

# Design of Forest Fire Land Vigilance Droid

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**Abstract** – The paper focuses on the purpose of surveillance in multiple medium by using a single model to serve the purpose of surveillance. FO-FI-LA Vigilance Droid is the name of our paper where every word suggests a meaning to the purpose. FO-FI-LA means Forest, Fire and Land, the mediums where the robot is to be used for surveillance purpose. Vigilance means the surveillance purpose and the Droid is another name to the robot. Therefore, the name suggests that the same robot is to be used in forest, fire and land for the surveillance purpose. While surveying the fire affected area, the robot is then sent to the fire affected area and then with the help of the camera which are been fitted on the chassis of the robot, we would be able to survey about the area and the measures to be taken accordingly. The directions to this robot is been provided with the help of FR-Sky control. Now, while surveying the forest area, as the forest is the wide area, the area needs to be covered by man-power. Therefore, this robot is the solution to the problem where less manpower can have used and the area where the situation is much more hazardous can looked after. On the land area, it is a two-wheeled drive robot, so it is easier for it to drive on the land area. Also, a rod is fixed on the back side of the robot in order to provide stability to the robot. Moreover, the camera is fitted on the center on the robot which will be providing a wide view from the system and also will record the same in the memory. The robot will also consist numbers of sensors which will be used for various purposes when needed

**Index Terms** – Caddx Tarsier V2 Camera, Current Sensor network, Voltage Sensor Network, GPS Sensor Network

## I. INTRODUCTION

Over the years, the surveillance system in the world have evolved. Some were widely accepted all over the world, while the other had to face criticism for their systems. The surveillance is important for a country as the country's security comes to the question. China by far has the most numbers of security cameras, The United States is joined by China and Germany with the largest number of video surveillance cameras in the world. By far surveillance does not only mean to survey the area. It can help mankind in many ways and can

reduce the manpower being used for the purposes. The surveillance system will be consisting of a camera which will be connected to a transmitter and receiver will be at the receiver's end where the data for the same will be transferred and the person can survey a particular area by sitting at one place in an idle position. Then the problem arises is the range? What range can this wireless communication propose? Also A major factor nowadays is the Fail Safe Circuit. What if the robot is facing any issues and is unable to perform according to our needs and requirement? Will it be returning to us while the chassis is around 2 to 3 kilo-meters away from us? All such

questions arise due to the advancement in the technology with the time. No person could have ever thought that it would be possible for a human to survey a place by far sitting at one place. Moreover, the systems being manufactured in the current scenario does not focus on working with the multiple medium. For example, if the system is being made to perform a surveillance task on a land area, it would only focus on the land area. That brings us to the variety of products where we first need to think about our requirement and search for the products according to our needs. What if all these requirements are fulfilled and you can also exercise some extra benefits in terms of range and the medium to be working with? What if the robot would enter into the fire in a fire affected area and provide us with the real time data with the people being stuck in the fire? What if the robot is made so hard that it can be thrown up to certain heights in a multi-storeyed building? All these questions arises in our minds and here we have come up with the solution to it. The robot will serve the purpose of surveillance and try to solve the real time problems that we as a humans face in a hazardous situations. Also, as a secondary part, it focuses on reducing the manpower. Also, the real time data are being presented through wireless transmission of the data over an excellent proposed range of the system.

## II. PROPOSED SYSTEM

Fire in multi storey building is major concern nowadays because the situation cannot be known from downstairs. Surat Fire incident 2019 at coaching centre. Vadodara the signet commercial complex fire incident, where 125 rescued from building. Forest is a wide area, so the time elapsed for the surveillance or animal scouting is very long if done through dedicated team.

Australia wildfire disaster 2019 in which the surveillance is done by helicopters and drones from top of the forest, what is really happening is much more difficult to know from top we can say next to impossible at the time of disaster. Land areas,

specifically for border areas where the area of coverage is much long and to perform surveillance task by human team will take much more time and man power.

Also CRPF (central reserve police force) is actively working on the borders for this type of scouting task so to reduce this special team's man power for the location where they are really needed most.

## III. BLOCK DIAGRAM

The working of the whole system is being explained with the help of a block diagram. The block diagram consists of the components that play a major role in the working of the system. The control transmitter is the main control device for the robot it will send the control signals to the control receiver via radio signals. The control signals then identifies the channel of the transmission and gives output accordingly to output devices such as motors and fans. The robot is having 2 wheel drive system so two motors are connected to control receiver with electronic speed controller, when we send motor control data to receiver it will communicate ESC and ESC will accordingly give output to motors with specific speed, the speed will as we access throttle on control transmitter.

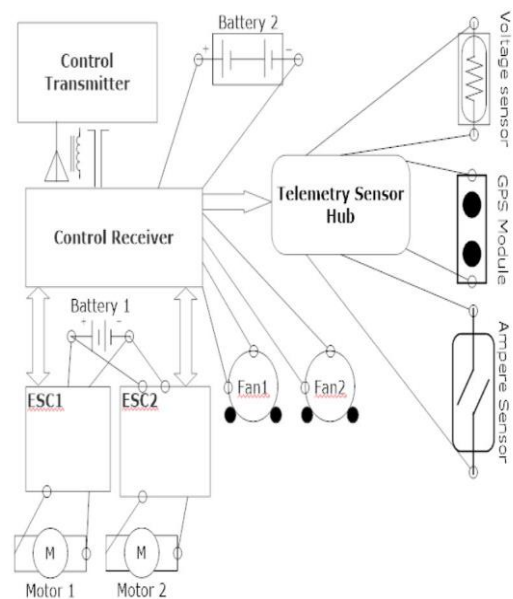
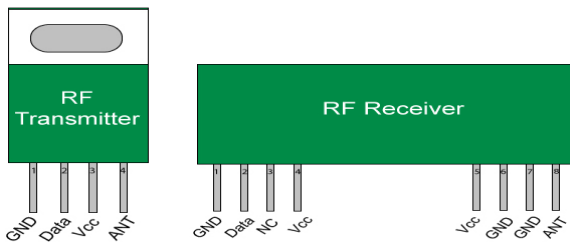


Fig. 1 Working of the System.

Same thing happens for cooling fans now here we do not require speed controller because the fan is supposed to work on full speed, when control receiver matches with the channel of fans it will turn on/off accordingly. The GPS module, MLVSS voltage sensor and fas100s current sensor is connected to sensor hub and sensor hub is connected to control receiver. So all the real time data of GPS coordinates, voltage level and current levels of battery will be sent to control transmitter display.

#### IV. HARDWARE COMPONENTS

The RF module operates at Radio Frequency. The frequency range of module varies between 30 kHz & 300 kHz. The digital data is represented as variations in the amplitude of carrier wave in the RF system. The RF module consists of radio frequency transmitter and receiver. The above RF module works on the 433 MHz frequency.



**Fig 2:** RF Transmitter and Receiver

**Table-1:** Pinout of RF Transmitter/Receiver

NO	Pins	Description
1	Gnd	Ground (0 volt)
2	Data	Serial data
3	VCC	5 volt power supply
4	ANT	Transmitting/ Receiving antenna
5	NC	Not connected

The customization work was been carried out on the Transmitter with the battery backup and the range of operation. Fr-Sky gives wide range of operation with an enormous area accessible through it. Fr Sky transmitter consists of a numbers of buttons each used for a particular purpose. The FrSky becomes compactible with the system and also the aim of building such system was to minimise the use of programming over the system. Thus, it would make user friendly and be easy to use for any human.

The receiver used in the robot is R9+ Slim Receiver. It consists of 16 telemetry channels. The operating voltage range DC 3.5V i.e 12.6V. The receiver is compactible. Also, the receiver gives an impeccable range of operation giving the range up to 10 kilo-meters.

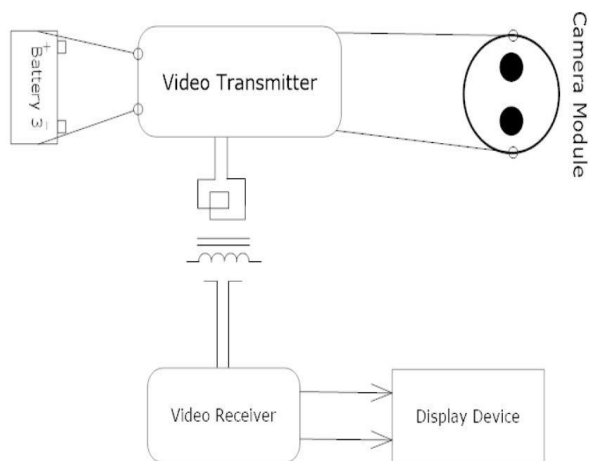


**Fig 3:** FrSky Transmitter

The camera will be used for the surveillance in forest and land as well as in fire. Therefore, the camera was needed to be selected in such a way that it works in all the areas. After all the research work, the camera selected was the Caddx Tarsier V2.



**Fig. 4:** Caddx Tarsier V2 Camera



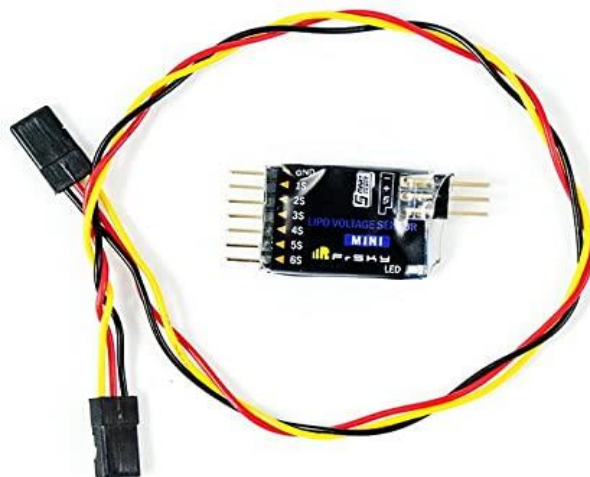
**Fig. 5:** Camera Module Working

The range extender was used in order to extend the range of the wireless communication of the system. The proposed range for the communication is 8 to 10 kilo-meters of wireless transmission and reception of the data. Range extender comes under an integral part of the paper as the communication at such a long distance was not possible with the normal components used. The range extender basically presents an extended hand to the available range and gives it a boost by extending it. The Range Extender used under the paper is R9M Range Extender for the reception and transmission of the data over a longer distance.



**Fig. 6:** Range Extender

The MLVSS voltage sensor is capable to measure 6 volts to 25 volts and the power consumption remains 10m@5V. It is a precised sensor giving the precision up to 0.05V.



**Fig. 7:** MLVSS Voltage Sensor

The FAS100s current sensor is a light weight sensor with a measurement range ranging from 0 to 100A. The current consumed by the sensor is 27mA@5V and the maximum safe current it could pass through is 100A.



**Fig. 8:** Fas100s Current Sensor

A temperature sensor is a device, usually an RTD (resistance temperature detector) or a thermocouple, that collects the data about the temperature from a particular source and converts the data into understandable form for a device or an observer. A temperature sensor used here is the sensor which will be sensing the temperature inside the boy and outside the body too. Therefore, two temperature sensors will be used thereafter for the measurement. One for measuring the temperature inside the body as there are lots of electronic components present inside the body. Another one for measuring the outer temperature of the body



**Fig. 9:** Temperature Sensor

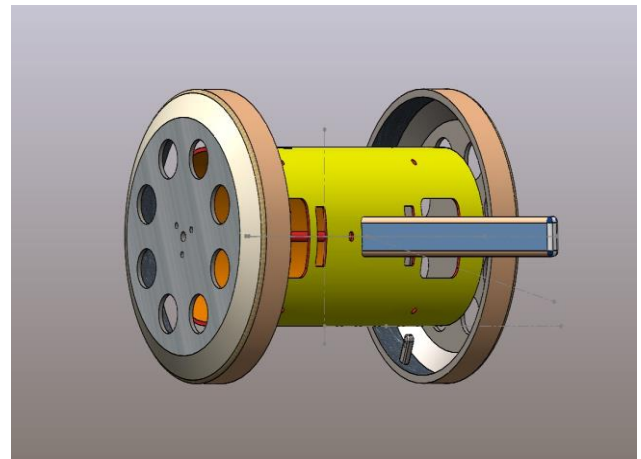
GPS sensor gives the coordinate of current position of robot the sensor is widely used for defence surveillance where the exact coordinated gives much importance. Also in forest area the exact coordinates helps to achieve varies application like animal life scouting.



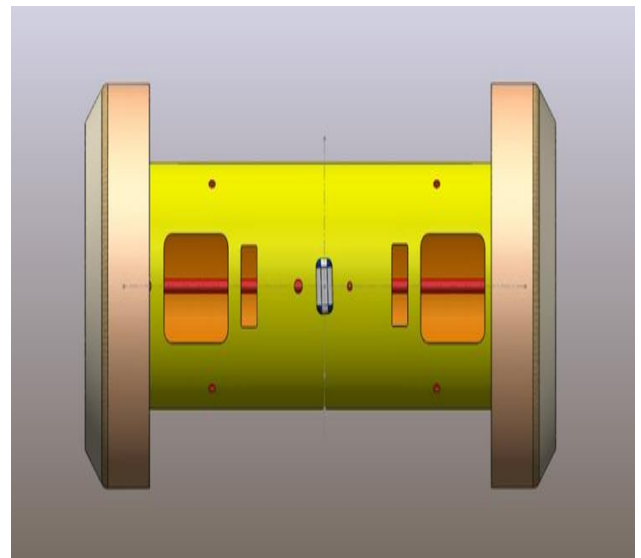
**Fig. 10:** GPS Sensor

## V. DESIGN OF BODY

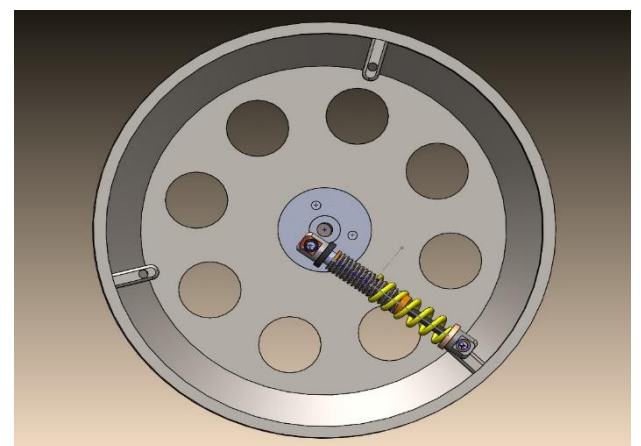
The body of the system is designed in such a way that the robot can move freely. The robot was made a two wheeled drive robot as the robot was to be made as compact as possible so that it would not be possible to spot the robot. The design work is being on Solid Works software. The wheels of the robot are designed in such a way that the fire cannot enter inside the body. Also, the holes present on the surface of the wheel reduces the weight of the overall tyre. To absorb the shocks, the oil dampers are used and connected inside the wheel. When it dropped or thrown from a height, these oil dampers work as a shock absorbers and will protect the force transmission towards the main chassis of the robot. The dampers are arranged at 1200 angle and three dampers are attached in order to the cover the whole wheel.



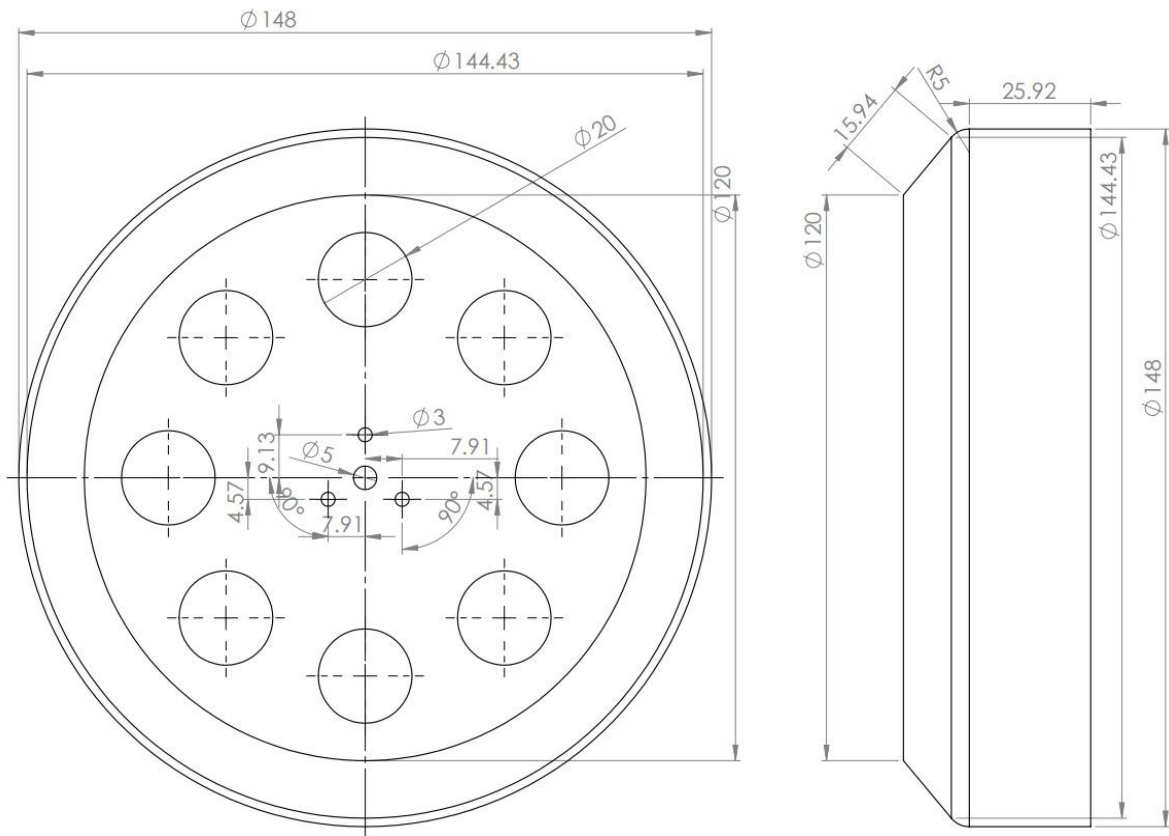
**Fig. 11:** Body Design



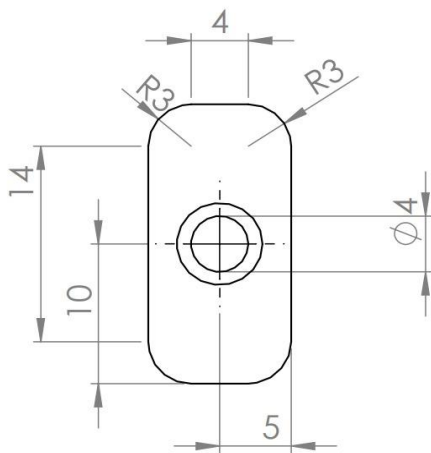
**Fig. 12:** Front View



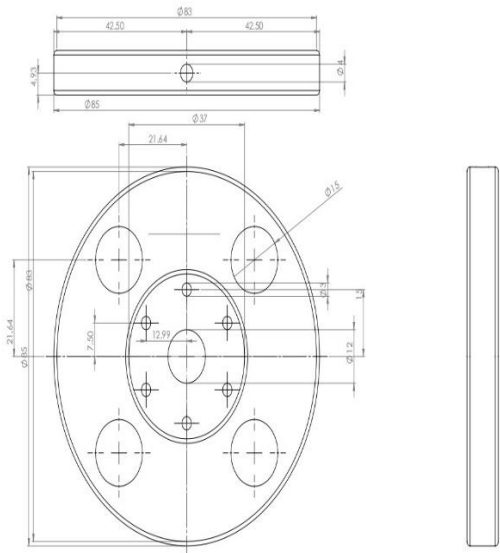
**Fig. 13:** Wheel Design



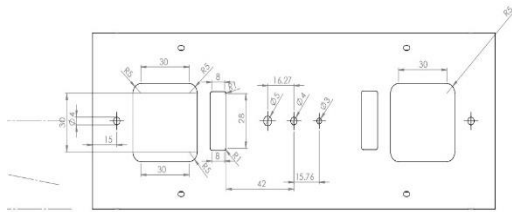
**Fig. 14: Wheel Front End**



**Fig. 15: Stick Attachment**



**Fig. 16: Mounting of the Motor**



**Fig. 17: Body Design**

## VI. MATERIAL SELECTION

Material selection was an integral part of the paper as the robot was supposed to work in multiple medium. Therefore, lot of research work was being done on the same. Three materials were selected out of the variety of materials and the comparison of the same has been shown in the table below.

**Table-2: Comparison between materials**

Parameters	AIISI 4130 STEEL	Ti6Al4V	ALUMINIUM 6063
Brinell Hardness	197	379	73
Vickers Hardness	209	414	96
Ultimate Tensile Strength	670 MPa	1170 MPa	241 MPa
Yield Tensile Strength	435 MPa	1100 MPa	214 MPa
Modulus Of Elasticity	205 GPa	114 GPa	68.9 GPa
Ultimate Bearing Strength	-	2140 MPa	434 MPa
Yield Bearing Strength	-	1790 MPa	276 MPa
Fatigue Strength	-	160 MPa	68.9 MPa
Machinability	70%	-	50%
Melting Point	1432°C	1604°C	616°C
Thermal Conductivity	42.7 W/mk	7.1 W/mK	200 W/Mk
Specific Heat Capacity	0.477 J/g °C	0.5263 J/g °C	0.45 J/ g°C

## VII. CONCLUSION

After the successful implementation of the idea the robot will be able to perform surveillance in multiple mediums and will be able to transmit and record live footage of whole operation. The robot will be covering the larger

range of span using range extender. The overall benefit can be described as the robot is able to reduce man power with higher accuracy and precision, save the time of unnecessary team assigned for scouting in border area. Moreover the salient feature of the robot like No programming, easily repairable and replaceable is essential for the use in fire department, defence department, abs forest department.

In future we can provide IP68 water and dust proofing to whole body for extreme protection against dust and water. Future application add up on water surveillance using same robot. Implementation of thermal imaging camera for better quality video surveillance in night and in fire. For surveillance and spying in enemy territories a drone can be used to pick the robot and drop it from height then drone will work as signal repeater for robot for long range surveillance.

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