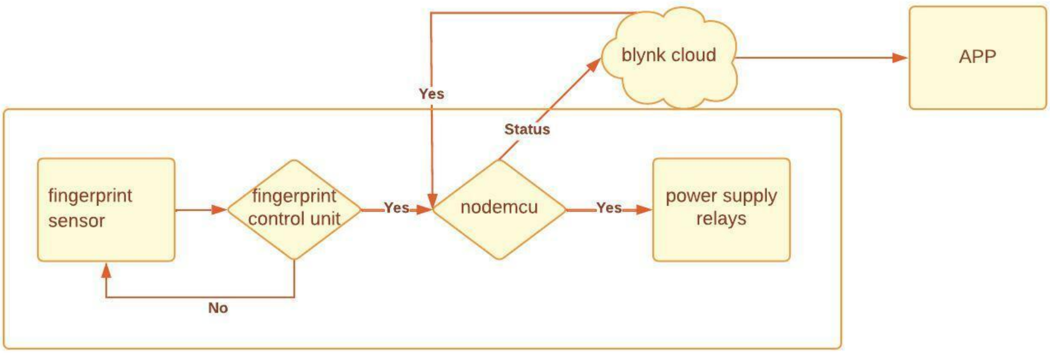

Figure 12.5 Flow chart of the fingerprint unit

As seen in Figure 12.5 at first the finger print sensor reads the fingerprint and sends the signal to control unit if the control unit authenticates the fingerprint it gives a positive 5v signal to the Arduino if not it gives a 0v signal and shuts down.

When Arduino receives a 5 v signal from the control unit it triggers the relay which will power the entire sentry gun.

Now turn off the sentry gun the sensor has to be authenticated again and the sensor gives 5v signal to the Arduino which turns the relay shutting down the system

12.5.2 Working Of Unit 1,2,3

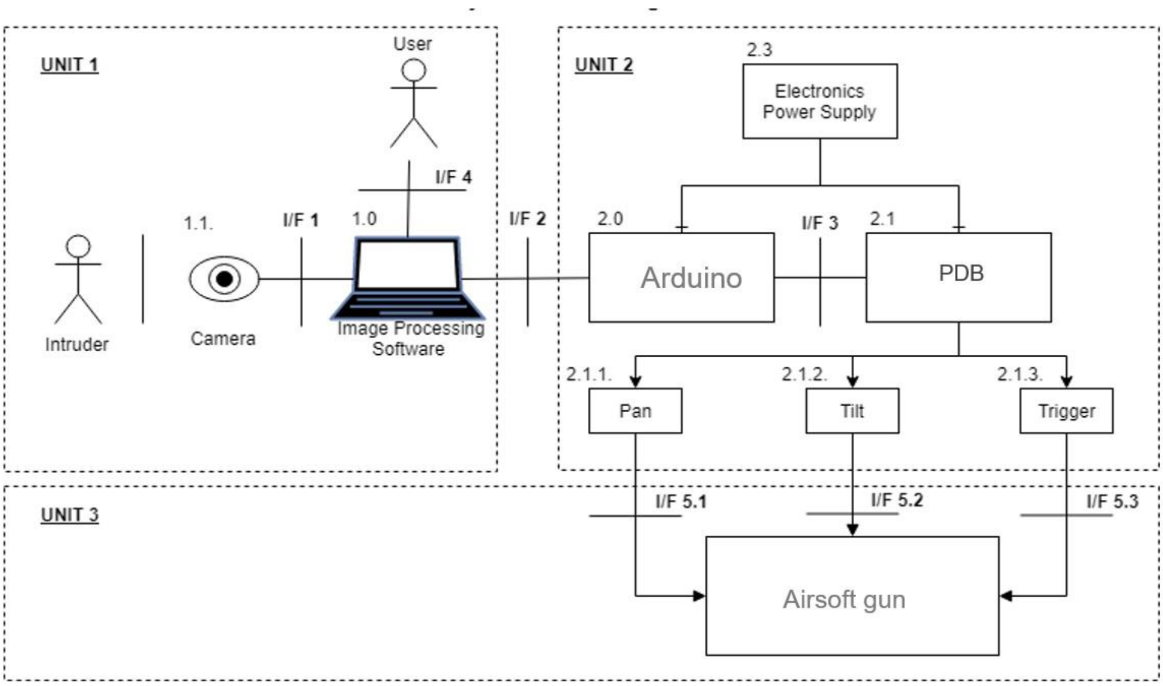

Figure 12.6 : Final System design for the sentry gun

Functional Units (F/U)

1. Software

    1.1.processing software and Arduino ide

    1.2.Camera for visual input.

2. Arduino

    2.1.Pdb

    2.2.Motor Controller

    2.3.Power Supply

Hardware (unit 3):

3. 1.base structure

3.2.pan structure

3.3tilt structure 3.3.1gun holster

Interfaces (I/F)

1. Camera to PC interface: Universal Serial Bus (USB)
2. PC to SBC interface: Serial cable
3. Arduino to servo: From GPIO pins to pdb
5. Servo to structure

    5.1.Pan servo to pan motion structure: Gears

    5.2.Tilt servo to tilt motion structure: Gears

    5.3.Trigger relay to gun

- UNIT 1:program gets visual data from the web cam (1.2) through IF.1 and compare it with previous image to locate the moving object and sends the position of the object to arduino ide
- UNIT 2:Arduino Ide(1.1) received data from system1 is processed and sent to system2
- UNIT 3:the received data from system 1is sent as pwm signals to x axis and y axis servos by system 2
- Then the servos move the gun to exact position and the trigger command is given by system 1 which is relayed to system 3 through system 2
- And it activates the trigger relay and shoots the gun

when there is no possible moving objects inside the frame after a few minutes servo THE sentry gun will move left to right on a repeating pattern as it represents scanning mode

12.5.3 Switching Between Sources

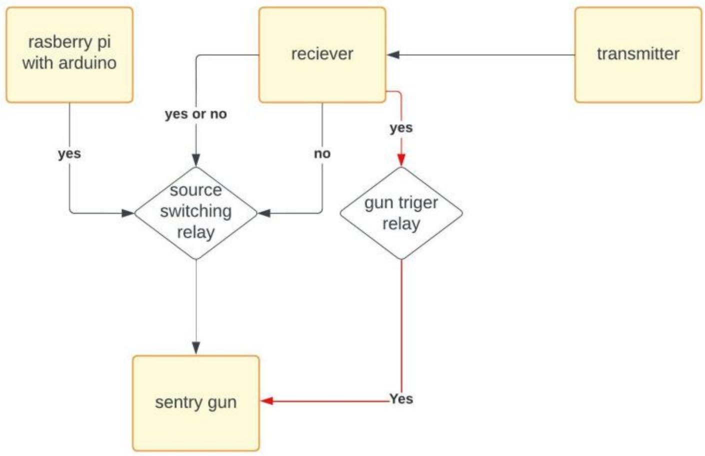

Fig 12.7 flowchart for the source switching

- switching between two source for the sentry gun control between autonomous mode and manual mode can be can be done using 4 relays
- 2 for pan and tilt servo and the other two relay can be used for the trigger control of the gun.

12.5.4 Working of the whole system

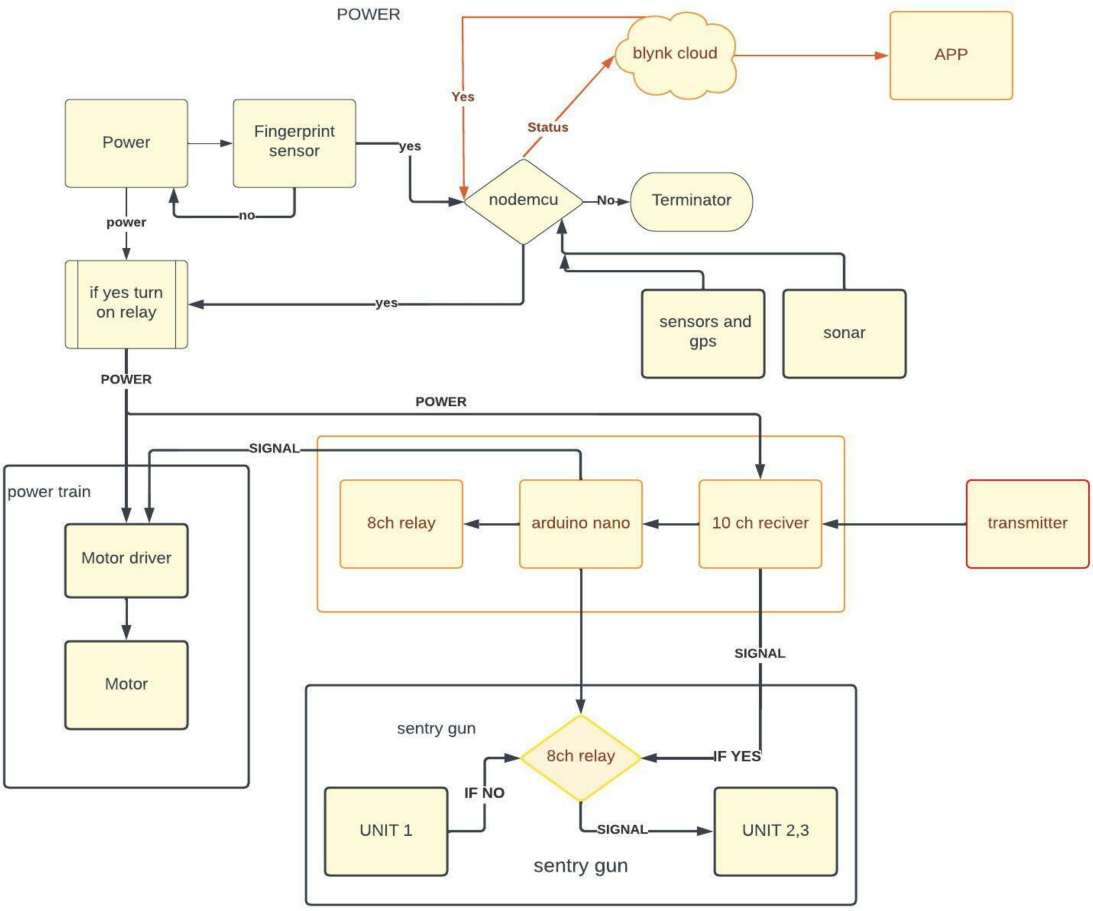

Fig 12.10 flow chart of the whole system

Fig12.10 shows the flowchart of the entire rower

12.6 Wireless networking

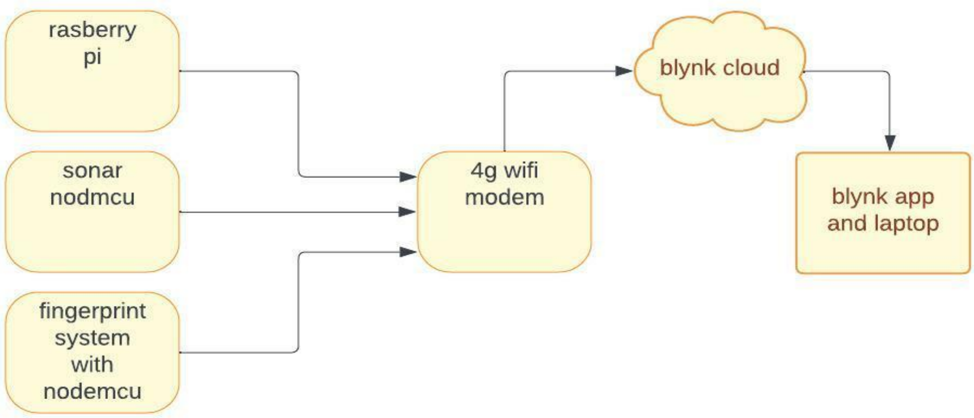

Fig 12.8 wireless networking flowchart

Fig 12.9 4g Wi-Fi dongle

As all the networking devices in this rower need Wi-Fi to send the sensor data and the sonar data over the air to the blynk server.

A Wi-Fi network is needed But the Wi-Fi network should move along with the rower so the concluded solution was to use a wifi dongle.

Fig 12.8 and 12.9 shows the wifi dongle which will be mounted on the rower and all the devices which require wifi and Ethernet will be directly connected to the dongle .

This dongle will be connected to the 4g network and it can be controlled anywhere from the world (provided the motor driver is connected via nodemcu instead of Arduino nano) as we can inject the pwm signal through the nodemcu wirelessly anywhere from the world

And this is a future proof rower in which 4g can be easily switched over to 5g by simply upgrading the dongle to a 5g dongle.

12.7 ENDURANCE

Raspberry pi can work for 20 hours

The sentry gun has an endurance of 15.5 hours

POWER CONSUPTION CHART

components	Power consumption
Standby(gps , v sensor , nodemcu)	350 mA
9 relays	150 mA
Laser diode (with 1 relay)	70 mA
gun	2 A
vtx	63 mA
ignitor	9 A
Sudden acceleration	10 A
Standard movement	5 A
Wheel spin	6.5 A

Chapter 13

Conclusion and future scope

13.1 Conclusion

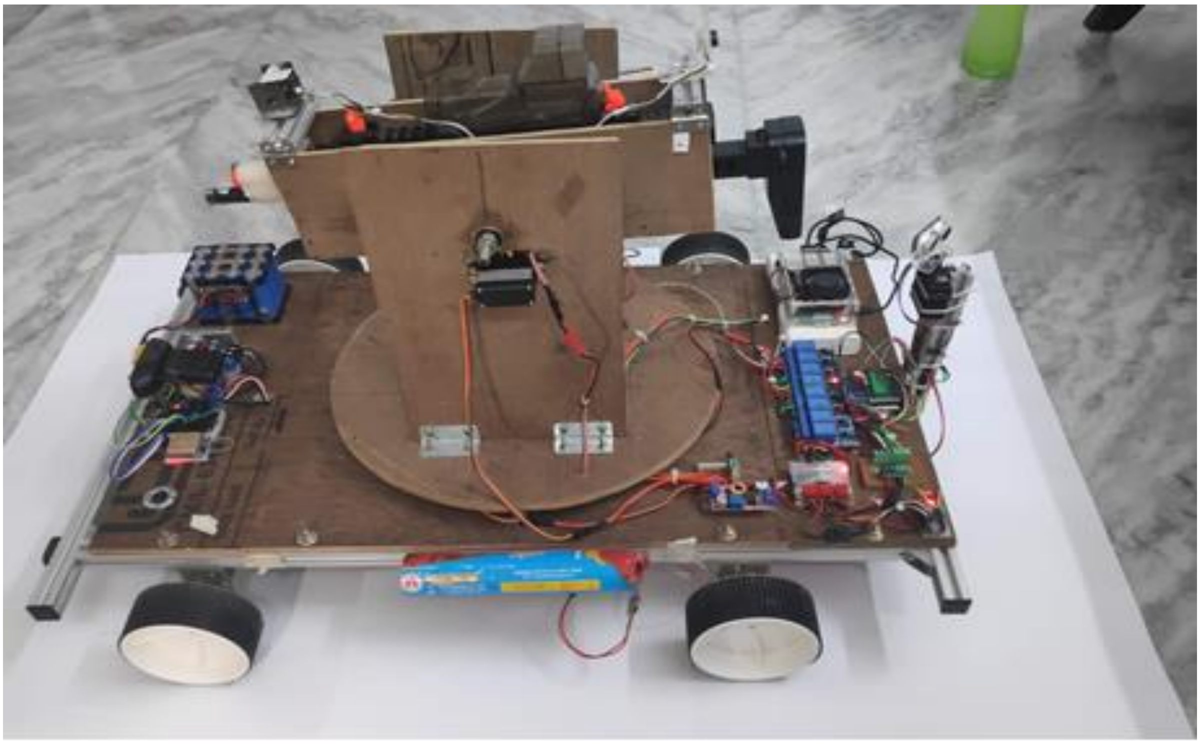

Fig 13.1Right side view of the rower

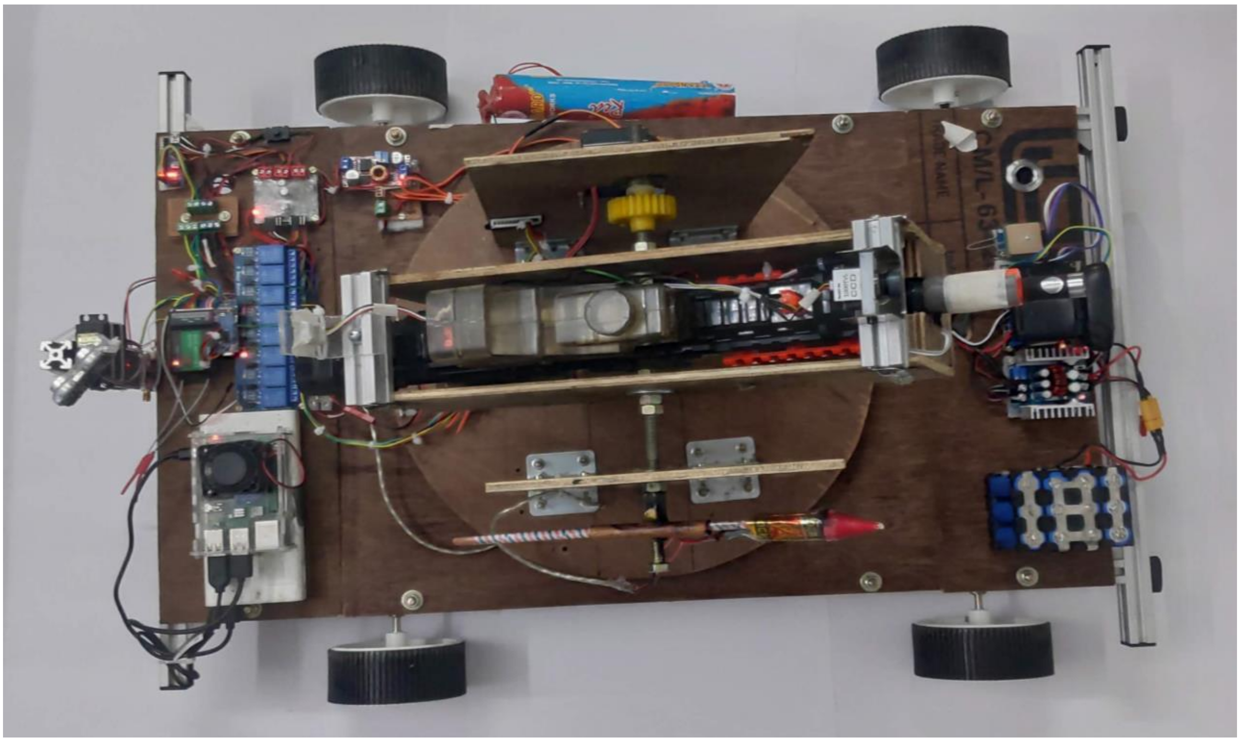

Fig 13.2 top view of the rower

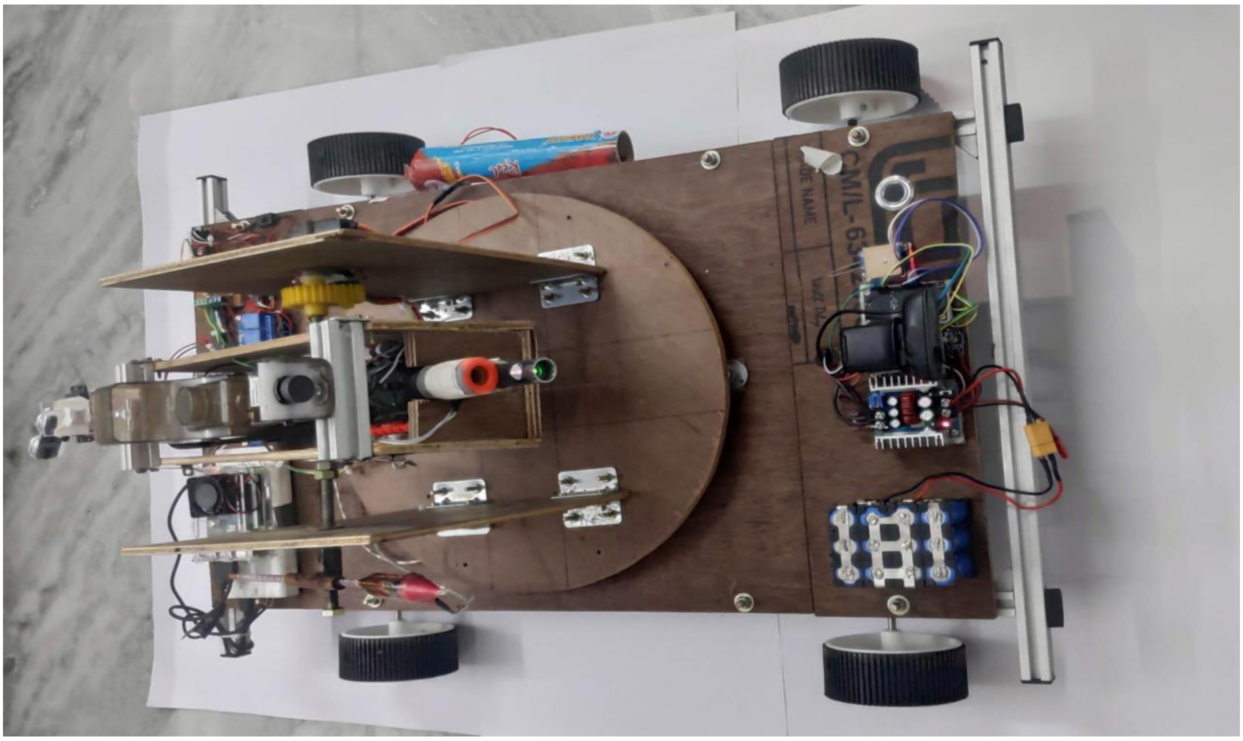

Fig13.3 Front view of the rower

Fig 13.1, 13.2, 13.3 shows the completed rower which has been completed in the given time span of 6 month with proper planning and execution .

We have successfully designed and developed a offensive rower which has a autonomous sentry gun on it as we faced many problems during the manufacturing of the rower we overcame those problems with research and by trial and error methods Finally we integrated multiple systems within the rower and made it an capable offensive rower for military and civilian purposes

All our objectives were achieved and found solution to different logical problems in systems such as video transmission and wireless sonar

I made the rower in such a way that future enhancements will be fully possible without any major modifications as I used aluminum extrusion we can simply add or remove the components deemed unnecessary in future improvements

All the systems were tested and evaluated for performance and every system passed the test

13.2 Future Scope

If we want to increase the range of this rower we can simply increase the power of the fly sky transmitter and the power output of the fpv transmitter.

Nodemcus can be used instead of Arduino nano in the motor driver section so that it can be controlled from anywhere in this world over the internet

This rower can be easily upgraded to the 5g standards by simply replacing the 4g modem with a 5 g modem as the 5g network has high bandwidth and very less lag compared to 4g networks we can control this rower anywhere from this world.

In the future the existing wheeled drive can be replaced with tracked drive which increases the stability of the whole rower

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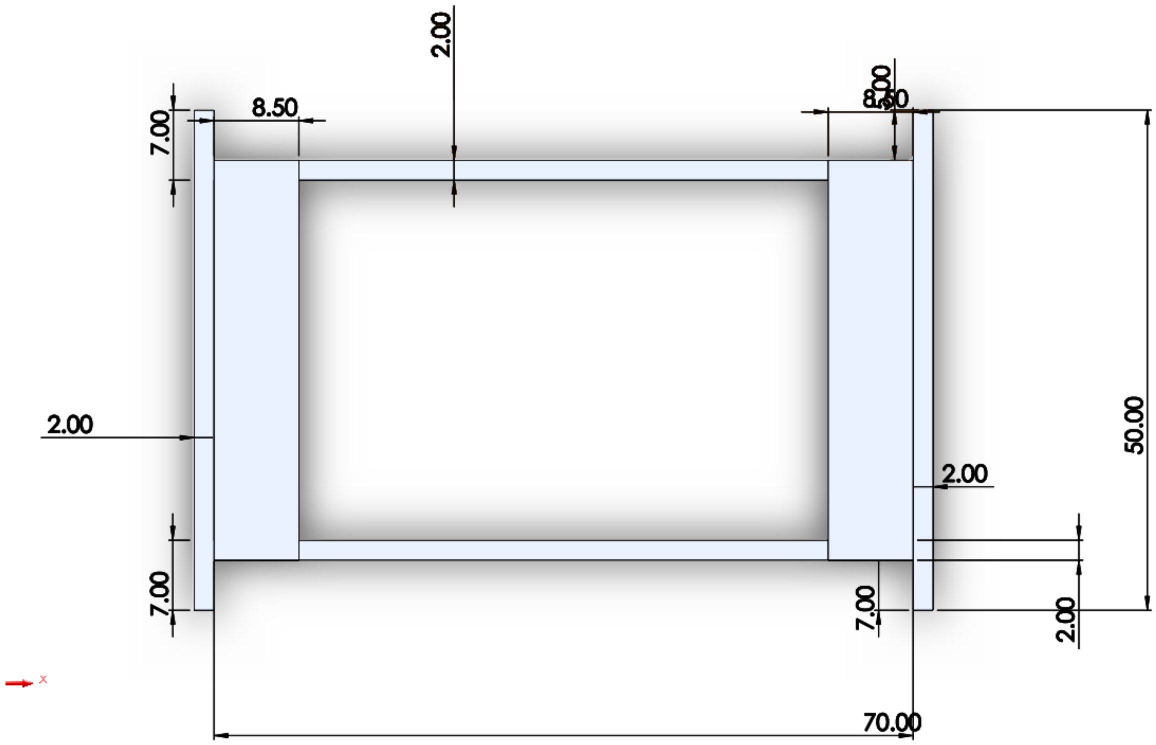
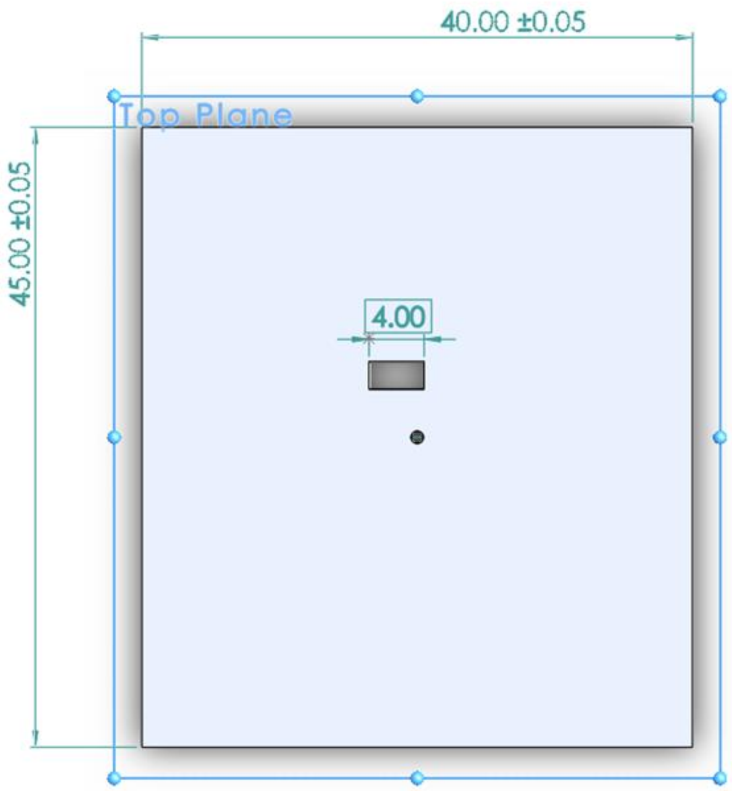
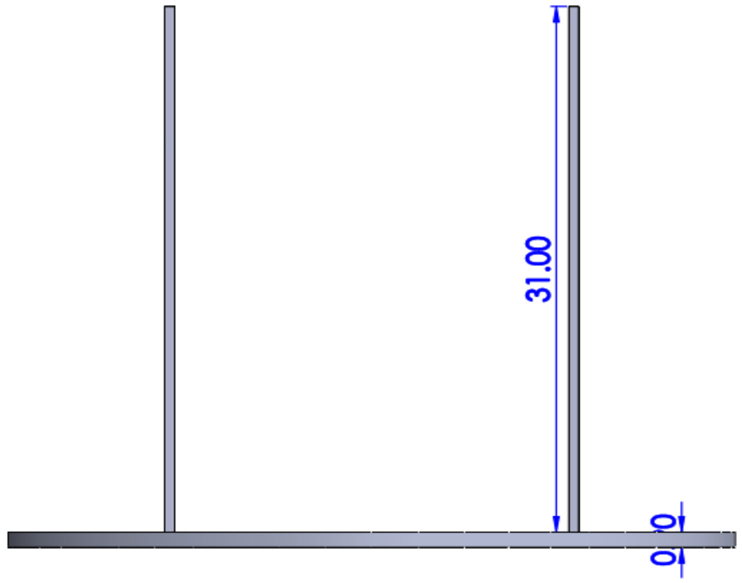
A . 3d Models



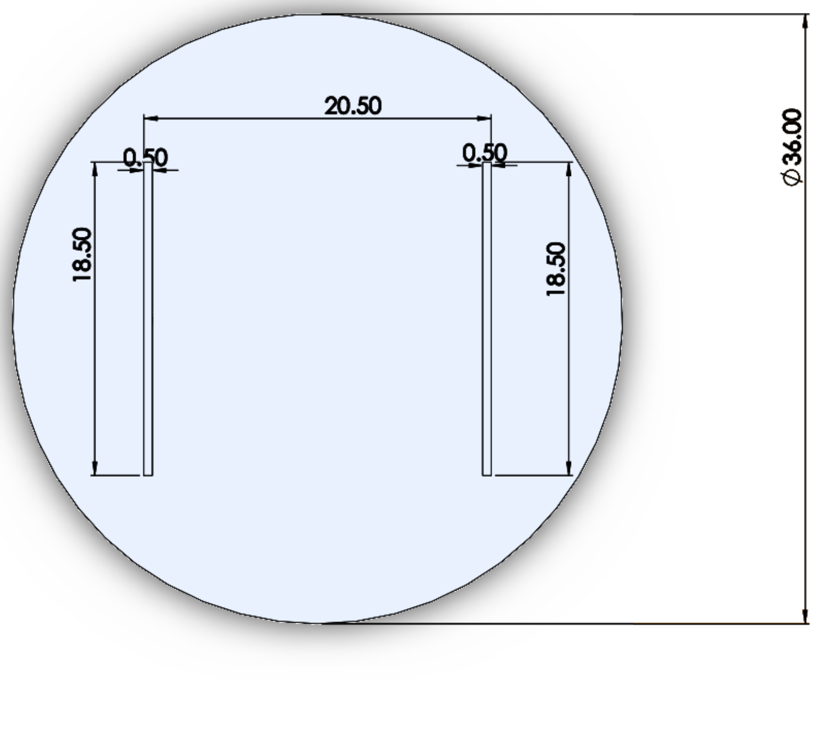
2.00
8.50
8.50
2.00
7.00
2.00
2.00
50.00
7.00
7.00
2.00
70.00



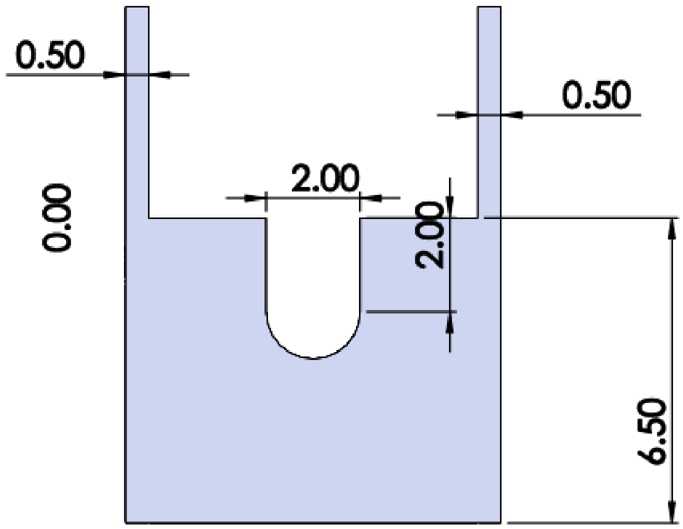
40.00 ±0.05
Top Plane
45.00 ±0.05
4.00

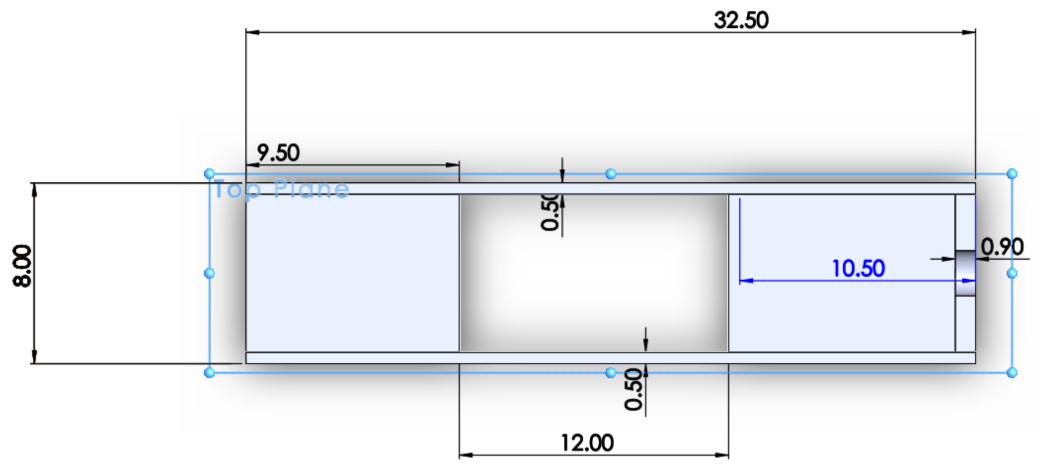


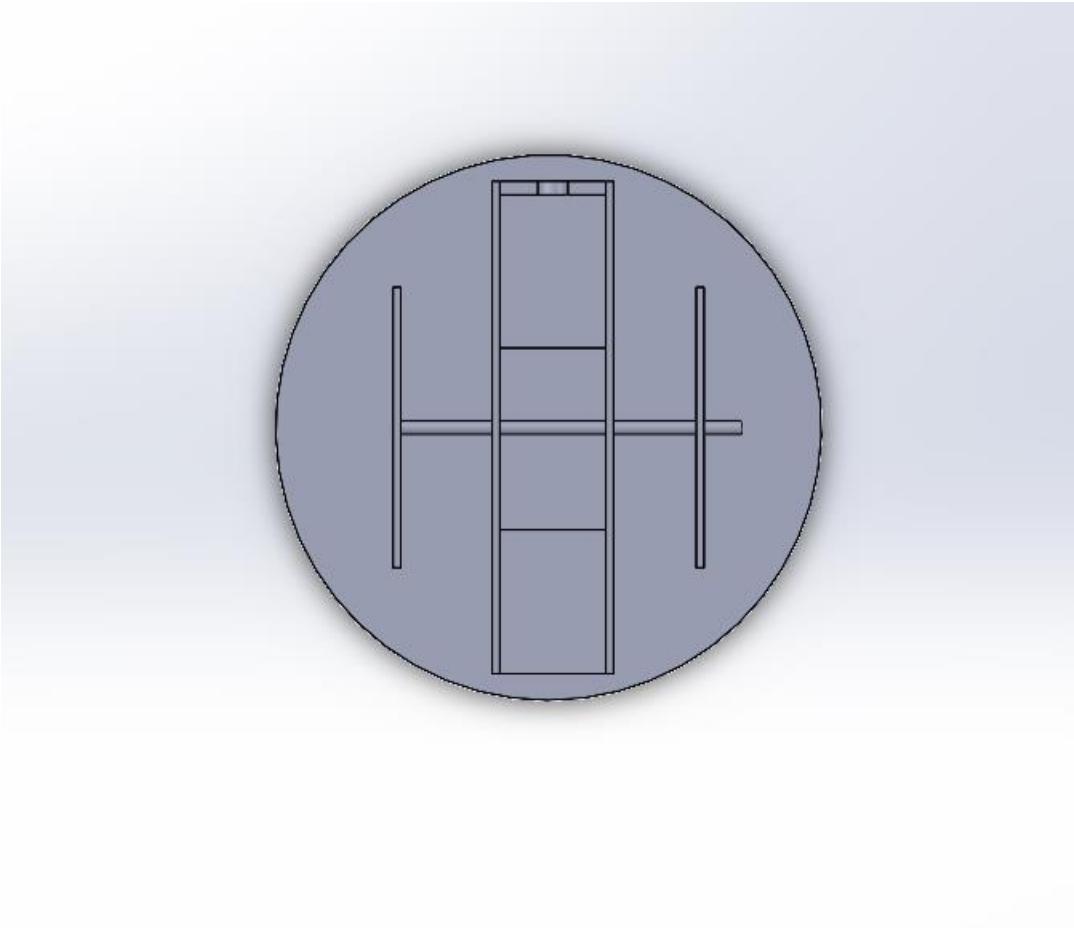
31.00

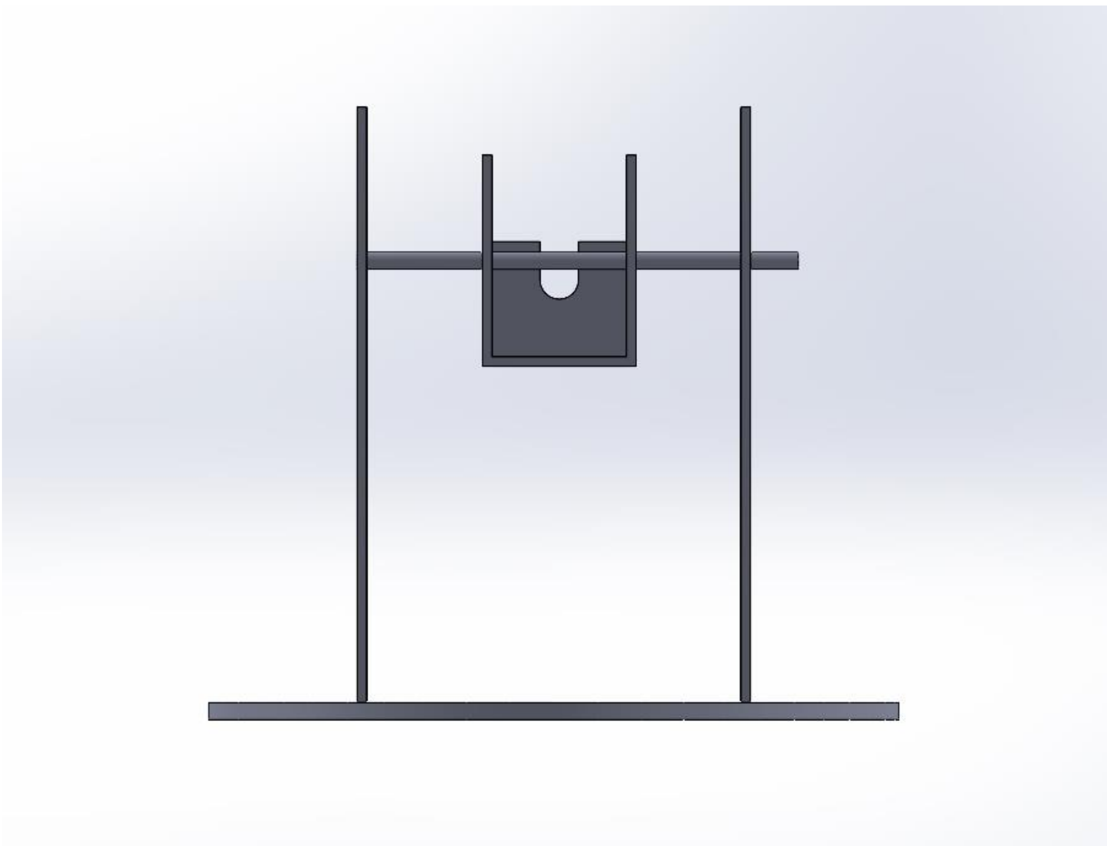


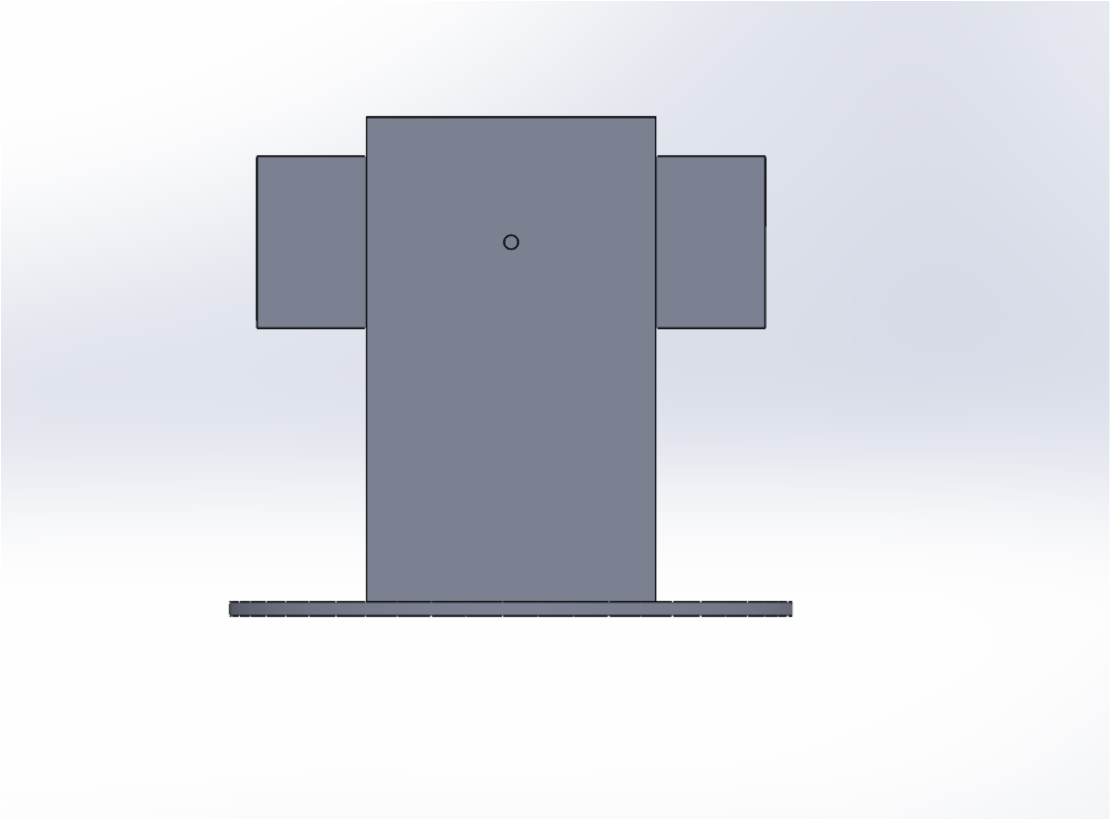
20.50
0.50
0.50
18.50
18.50
⌀36.00


0.50
0.50
2.00
0.00
2.00
6.50


32.50
9.50
Top Plane
0.50
0.90
10.50
8.00
0.50
12.00







B Arduino Codes:

Receiver to relay decoder :

```
int channel;
int in5 = A0;
int in6 = A1;
int in7 =A2;
int in8 =A3;
int in9 =A4;
int in10 =A5;
int out5 = 4;
int out6 = 12;
int out7 =6;
int out8 =7;
int out9 =8;
int out10 =9;
int channel5;
```

```
int channel6;
int channel7;
int channel8;
int channel9;
int channel10;
void setup() {
  //pinMode(a ,INPUT);
 // pinMode(b ,OUTPUT);
  pinMode(in5, INPUT);
  pinMode(in6, INPUT);
  pinMode(in7, INPUT);
  pinMode(in8, INPUT);
  pinMode(in9, INPUT);
  pinMode(in10, INPUT);
  pinMode(out5, INPUT_PULLUP);
  pinMode(out6, INPUT_PULLUP);
  pinMode(out7, INPUT_PULLUP);
  pinMode(out8, INPUT_PULLUP);
  pinMode(out9, INPUT_PULLUP);
  pinMode(out10, INPUT_PULLUP);
  pinMode(out5, OUTPUT);
  pinMode(out6, OUTPUT);
  pinMode(out7, OUTPUT);
  pinMode(out8, OUTPUT);
  pinMode(out9, OUTPUT);
  pinMode(out10, OUTPUT);
    Serial.begin(9600);
  }

void loop() {
  {
    channel5 = (pulseIn(in5 ,HIGH));
  if (channel5 > 1500)
  {
```

```
  digitalWrite(out5,HIGH);
}
if (channel5 < 1300)
{
  digitalWrite(out5,LOW);
}}
{
  channel6 = (pulseIn(in6 ,HIGH));
  if (channel6 > 1500)
{
  digitalWrite(out6,HIGH);
}
if (channel6 < 1300)
{
  digitalWrite(out6,LOW);
}}
{
  channel7 = (pulseIn(in7 ,HIGH));
  if (channel7 > 1500)
{
  digitalWrite(out7,HIGH);
}
if (channel7 < 1300)
{
  digitalWrite(out7,LOW);
}}
{
  channel8 = (pulseIn(in8 ,HIGH));

if (channel8 > 1500)
{
  digitalWrite(out8,HIGH);
}
if (channel8 < 1300)
```

```
 {
   digitalWrite(out8,LOW);
 }}
 {
   channel9 = (pulseIn(in9 ,HIGH));
   if (channel9 > 1500)
 {
   digitalWrite(out9,HIGH);
 }
 if (channel9 < 1300)
 {
   digitalWrite(out9,LOW);
 }}
 {
   channel10 = (pulseIn(in10 ,HIGH));
   if (channel10 > 1500)
 {
   digitalWrite(out10,HIGH);
 }
 if (channel10 < 1300)
 {
   digitalWrite(out10,LOW);
 }}
}
```

Wireless Radar

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "";
char ssid[] = "";
char pass[] = "";
#include <Servo.h>
const int trigPin = 12;
const int echoPin = 13;
long duration;
int distance;
Servo myServo;
WidgetBridge bridge1(V10);
blynk_connected()
{ bridge1.setAuthToken("");
}
void setup(){
{
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
 }
{
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
    Serial.begin(9600);
    myServo.attach(15);
}
}
void loop(){
  Blynk.run();
      for(int i=15;i<=165;i++){
        myServo.write(i);
        distance = calculateDistance();
```

```
        Serial.print(i);
        Blynk.virtualWrite(V5,i );
        bridge1.virtualWrite(V5,i);
         Blynk.virtualWrite(V6,distance );
        bridge1.virtualWrite(V6,distance);
    }
    for(int i=165;i>15;i--){
        myServo.write(i);
        distance = calculateDistance();
        Serial.print(i);
        Blynk.virtualWrite(V5,i );
        bridge1.virtualWrite(V5,i);
        Blynk.virtualWrite(V6,distance );
        bridge1.virtualWrite(V6,distance);

    }

}
int calculateDistance(){
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);

    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance= duration*0.034/2;
    return distance;
}
```

Wireless Radar Reciever

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "";
char ssid[] = "";
char pass[] = "";
        BlynkTimer timer;
        WidgetBridge bridge1(V10);
                int degre=0
        int distance=0;
        unsigned long startMillisReadData;
        int secondsDataDisplay = 1000;

void setup()
{
        Serial.begin(9600);
        Blynk.begin(auth, ssid, pass);
        while (Blynk.connect() == false) {}
}
void loop()
{
        Blynk.run();
        delay(400);//1100 for blank  400 for active
        {
         Serial.print(degre);
         Serial.print(",");
         Serial.print(distance);
         Serial.print(".");
              }
}
BLYNK_WRITE(V5)
{
degre = param.asInt();
```

```
}

BLYNK_WRITE(V6)
{
distance = param.asInt();

}
```

Gps Voltage Fingerprint Sensor

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <SoftwareSerial.h>
BlynkTimer timer;
#include <TinyGPS++.h>
const int RXPin = 0, TXPin = 4;
int Vsensor = A0;
int pbuttonPin = 1;
int relayPin = 3;
int val = 0;
int lightON = 0;
int pushed = 0;
const uint32_t GPSBaud = 9600;
SoftwareSerial gps_module(RXPin, TXPin);
TinyGPSPlus gps;
WidgetMap myMap(V0);
float gps_speed;
float no_of_satellites;
String satellite_orientation;
unsigned int move_index = 1;
 float correctionfactor = 8.6800;
float vout = 0.0;
```

```
float vin = 0.0;
float R1 = 30000;
float R2 = 7500;
int value = 0;
char auth[] = "";
char ssid[] = "";
char pass[] = "";
void myTimerEvent()
{
  Blynk.virtualWrite(V1, millis() / 1000);
}
void setup()
{
Serial.begin(9600);
  Serial.println();
  gps_module.begin(GPSBaud);
pinMode(Vsensor, INPUT);
  Blynk.begin(auth, ssid, pass);
    timer.setInterval(1000L,sensorvalue1);
    timer.setInterval(5000L, checkGPS);
pinMode(pbuttonPin, INPUT_PULLUP);
pinMode(relayPin, OUTPUT);
digitalWrite(relayPin, HIGH);
}
void checkGPS(){
  if (gps.charsProcessed() < 10)
  {
    Serial.println(F("No GPS detected: check wiring."));
      Blynk.virtualWrite(V4, "GPS ERROR");
  }
}
void loop()
{
    while (gps_module.available() > 0)
```

```
 {
   if (gps.encode(gps_module.read()))
   displayInfo();
 }
 Blynk.run();
 timer.run();
 {
 val = digitalRead(pbuttonPin);
 if(val == HIGH && lightON == LOW){
   pushed = 1-pushed;
   delay(100);
 }
 lightON = val;
     if(pushed == HIGH){
       Serial.println("Light ON");
       digitalWrite(relayPin, LOW);
     }else{
       Serial.println("Light OFF");
       digitalWrite(relayPin, HIGH);
        }
 delay(100);
}
}
void displayInfo()
{
 if (gps.location.isValid())
 {
   float latitude = (gps.location.lat());
   float longitude = (gps.location.lng());
   Serial.print("LAT:  ");
   Serial.println(latitude, 6);  // float to x decimal places
   Serial.print("LONG: ");
   Serial.println(longitude, 6);
       Blynk.virtualWrite(V1, String(latitude, 6));
```

```
    Blynk.virtualWrite(V2, String(longitude, 6));
    myMap.location(move_index, latitude, longitude, "GPS_Location");
    gps_speed = gps.speed.kmph();
    Blynk.virtualWrite(V3, gps_speed);
    no_of_satellites = gps.satellites.value();
    Blynk.virtualWrite(V4, no_of_satellites);
    satellite_orientation = TinyGPSPlus::cardinal(gps.course.value());
    Blynk.virtualWrite(V5, satellite_orientation);
  }

  Serial.println();
}
void sensorvalue1()
{
int sdata = 0;
   value = analogRead(Vsensor);
   vout = (value * 5.0) / 1023.0;
   vin = vout / (R2/(R1+R2));
    vin = vin - correctionfactor;
Serial.print("INPUT V= ");
Serial.println(vin,4);
sdata = vin;
Blynk.virtualWrite(V6, sdata);
}
```

Motor Driver Decoder

```
int in1 = 7;
int in2 = 8;
int in3 = 2;
int in4 = 4;
int in5 = 12;
int in6 = 13;
int enable1 = 6;
int enable2 = 9;
int channel_1 = 10;
int channel_2 = 11;
int channel_3 = 3;
int channel_4 = 5;
void setup()
{
  {
  pinMode(channel_1, INPUT);
  pinMode(channel_2, INPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(enable1, OUTPUT);
  pinMode(enable2, OUTPUT);
 Serial.begin(9600);
}
{
  pinMode(channel_3, INPUT);
  pinMode(channel_4, INPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);

  pinMode(in5, OUTPUT);
  pinMode(in6, OUTPUT);
  Serial.begin(9600);
 }
```

```
}
void loop() {{
  int pwm = 0;
  int value = pulseIn(channel_1, HIGH, 25000);
  if(value==0)
  {
     digitalWrite(in1, LOW);
     analogWrite(enable1, 0);
  }
  else if(value > 1500)
  {
     pwm = map(value, 1500, 2010, 20, 255);
     digitalWrite(in1, HIGH);
     analogWrite(enable1, pwm);
  }
  else if(value < 1480)
  {
     pwm = map(value, 1480, 990, 20, 255);
     digitalWrite(in1, LOW);
     analogWrite(enable1, pwm);
  }
  else
  {
     digitalWrite(in1, LOW);
     analogWrite(enable1, 0);
  }
  delay(10);
}
{
  int pwm1 = 0;
  int value1 = pulseIn(channel_2, HIGH, 25000);
  if(value1==0)
  {
     digitalWrite(in2, LOW);
```

```
    analogWrite(enable2, 0);
  }
  else if(value1 > 1500)
  {
    pwm1 = map(value1, 1500, 2010, 20, 255);
    digitalWrite(in2, HIGH);
    analogWrite(enable2, pwm1);
  }
  else if(value1 < 1480)
  {
    pwm1 = map(value1, 1480, 990, 20, 255);
    digitalWrite(in2, LOW);
    analogWrite(enable2, pwm1);
  }
  else
  {
    digitalWrite(in2, LOW);
    analogWrite(enable2, 0);
  }
  delay(10);
}
{
  int pwm2 = 0;
  int value2 = pulseIn(channel_3, HIGH, 25000);
  if(value2==0)
  {
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);
  }
  else if(value2 > 1500)
  {
    digitalWrite(in4, HIGH);
  }
  else if(value2 < 1480)
```

```
  {
     digitalWrite(in3, HIGH);
  }
  else
  {
     digitalWrite(in4, LOW);
     digitalWrite(in3, LOW);
  }
  delay(10);
}
{
  int pwm3 = 0;
  int value3 = pulseIn(channel_4, HIGH, 25000);
  if(value3==0)
  {
     digitalWrite(in5, LOW);
     digitalWrite(in6, LOW);
  }

  else if(value3 > 1500)
  {
     digitalWrite(in6, HIGH);
  }
  else if(value3 < 1480)
  {
     digitalWrite(in5, HIGH);
  }
  else
  {
     digitalWrite(in5, LOW);
     digitalWrite(in6, LOW);
  }
  delay(10);
}
```

C Future Chart

component	past	past	present	Future
	Direct drive	Helical gear	Spur gear	-
servo	-	MG995	Mg958	-
sentry gun buck converter	-	Lm2596	XL4015E1, Mini 360	-
Fingerprint system	-	Arduino nano	Nodemcu Esp8266	Esp32
Power system	-	1 channel relay	2 channel relay	-
Switching board	-	4 channel relay	10 channel relay	-
Pwm decoder board	-	Arduino uno	Arduino nano	Esp32
transmitter	Turnigy 5X 5 channel	Flysky I 6s 10 channel	Flysky I 6s 10 channel	-
receiver	5 channel receiver	6 channel receiver	10 channel receiver	-
Motor driver decoder	Arduino uno	Arduino uno	Arduino nano	Esp32
Power supply	-	12 volt smps	16.8 v lion battery	-
Power supply	-	LM2596	300w step down	-
gps	-	Neo 6m	Neo 8m	-
Autonomus processing	-	Laptop	Raspberry pi 4	-
networking	-	-	4g modem	5 g modem
Rower wheels	-		Plastic wheeled	Tracked drive
Fpv vtx	-	-	600 mW	2W
Fpv camera	-	-	1000 TVL targeting cam	4 k onboard recording