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Electronic Hovercraft

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Abstract: ***The small autonomous vehicles of the future will have to navigate close to obstacles in highly unpredictable environments. Risky tasks of this kind may require novel sensors and control methods that differ from conventional approaches. Recent ethological findings have shown that complex navigation tasks such as obstacle avoidance and speed control are performed by flying insects on the basis of optic flow (OF) cues, although insects' compound eyes have a very poor spatial resolution. The implementation of an optic flow-based autopilot on a fully autonomous hovercraft. Tests were performed on this small (878-gram) innovative robotic platform in straight and tapered corridors lined with natural panoramas. A bilateral OF regulator controls the robot's forward speed (up to 0.8m/s), while a unilateral OF regulator controls the robot's clearance from the two walls. A micro-gyrometer and a tiny magnetic compass ensure that the hovercraft travels forward in the corridor without yawing. The lateral OFs are measured by two minimalist eyes mounted sideways opposite to each other. For the first time, the hovercraft was found to be capable of adjusting both its forward speed and its clearance from the walls, in both straight and tapered corridors, without requiring any distance or speed measurements, that is, without any need for on-board rangefinders or tachometers.***

Keywords: Arduino, Embedded C, LoRa**(SX1275 Ra-02),** ***Android.***

I. INTRODUCTION

Generally most of the disasters occurs in borders and area filled with water. For example in rainy season Hyderabad was fully filled with water due t the leakage of drainage water.in these disaster destructive elements which not only caused the infrastructure but also took lives of many people which is very sad to see and hear. These type of disasters make so many relation breaking and also taking the lives of human beings and animals trees etc.so in order to protect the trees, animals, humans, Infrastructures, efforts of engineers, workers, government we need such system which can save lives, effort and human attachments.

In this project we made use of the Arduino uno which is having atmega 328 microcontroller chip and we made use of many components as DC motors, BLDC motors(propellers),HC-05 Bluetooth control, Li-po battery which gives the appropriate power supply to the system to control the motor speed.

II. LITERATURE SURVEY

We referred various different type of existing models and located them for helpful to our device work.

The first practically designed hovercraft was designed from British invention in 1950's.they are now used throughout the world as transport in disasters relief, coast guard, military and survey applications.

A hovercraft is in simplest form hovercraft compose a hull that can float on water and carries out a cushion of air retained by a hexible skirt.

Hovercraft is a boat like vehicle but that are much more better work than the boat why because they not only travel on water they also travel on grass, mud, sand, hill areas as well as on ice.

During the 1950's English by name of Christopher cockerel developed and patented the first hovercraft .for this invention people and the queen of British named sir Christopher cockrell. He made the hovercraft which that can carry the passengers upto 400 people and have carried more than 30 million passengers.

Cockrell theory was instead of using plenum chamber as the theory of thornycrott device. Air was pumped into narrow tunnel.cockerell successfully tested his theory and filled his first patent in 1955.the birth of first hovercraft was 1959.first hovercraft was having the featone of

Weight=4 tons

It can carry=3mens

Speed=1.85kmph on water.

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III. WORKING

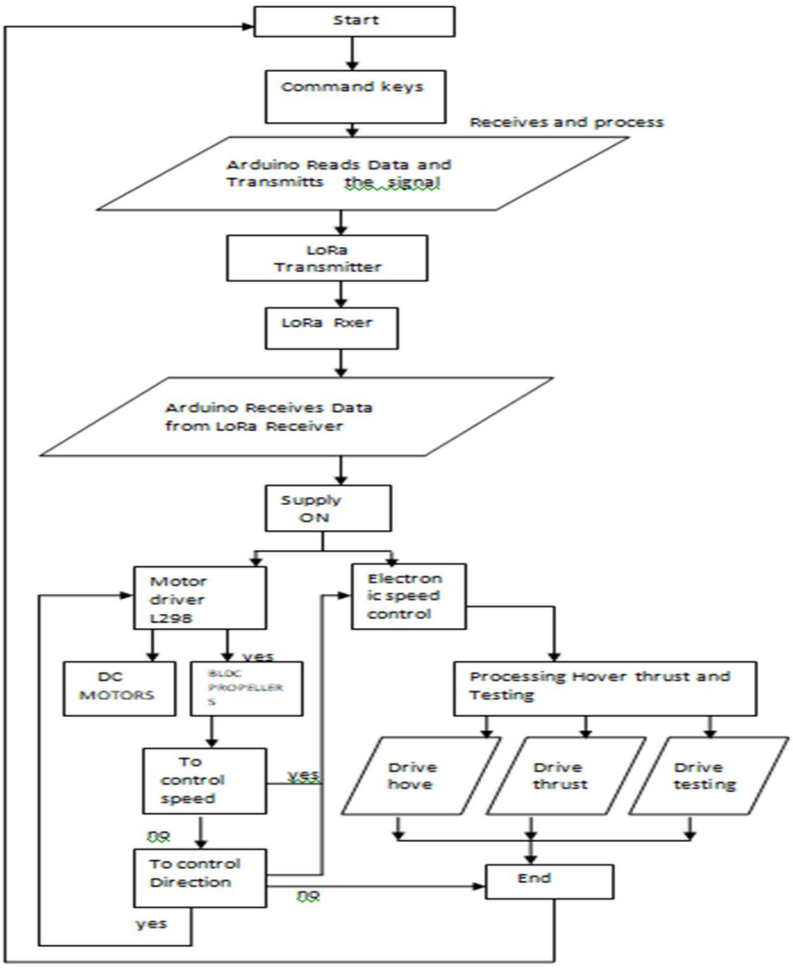


Fig 1. Flow Chart of Working Model

Two DC motor which one having the 1500-2500rpm speed and the propellers for this we used drone motors BLDC(brush less dc motors) which one having the 19500-35500 rpm.with the help of **LoRa (SX1275 Ra-02)** Transmitter we can control the navigation of device.

When the down propeller start then the air will filled in cushion. When the speed of the motor is inverts that much amount of air will filled in the cushion.

When the back propeller turns on then device will move forward direction. If we need left to move left motor will turns on. When right side to move right motor will turns on. Where ever the disaster happen it can easily go.

In this here we starts the setup of device by switching on or giving power supply by the Li-po battery. Which is having 2amp-12volts then the Arduino uno seeks digital input from the LoRa (SX1275 Ra-02) Transmitter.

LoRa (SX1275 Ra-02) we give analoge input and that input data is converted into digital and it transmitted to Arduino Uno. Now we need control the motors. Arduino gives the digital data to L298 motor drive with that we can turn on required motors and to navigate the device left and right we can use L298 motor drive.

To control the speed of the motors we use ESC(electronic speed controllers) which can having the specifications of 18A,11.1-14.8v with that we can increase and decrease the speed of motor. An ESC (electronic speed controller) controls the brushless dc motor speed here BLDC motor of propellers. Basically BLDC motor are use for drone, for prototype we used drone BLDC motor which is having 19500-35500rpm speed.

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IV. WORKING PRINCIPLE

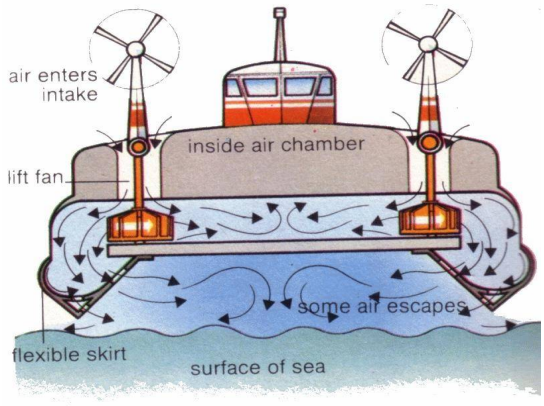


Fig 3. prototype

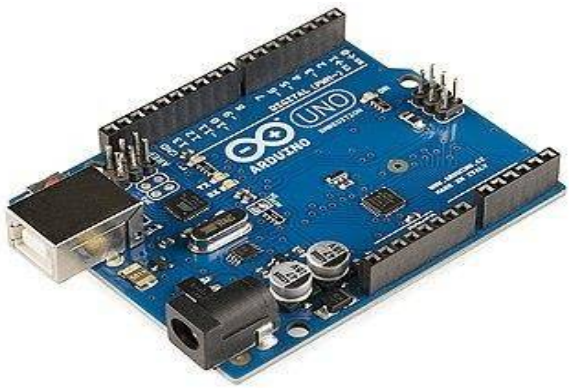
The hovercraft is a self-driving car, strongly supported by a self-made slow pillow a moving, high-altitude air emanated from the lower surface and contained inside a flexible skirt such is perfectly lung and has some ability to travel under the most beautiful places. Basically, the hovercraft floats over the surface of the earth over the air cushion provided by the lifting fan. The underground pressure eliminates all forms of collision and ease of hovercraft movement and pressure stability maintains sufficient height. A horizontal divider separates the air generated from the propeller into compressed air used for air compress while pressure is used for compression. Due to the air flow, the skirt fills up and the body is pushed and lifted when the lifting force is greater than the body weight. The stretched skirt provides content, enhances balance and makes the work of art versatile place. After the art lift, the blower mounted on the input engine enters the air facing backwards.

To control the direction of art to move forward, backward, right and left, using a microcontroller. This type of the vehicle can ride equally on ice, water, mud, or limited land. Because nothing is straight forward The collision between the hovercraft and the surface of the earth, the collision will be lowered so the hovercraft can move at high speed.

There are four main concerns when designing a hovercraft: boat, gravity, lifting system, and skirt. The design of the boat depends on the load that the hovercraft will carry determines the size of the boat. After knowing the hovercraft load, it is necessary to plan the location for each cargo to determine gravity and calculate the dead weight on the boat. If the dead weight is fixed, the lifting system needs to be set up in order to create the right pressure to lift the hovercraft. After that, the skirt should be able to support the required pressure and press the art on top. Like an empty car, The hovercraft can usually be controlled by remote control or self-driving, using neural network navigation process. In addition, many methods can be used in relation to improving speed control such as Equivalent Integration (PI), Equivalent Release (PID), Logic Fuzzy Control or combination among them.

V. HARDWARE DESCRIPTION

A. Arduino UNO



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Arduino UNO is an open source microcontroller board based on Microchip ATmega328P microcontroller and developed by Arduino.cc. It is equipped with sets of digital anchors and analog input / output (I / O) that can be interrupted on various expansion boards (shields) and other circuits. IDE (Integrated Development Environment) with cable B of type B. It can be powered by a USB cable or a 9-volt external battery, even if it accepts values between 7 and 20 volts.
The same goes for Arduino Nano and Leonardo. Hardware reference design is still distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Editing and production files for other hardware types are available.

Technical specifications

1) Microcontroller: Microchip ATmega328P
2) Active Voltage: 5 Volts
3) Input Voltage: 7 to 20 Volts
4) Digital I / O anchors: 14 (of which 6 provide PWM output)
5) Analog Input Anchors: 6
6) Current DC per I / O Pin: 20 Ma
7) DC current of 3.3V pin: 50 mA
8) Flash Memory: 32 KB of its 0.5 KB used by bootloader
9) SRAM: 2 KB
10) EEPROM: 1 KB
11) Clock speed: 16 MHz
12) Length: 68.6 mm
13) Diameter: 53.4 mm
14) Weight:25g
15) PWM - Speed control.
16) H-Bridge-Control steering rotation

B. DC Motor Control

In order to fully control a DC car, we must control its speed and rotation direction. This can be achieved by combining these two methods.



1) *PWM-For Speed Control:* The speed of a DC motor can be controlled by varying its input power. The most common way to do this is to use PWM (Pulse Width Modulation). PWM is a process in which a standard amount of input power is adjusted by sending a series of ON-OFF pulses. The medium power is equal to the width of the pulse known as the Duty Cycle. The higher the work cycle, the greater the voltage applied to the dc car (High Speed) and the work cycle decreases, the lower the power consumption in the dc car (Low Speed).

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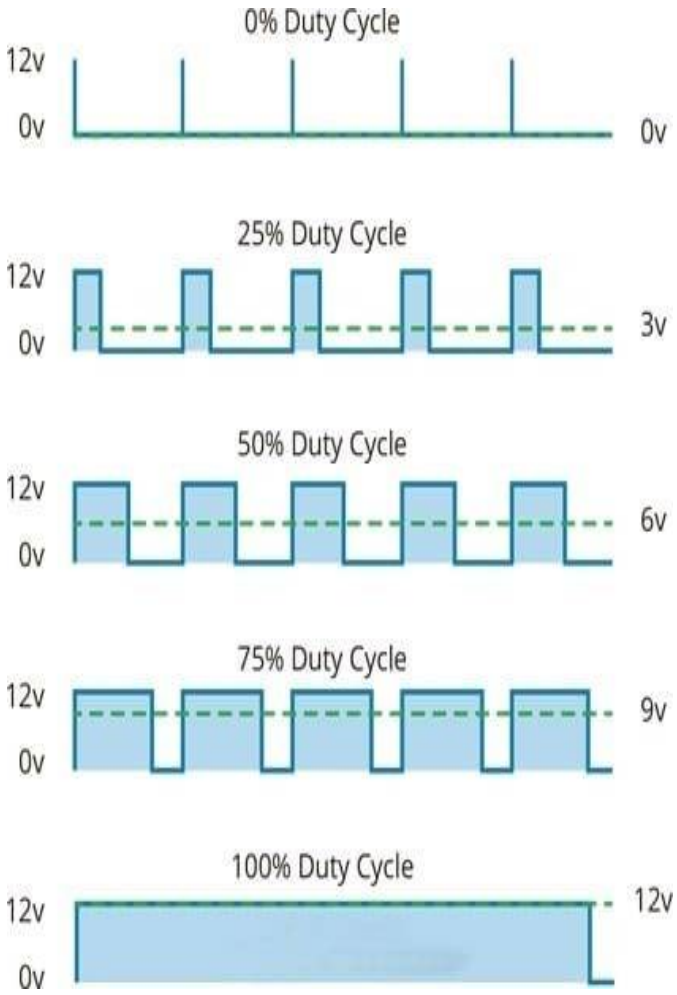


Fig 7.Duty cycle graph

C. ESC

The term ESC stands for "electronic speed control" is an electronic circuit used to change the speed of an electric vehicle, its route and to act as a powerful brake. ESC can be a separate unit that enters the waterfall control station or assembles the receiver itself, as is the case with most R / C toycars.



D. LoRa

LoRa (Long Range) is a proprietary low-power wide-area network modulation technique. It is based on spread spectrum modulation techniques derived from chirp spread spectrum (CSS) technology.It was developed by Cycleo of Grenoble, France and acquired by Semtech, the founding member of the LoRa Alliance and it is patented.

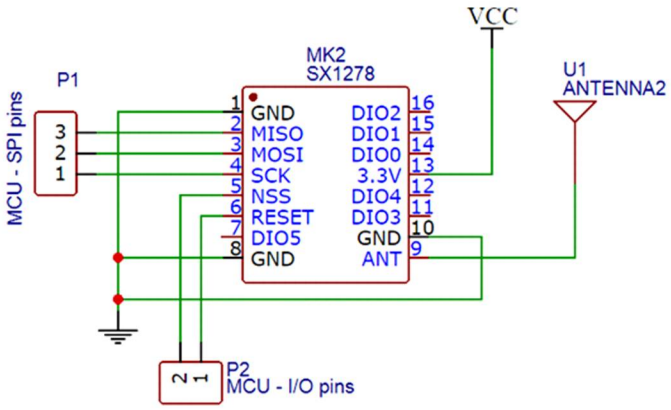
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1) *Features:* LoRa uses unlicensed sub-ghz radio frequency bands, such as the EU433 (433.05-434.79 Mhz), and EU863-870 (863-870/873 Mhz) in Europe, AU915-928/AS923-1 (915-928 Mhz) in Australia, US902-928 (902-928 Mhz in North America, IN865-867 (865-867 Mhz) in India, AU915-928/AS923-1, and others.EU433 the South-East, south-east Asia. LoRa is a long-distance data transmission with low-power consumption. These include the physical layer, while the other technologies and protocols such as LoRaWAN (Long Range Wide Area Network), the upper layers. It achieves transfer rates of up to 0.3 kb / s and up to and including 27 kbit / s, depending on the division factor. Rooted devices for the physically handicapped services is to be used for a three-way of the installation of the devices, by using the tags on the port.
2) *LoRa PHP:* LoRa uses a proprietary, extended-spectrum modulation, which is similar to, and derived from chirp spread spectrum (CSS) modulation. The Spread spectrum LoRa modulation is carried out by the feeding of every bit of the load, with a variety of chirps of the information. The speed at which the distribution of information that is transmitted is referred to as the sign of the rate, and the ratio of the nominal character of the fare and the chirp rate and the distribution of factor (SF), which is the number of characters that can be sent per bit of information. The result is Maria of digital modulation in which M=2SF of the desired signal at the modulator output chirp-modulated signal with a frequency in the range of (f0-B/2, f0+B/2), M is the different initial frequencies, and the instantaneous frequency increases linearly, and the pay-to-f0-B/2, when the maximum frequency is f0+B/2. Lora is the location of the data, with the sensitivity of a fixed-bandwidth channel, in the selection of the value of the spread (of the radio parameter to be selected is between 6 and 12). Low SF, to mean that it is more than that instagram has sent per second; therefore, you can encode more information per second. Higher SF-means that you are less instagram-per-second; therefore, there is less data to encrypt on a per-second. Vis-à-vis that of the low-SF, sending out the same amount of data at a high SF, the longer it takes to get to a transmission known as the 'airtime'. The more time it means that the modem is higher, and more and more energy is consumed. The advantage of the high-SF-is-a-long antenna, while the receiver will have more options for signal, power extraction, which in turn leads to a better sensitivity. The LoRa modem, you can set the output power of 2 dbm 14 dbm (433 Mhz) with a maximum of 20 dbm (865 Mhz to 867 Mhz, 915 Mhz 923 Mhz) in accordance with the regulations of each country. High output power, gives the receiver a higher strength and a higher sensitivity, but at the cost of consuming more power. There has to be calculated for the studies to the understanding of Graft performance in terms of energy consumption, the total amount, and thus the average access performance. In addition, LoRa uses use of forward error correction coding to improve the immunity to interference. The high Icc range, is distinguished due to a large network of budget, 155 to 170 db.
3) *LoRa Alliance:* The LoRa Alliance is an organization founded in 2015 to support the LoRaWAN protocol as the long-range wide-area network (can), as well as ensuring the compatibility of all of the LoRaWAN products and technologies. It is a non-for-profit organisation with over 500 members.Some of the Important members of the Alliance, IBM, Everynet, Actility, a MicroChip, Orange, Cisco, KPN, Swisscom, Semtech, A2A Smart City SPA, Bouygues Telecom, Singtel, Proximus, that The Things Industries, and Cavagna Group. In 2018, the LoRa Alliance has more than 100 LoRaWAN network operators in more than 100 countries.[26] and The Alliance is managed by the leisure management Group in Beaverton, Oregon.
4) *LoRaWAN for 4G/5G Networks:* With the expansion of the Internet of Things, it is possible to find it in the LoRaWAN as a solution to the high cost and high energy-IoT, for 4G/5G networks. With the help of LoRaWAN, it will allow us to solve the problem with the newly-developed 5G network, and will be able to recover a number of situations.
5) *Features*

a) LoRa Modem
b) Operating Voltage: 3.3V
c) Operating Frequency: 433Mhz
d) Half-Duplex SPI communication
e) Modulation Technique FSK,GFSK,MSK,GMSK,LoRa
f) Packet size: 256 bytes
g) Sensitivity: -148db

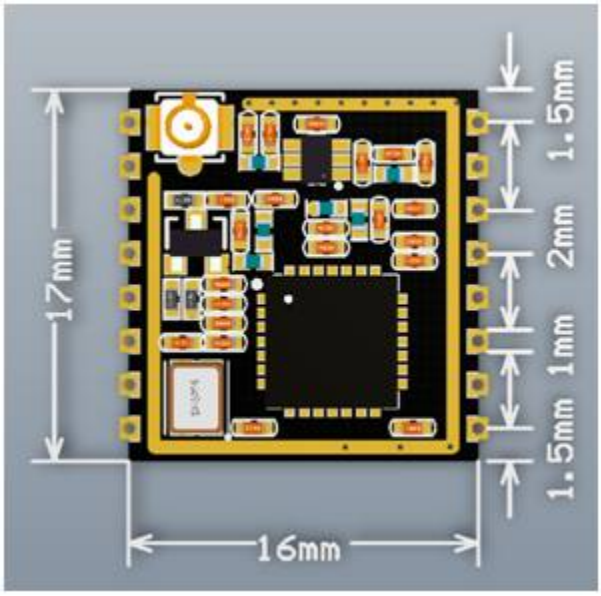
6) *Setting up LoRa SX1278:* The LoRa SX1278 works with SPI communication protocol so it can be used with any microcontroller that supports SPI. It is mandatory to use an Ariel (antenna) along with the module else it might damage the module permanently. The module should be powered only with 3.3V and the SPI line can be connected to uP/uC as shown in the image below.

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To communicate with the module some standard libraries are also available for Arduino like LoRa by Sandeep and other platforms. The module comes in a surface mount style package hence care should be taken while soldering. It is also a common practice to solder wires and pins with the module to use it as through hole module.l

E. 2D Model



F. Brush Less DC Motor



Fig 9. BLDC

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In brushless DC motors, the electronic servo system replaces the commutator contacts. The electronic sensor detects the rotor angle and controls the semiconductor switch as transistors change current through the windings, which change the direction of current or, in some motors to turn it off, at the right angle for the electromagnet to form a -torque in one direction. Slide contact removal allows non-brushless engines to have minimal impact and long life; their working life is limited only by the lifespan of their bears.

A standard brushless car has permanent magnets around the arm that do not change, eliminating the problems associated with the current connection to a moving armature. The electronic controller replaces the DC passenger car assembly assembly, which continues to change the section to the windings to keep the car turning. The controller enables a simultaneous power distribution using a solid state circuit rather than a flow system Brush-free motors offer several advantages over DC brushed, including high to heavy torque, increased efficiency producing more torque per watt, increased reliability, reduced noise, longer life by eliminating road erosion and road travel. , the elimination of ionizing sparks from the commutator, and the complete reduction of electromagnetic interference (EMI). Since there are no pulses on the rotor, they are considered centrifugal force, and because the windings are supported by the housing, they can be cooled by operation, which does not require air penetration inside the car to cool. This means that the occupants of the vehicles can be completely sealed and protected from contamination or other external matter. Brush-free car switching can be done on software using a microcontroller, or it can be done alternatively using analog or digital circuits. Exchanging electronic items instead of brushes allows for greater flexibility and capabilities that are not available with brushed DC cars, including speed limits, microstepping performance to control slower and smoother movements, and torque grip when stationary. Control software can be made with a specific vehicle used in the system, which results in better mobility performance. The maximum power that can be used in an unmanned vehicle is limited to almost the extreme heat which weakens the exhaust and will damage air congestion.

When converting electricity into electric power, brushless motors work better than brushed motors mainly due to the lack of brushes, reducing energy losses due to collisions. Improved performance is greater in regions that do not load and have a low load of vehicle operation curve. Areas and requirements where manufacturers use non-brush DC motors include unsafe performance, high speed, and performance where the gloss is dangerous (e.g. explosive areas) or may affect sensitive electrical equipment.

VI. CIRCUIT DIAGRAM

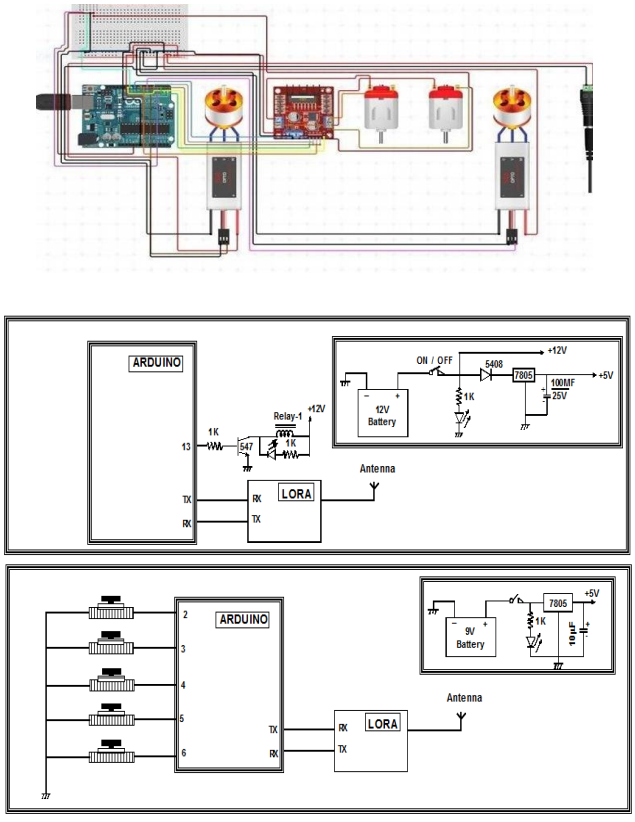


Fig 10.Circuit diagram

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VII. APPLICATION

A. Is It a remote mining vehicle
B. Engineering and bridge construction
C. Farming Fish farming
D. Bird Airport for birds in the airport and for rescue operations.
E. Pat Electrical power rotation and safety.

VIII. FUTURE SCOPE

1) In addition to a robotic machine that can capture various types of platforms such as small spy cameras, land mines, etc., it can be used for activities related to security issues.
2) When attaching a small light that works remotely before hovercraft, it can work at night and in areas where very low light is available.

Range Its range can be enhanced using IR LED's high direction. Also, it can be upgraded using the Camera and installed with the MATLAB software, thus allowing us to see the objects and its detection.

IX. CONCLUSION

In this paper we have discussed our approach to create a new type of rescue system to save people lives. The system designed is used for real time application and is secure. There is still lot of scope for development in the project.

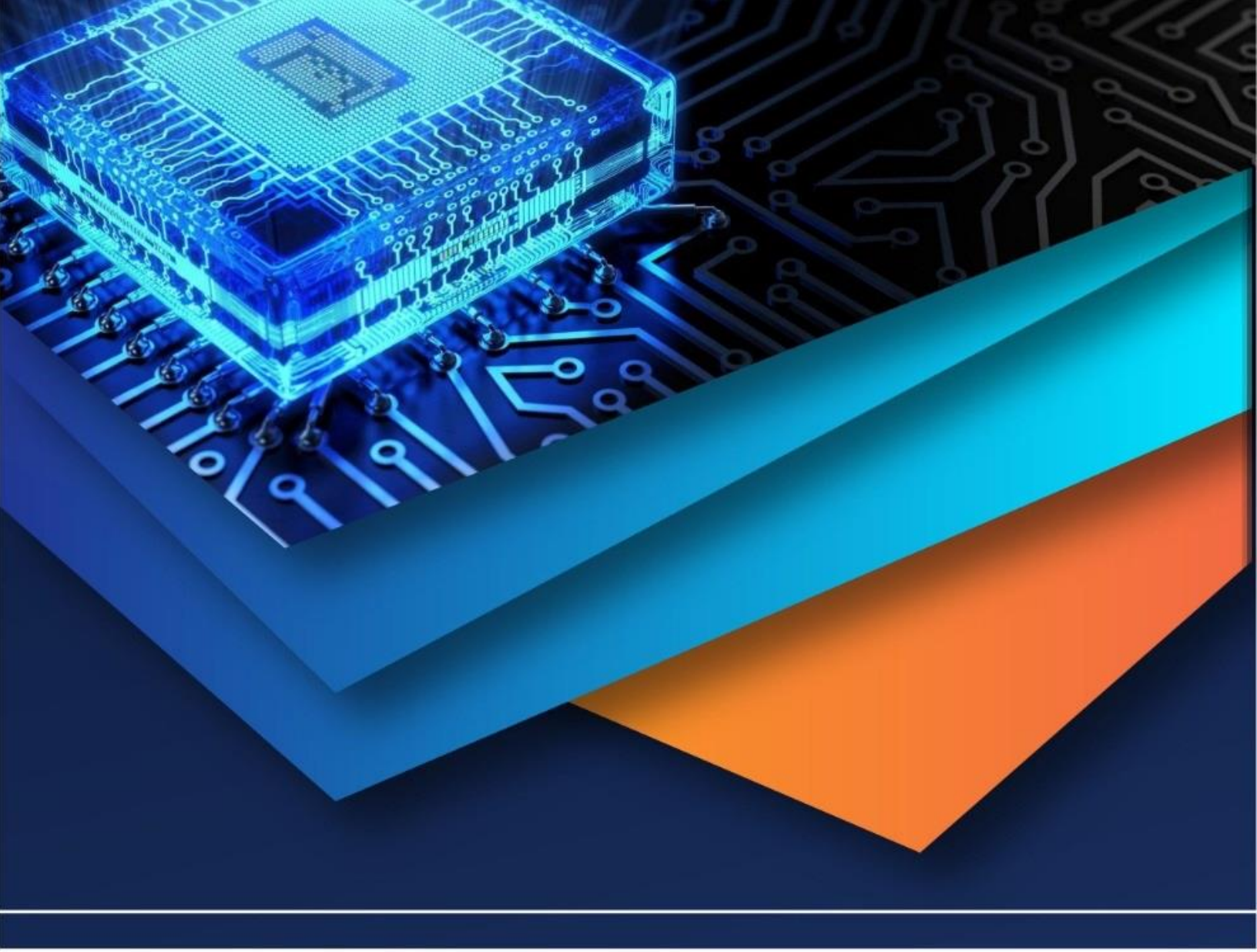
X. ACKNOWLEDGMENT

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