DESIGN AND FABRICATION OF WARBOT

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ABSTRACT

This paper talks about the emerging technology in the field of military to reduce the risk of soldier's life. This device is integrated with camouflage technology and also with internet of things to increase the effectiveness and to use without any compromise. Nowadays, military organizations take the assistance of an Army Robot in the risk prone area. These army robots are confined with various sensors to detect enemies, harmful explosives, mines, harmful gases, etc. The main objective of our system is to get the robot camouflaged including some additional parameters like Wi-Fi module and camera for real time data processing. With the help of IoT, the army robot can be controlled wirelessly through a smart phone with increased range of communication between the transmitter and receiver thereby controlling the robot far away from the risk prone area. Our proposed design and technology can also make the robot explore dangerous geographical areas where humans cannot enter. The camouflaging technique helps the robot to be invisible to the enemy thereby collecting information and sending it the receiver.

Keyword: - *Unmanned ground vehicle, army robot, sensors, Internet of things, camouflage and safety.*

1. INTRODUCTION

Now a day we use robots intensively in almost every fields, now this project is to implement robots in the field of army. This robot consists of electronic components and also a stable structural design to obtain all terrain. This robot is equipped with camouflaged technology with multifunctional army robot which can be controlled through smart phone using Wi-Fi. This robot contains weapons, sensors and camera. The main motive behind this robot is to reduce human losses in military operations or terrorist attacks.

2. PURPOSE

The idea was derived to reduce the human loses in military operations or terrorist attacks. This robot with camouflage technology is like a virtual spy and can involve into the strategic locations for observation and warfare purpose. The aim of our project is to design, manufacture and operate a robot via electronic devices like mobile or computers from far place and this robot is designed to survive in any terrain

3. OBJECTIVES AND SCOPE

- To build a robot that is composed of computing signals from PIR, IR, metal, color and gas sensor, for detecting obstacle, metal arms, toxic gas detection in stealth mode.
- To process the commands and drive dc motors for required movements.
- To operate robot via mobile as a remote-controlled device.
- To integrate camera for live video transferring.
- To integrate sound sensors and control the weapon with motor.
- To design a structural body to hold all components.

4. HARDWARE COMPONENTS USED

- Arduino mega
- Color Sensor
- PIR Sensor
- IR Sensor
- Metal Sensor
- Gas Sensor
- Relay
- Camera
- Wi-Fi Module
- Battery
- Sound Sensor
- DC Motor
- H-Bridge
- LED Strip

5. SOFTWARE REQUIREMENTS

- Arduino IDE and Blynk Application.

6. COMPONENTS

6.1 AURDINO MEGA

The Arduino Mega 2560 microcontroller board is based on Atmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Fig-1: Arduino Mega

6.2 PIR SENSOR

The PIR sensor used to detect the movement of human being within a certain range of the sensor is called as PIR sensor or passive infrared sensor (approximately have an average value of 10m, but 5m to 12m is the actual detection range of the sensor). Fundamentally, pyroelectric sensors that detect the levels of infrared radiation are used to make PIR sensors. There are different types of The PIR sensor circuit is used in numerous electronics projects which are used to discover a human being entering or leaving the particular area or room. These passive infrared sensors are flat control, consists of a wide range of lens, and PIR sensors can be easily interfaced with electronics circuits. Sensor and here let us discuss about PIR sensor with dome shaped Fresnel lens. The PIR sensor circuit consists of three pins, power supply pin, output signal pin, and ground pin. The PIR sensor circuit is having ceramic substrate and filter window as shown in the figure and also having dome like structure called as Fresnel lens.

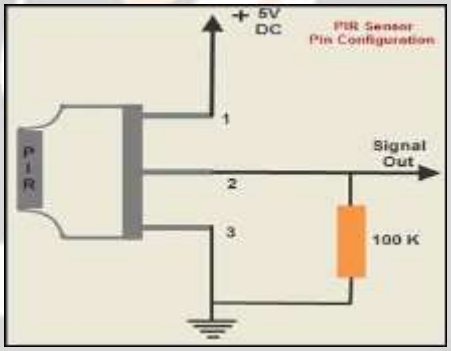


Fig-2: PIR Sensor pin configuration

6.3 IR SENSOR

Infrared Sensor consists of emitter and the receiver components together called as photo-coupler. Emitter has an IR LED and collector have a photo- diode. This device uses IR rays to detect any object present by receiving reflected rays of Infrared color rays.

Fig-3: IR Sensor

6.4 GAS SENSOR

This sensor measures the concentration of gas in its vicinity. It is used to detect the leakage of gases like Alcohol, LPG, Propene, Hydrogen, CO and even Methane. We use this sensor to detect the harmful gases present around the robot.

Fig-4: Gas Sensor

6.5 METAL SENSOR

Metal detector is used to detect metals by placing the probe on respective places. This sensor works on changing electromagnetic field when it comes in contact with metals. We use this sensor to detect land mines.

Fig-5: Metal Sensor.

6.6 COLOR SENSOR

This sensor is used to detect the colors in the surrounding and send data to the controller, by this the respective Combinations of RGB LED strip would have duplicated the Surrounding color.

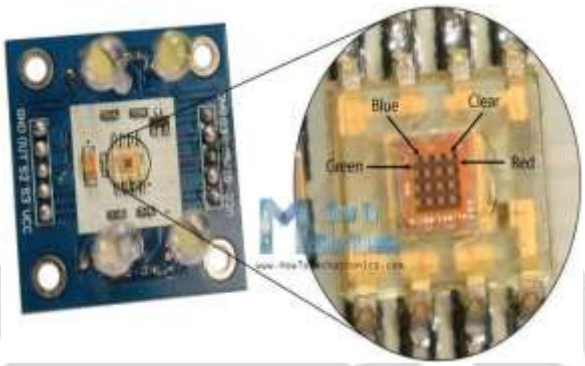


Fig-6: Color Sensor.

6.7 RELAYS

Relays are electrically controlled switches, which can be made and break the circuit with the help of passing low voltage current. By this the circuit status can be modified according to the requirements, we used 4-channel relays to control the DC Motors.

Fig-7: 4-Relay.

6.8 WI-FI MODULE

ESP8266 Wi-Fi module is low cost and used by IoT developers. It uses TCP/UDP communication protocol to connect with server /client. We use this module to connect mobile or pc for controlling the robot.

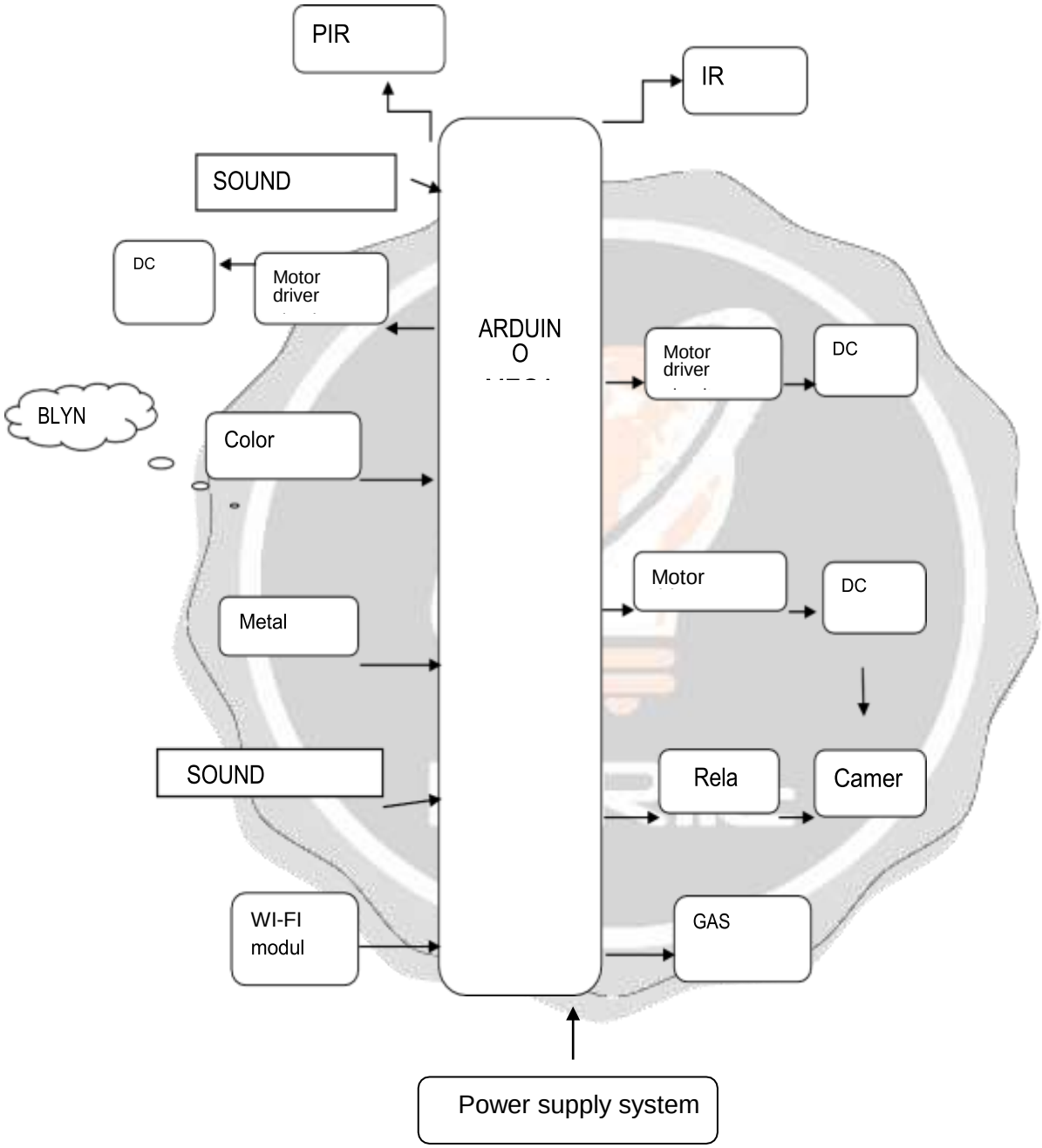
Fig-8: WI-FI Module

6.9 H-BRIDGE

L293D Motor Driver Circuit is used to control the DC motors to rotate clockwise or counter-clockwise. We are using this circuit to control the rotation of the camera fixed to the motor.

Fig-9: H-Bridge

7. BLOCK DIAGRAM



This diagram represents the flow of data graphically. A DFD shows the information is flown as input or output. This diagram does not show any information regarding process timing. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing.

8. DATA FLOW DIAGRAM

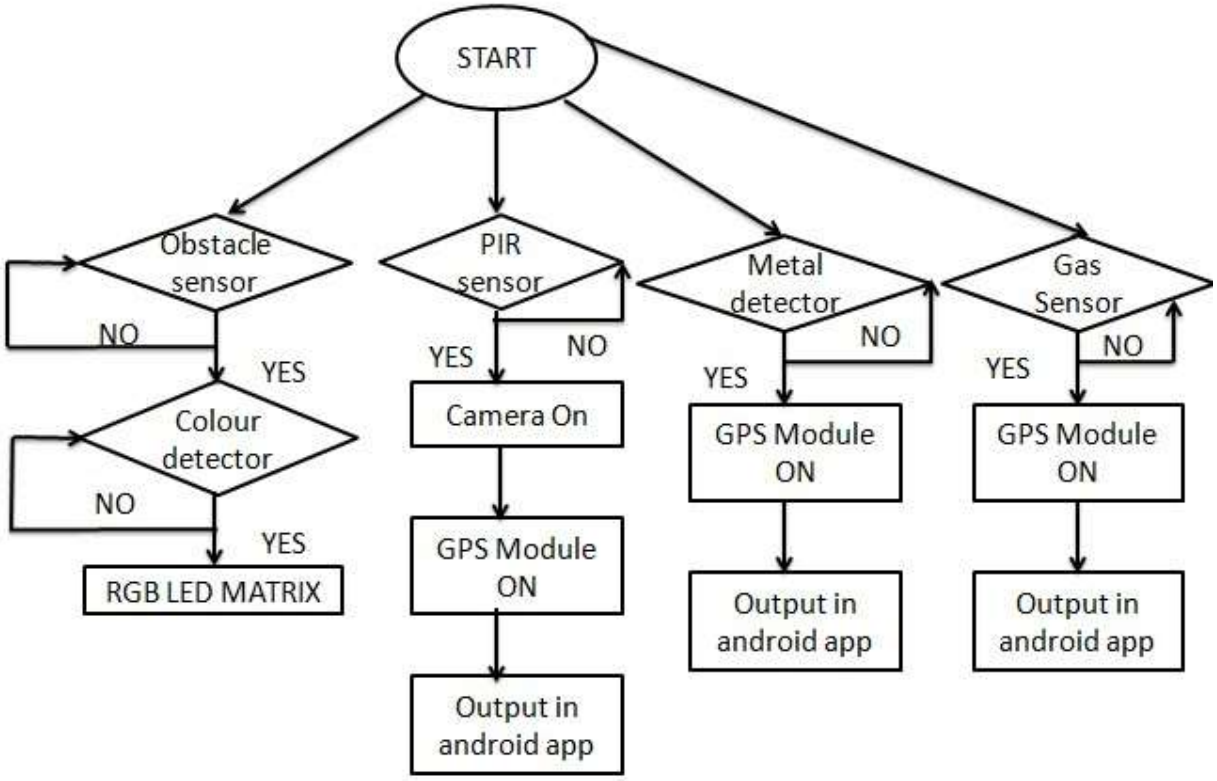


Fig-10: Data Flow Diagram.

Fig-10 represents the data flow diagram of the camouflage army robot. It contains four sensors. An obstacle sensor, PIR sensor, Color sensor, Metal detector and a gas sensor. In the course of robot movement if any obstacle is sensed then first it detected the color by using color sensor and that particular color is displayed in the RGB color matrix. If any human comes that is detected by PIR sensor and as soon as the human is detected camera and GPS turns on and that particular live video is sent to the android app.

If any landmines are present, then metal detector detects it and through GPS information will be sent to the android app. If any leakage of gases is present, then those gases are detected by gas sensor and that particular information is sent to the android app.

9. CAD MODEL

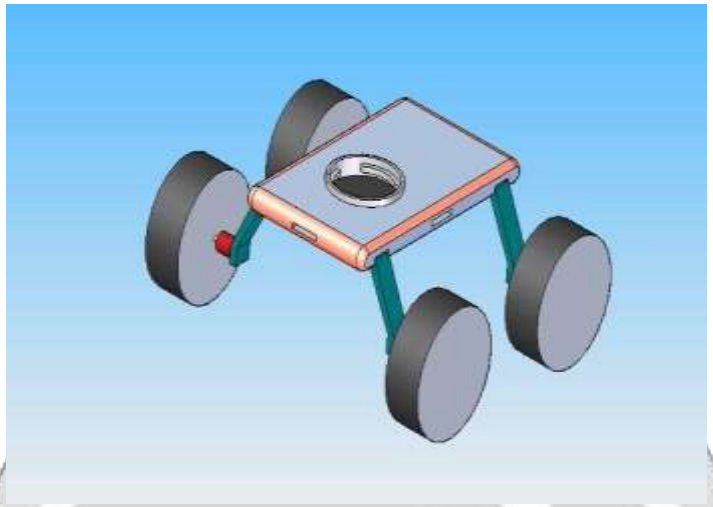


Fig-11: ISO View CAD Model.

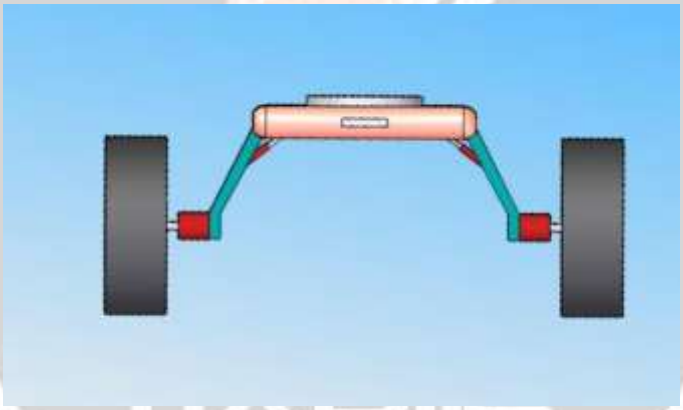


Fig-12: Front View CAD Model.

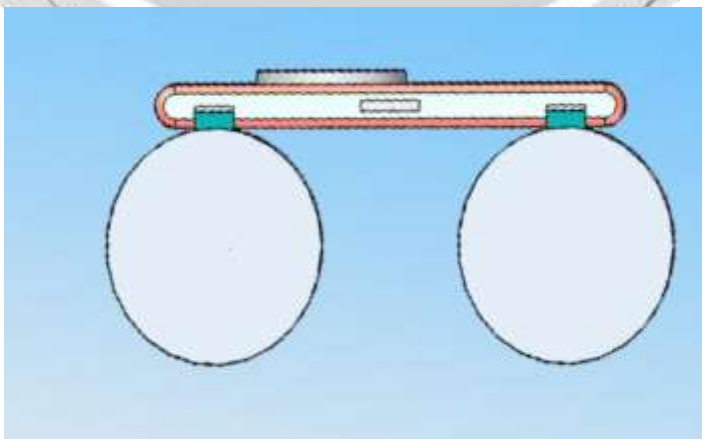


Fig-13: Side View CAD Model.

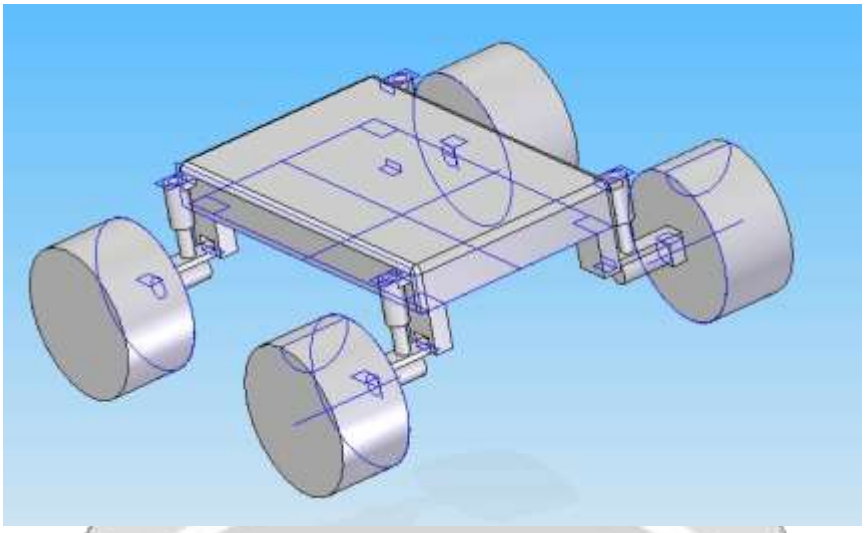


Fig-14: Isometric CAD Model.

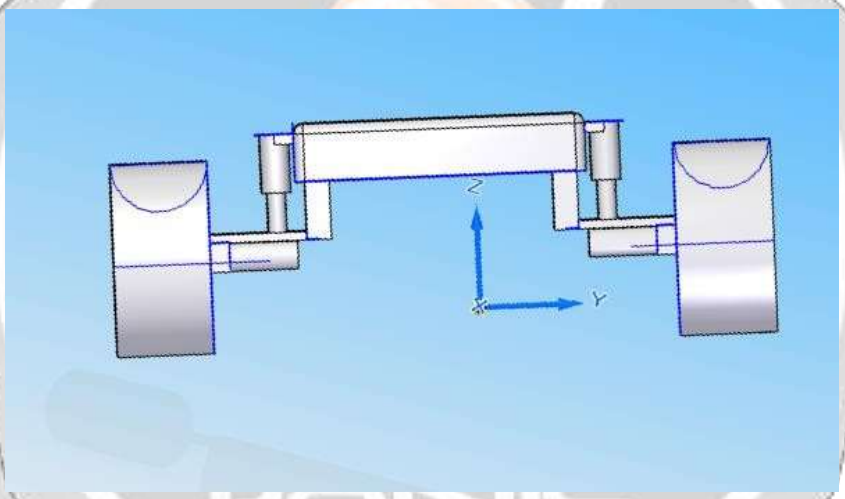


Fig-15: CAD Model.

9.1 MODEL DESCRIPTION

This model is designed to hold all the electric components in place. It is designed to hold a weapon with a circular socket as seen in the Fig. 11 ISO View CAD Model. This model contains slots on all four faces to plant sound sensor, IR Sensor and PIR Sensor. The load is carried by individual suspension system, by this the independent movement of wheels is obtained.

9.2 PROTOTYPE MODEL

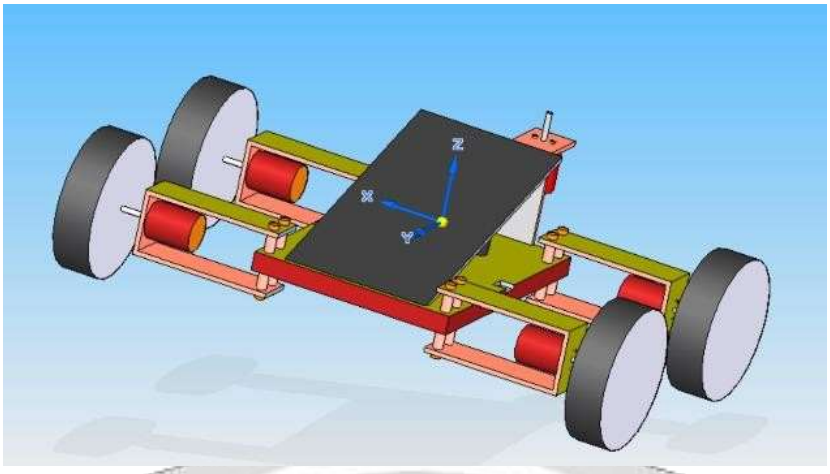


Fig-16: Isometric View CAD Model

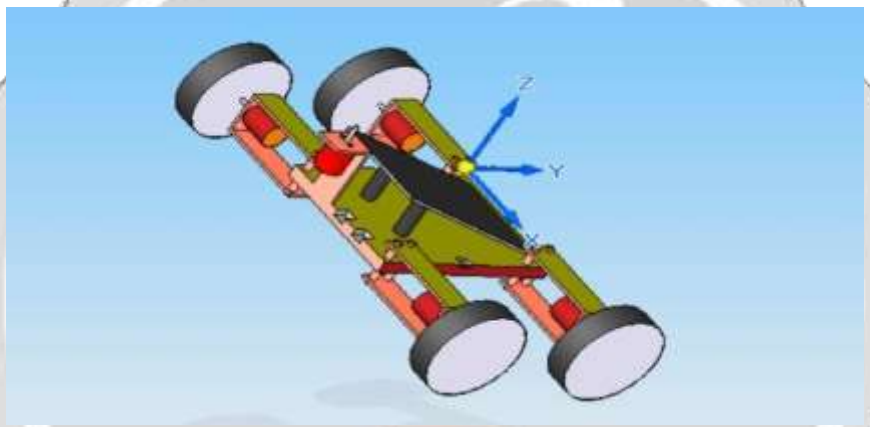


Fig-17: Isometric View CAD Model

9.3 PROTOTYPE MODEL IMAGES

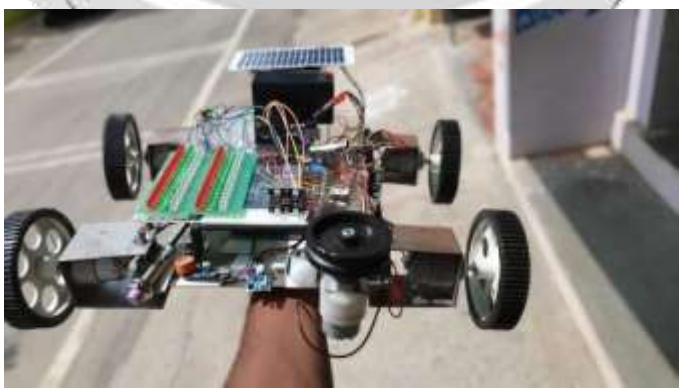


IMAGE-1

IMAGE-2

9.3.1 PROTOTYPE MODEL DESCRIPTION

The prototype model consists of a solar panel, along with IR Sensor, PIR Sensor, color Sensor and Metal Sensor placed in front. We have used lead-acid battery which is placed on top of the base plate. A solar panel is placed on the top of the model.

10 RESULTS AND CALCULATIONS

10.1 MAXIMUM TEST

- Even Ground [Smooth Surface]

Table-1 Time taken for the prototype to travel 10m

	1st timing (Sec)	2nd timing (Sec)	3rd timing (Sec)	Average (Sec)
Time Taken to Travel 10m	30	32	29	30

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Speed} = \frac{10\ \text{m}}{30\ \text{s}}$$

Speed = 0.33 m/s (or) 1.188 km/hr

- Uneven Ground [Gravel]

Table-2 Time taken for the prototype to travel 10m

	1st timing (Sec)	2nd timing (Sec)	3rd timing (Sec)	Average (Sec)
Time Taken to Travel 10m	46	43	51	47

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Speed} = \frac{10\ \text{m}}{47\ \text{s}}$$

Speed = 0.21 m/s (or) 0.756 km/hr

Speed Reduction of the model reduces by 36% when it travel in ground surface.

10.2 DC MOTOR POWER

If we use a motor of .128 HP the following calculations can be made-
0.128 HP = 96 Watts
Power Input, P_{in} = 96 Watts
Power output, $P_{out} = P_{in}$ x Efficiency
Efficiency of an electric motor to convert electrical energy to mechanical work done is assumed to be as 90%.
At 90 % efficiency
Power output, P_{out} = 96 x 0.9 = 86.4 Watts

As we know that,
Power = Torque x angular velocity = T x ω
Power = Force x radius x angular velocity
Power Output = 86.4 Watts
Radius of the wheel = 0.055 m
Angular Velocity, $\omega = 2 \pi \times n/60$ [n = 60 rpm (Given)]
$= 2 \times \pi \times 60/60$
$= 6.284$ rad/sec

Substituting the values in 1
86.4 W = Force x 0.055 m x 6.284 rad/s
Force = 250N exerted by the model

Velocity of the Model [Theoretical]
Velocity, v = r x ω
v = 0.055 m x 6.284 rad/sec
v = 0.345 m/sec

11. DISCUSSION

11.1 EXPECTED OUTCOME

- The goal of this research was to provide a low cost rescue robot for human detection in a disaster environment.
- Though the existing urban search and rescue robots are equipped with various sensor but the problem

with them is the cost.

- The sensor used in the development of this project is easily available and cost effective.
- Many lives can be saved by using this autonomous vehicle in war fields in a short duration which becomes time consuming and unaffected if done manually.
- This vehicle can be improved by using high range sensors and high capacity motors.
- Robot can further be equipped with speaker or recorder to interact with survivor and assure them of nearby help.
- This robot is developed on small scale and is cost and energy efficient, its future is bright and wide.

11.2 ADVANTAGES

- This robot ensures that there is not human left behind in a rescue operation.
- The system is not fully automated so the robot is safe to use in any locations.
- This system is equipped with IoT technology as it can be controlled from very far place.
- This system uses IoT technology by which the range of controlling is increased.

10.2 APPLICATIONS

- In Military applications to rescue humans.
- In rescue missions where human cannot reach.
- In war fields to defend enemies.
- This design is simple and cost effective.
- It can be used for civil purposes to explore geographical areas and to send data.
- For surveillance and patrolling this system can be used.

10.3 DRAWBACKS OF PROTOTYPE MODEL

We have designed and fabricated a prototype of the concept which we have visualized, the model has been equipped with small suspension system asper availability in market which was found not effective to the model hence decided to work on that for future. The overall components are effective as required to work. And also we need good quality of internet connection to transfer data else there is bit data delay in transferring.

10.4 SCOPE FOR FUTURE WORK

The overall project is developed to change color according to surrounding surfaces and controlled with IoT technology. While there are still more strong technologies that can be used without data transfer delays and also the base platform can be designed to carry huge loads as that depends on weapon used and develop the motors as well.

11. CONCLUSION

The main objective of our project is for border security by using camouflage technology and has been successfully accomplished wireless using Wi-Fi module driven by an Android App. We used PIR Sensor principle to detect motion of obstacles on path. We also used IR Sensor to detect obstacles. Gas sensor and metal sensor is used to sense toxic gases and metal weapons. In this system we used camera to share live video data to the android mobile, by this we can be accurate to take further stem in war field. In the scanning path if any obstacles or enemy is detected then data is transmitted to the control panel and control action take place.

12. AKNOLEDGEMENT

We feel immense pleasure in showing my gratitude to all the people who have made this work possible, by offering help and guidance whenever required. The people whom we list below are deeply acknowledged for their contribution and support. It brings a sense of privilege to associate this work with the name of my guide **Associate Professor Mr. Pramod v Koujalagi** working under whom has been a precious opportunity. We are very grateful to **Dr. Ramesh C, Head of Department** for providing me this opportunity to work. Special thanks to

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