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QUADCOPTER: Four Rotor Copter

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Abstract- Recently, many studies are being done for providing a proper detecting method which can track the persons in different situations with high efficiency. Although, several studies have been done for detect and tracking human either from a fixed camera station or from a camera which has motion, there is limited contributions for real-time human track or detect from camera which is installed on a real quad copter. The aim of this research is developing a real-time system for detect as well as tracking of the humans by a quad copter. In this regards we applied edge detection approach. The system is under implementation experimentally. The main object of this work was employing quad copter as a safety and security robot at the wide range areas.

Keywords - Quadcopter, Motors, Microcontroller etc.

I. INTRODUCTION

Quad copter also known as quadrotor copter or four rotor copter is a vehicle that moves upward with the help of its four propeller powered by four electric motors. These four vertically upward rotors help in any maneuver in its flying region. Since the quad copter is classified as unmanned aerial vehicle (UAV), it is believed that by the increasing demand for autonomous UAVs, quad copters are going to be developed in autonomous control system. Regarding their complicate structure, relate to the issue.[1][2][3] The quadcopter in these days taken into consideration by many of the robotics researches and its complication causes special abilities which can be used in broad range of usages.[4][5]Quad copter unmanned aerial vehicles (UAV) are used for supervision and reconnaissance by military and law enforcement agencies, as well as search and rescue missions in urban environments, which is a small UAV that can quietly hover in place and use camera to tracking people on the ground.

The basic design of quad copter consist of two pairs of propellers one is clockwise(CW) and another one is anti-clockwise(ACW), four 1400kV BLDC motors, four 30amp ESCs four motors, and the most important thing is KK2.1 microcontroller which consist of one accelerometer and gyroscopic sensor which will help the copter during its flight, and for modification we used a small solar panel which will help to give power to quad copter during sunlight, and the battery used is Li-Po 3 Cell, 11.1V, 5000mAh, 20C discharge Battery.

In the past time we have seen many quadcopters but there was something bad in them that thing was their cost and weight.

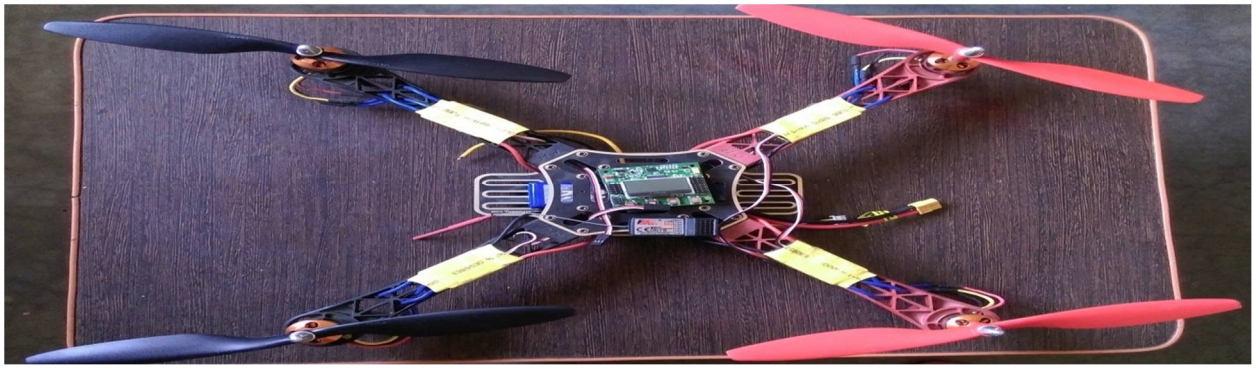

Fig 1: Assembled Quadcopter

Due to their heavy weight they require more high power motors and batteries so they were costly, also increased weight generate more drag force on quadcopter due to this their flight time and height was less. So in our project we tried to overcome these problems, the main thing on which we are focusing is cost, we tried to make it minimum cost.

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II. COMPONENTS

A. *Microcontroller*

Microcontroller consists of 3-axis gyroscope and 3-axis accelerometer. An accelerometer is a device measures acceleration forces. A gyroscope is a device used primarily for navigation and measurement of angular velocity. 3 axis gyroscopes are often implemented with 3-axis accelerometer to provide a full 6 degree of freedom [DOF] motion tracking system.

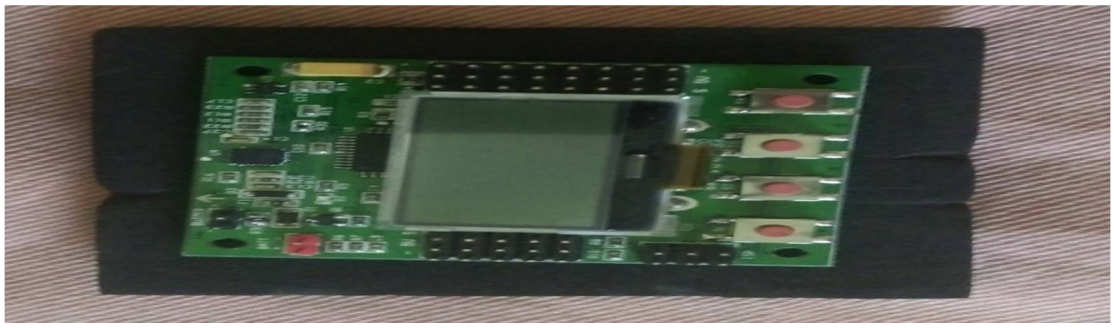

Fig 2: Microcontroller

B. *Dc Brushless Motor*

Brushless motors has more advantage compare to brushed motor, force motor and servo motor in terms of comparatively more efficiency, reliability, longer life span, more power, high torque per weight, reduced noise factor, elimination of ionizing sparks from commutator and overall reduction of electromagnetic interface**.**

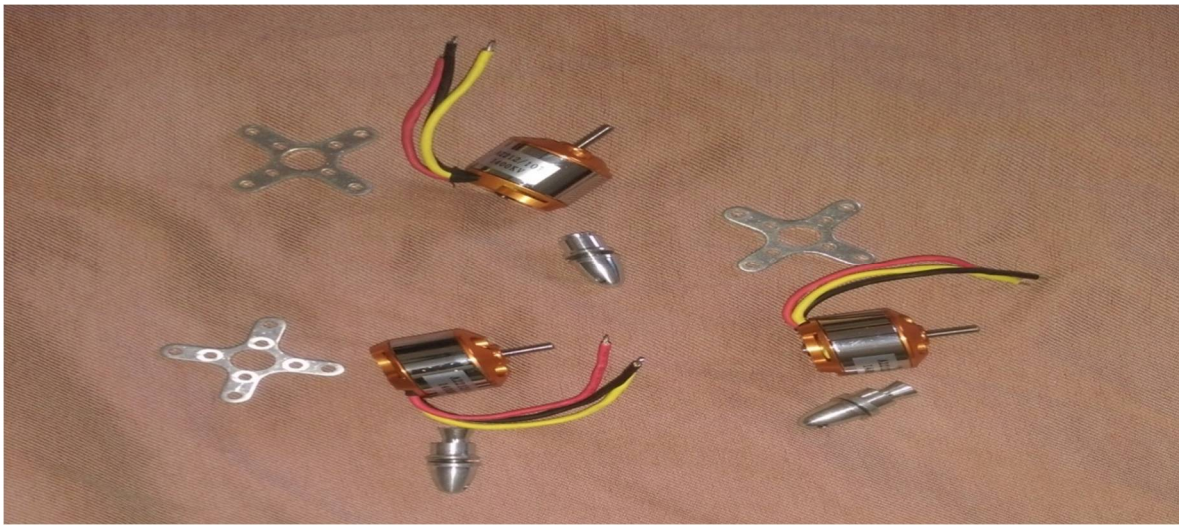

Fig 3: Motors

C. *Propellers*

Propellers are used to generate aerodynamic lift force. A pair of clockwise rotating and a pair of counter clock wise rotating propellers nullifies the gyroscopic effect of each individual motor. We will be using propellers having diameter of 10 inches and pitch of 4.5 inches/revolution.

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Fig 4: Propellers

D. Electronic Speed Controller (ESC'S)

An ESC is an electronic circuit used to vary an electric motor's speed and also acts as dynamic brakes of the system. An ESC controls the brushless motor by converting the supplied DC from the battery into three phased AC. We are using v3.1, 25 A basic Turnigy brushless speed controller**.**

Fig 5: Electronic Speed Controller

E. Battery

Lithium polymer batteries (Li-Po) are most popular for powering remote control aircraft due to its light weight, energy density, longer run times and ability to be recharged. We selected turnigy 2200mah, 11.1 V, 3 cell, 25 C battery.

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Fig 6:Battery

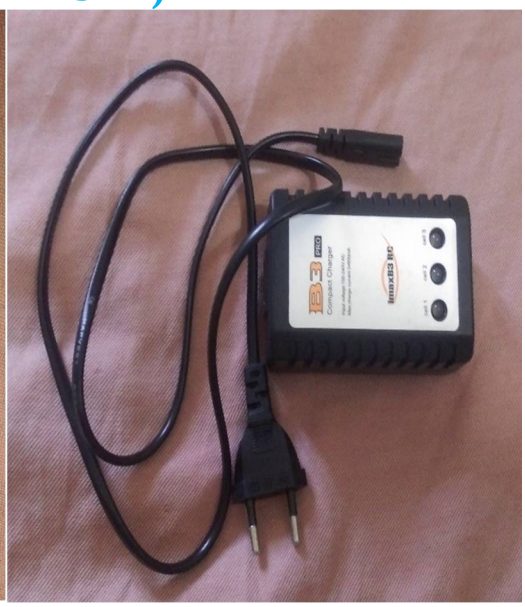

Fig 7: Charger

F. Li-Po Alarm

A Li-Po alarm is an audible and visual alarm that plugs into battery to provide a voltage warning during flight to land the quadrotor prior to failure due to low voltage**.**

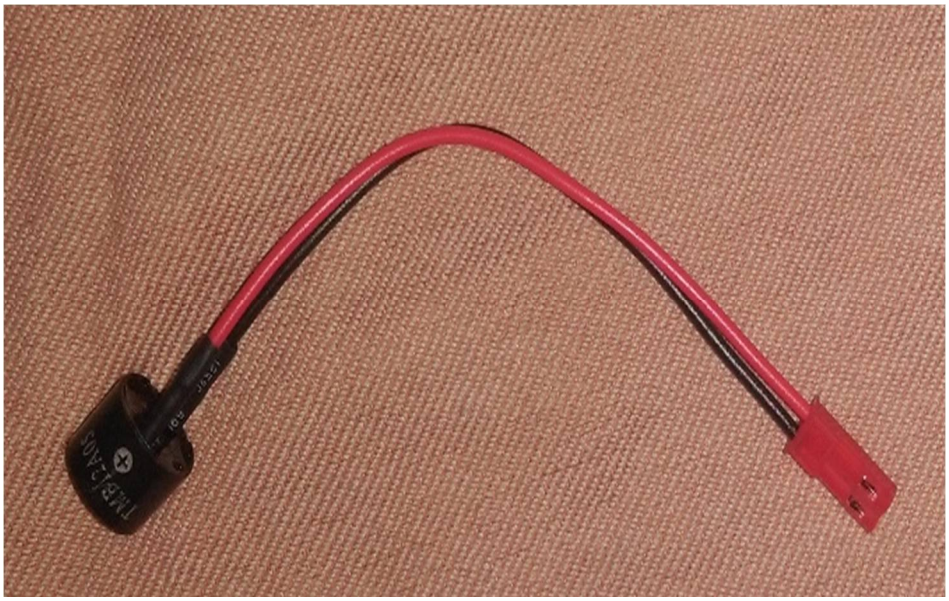

Fig 8: Li-Po Alarm

G. Remote Controller (RC)

A radio control (RC) system needs a transmitter and receiver. Remote controller is used to serve multi purposes like voltage regulation to ESCs, steering control, vertical take-off and landing (VTOL).

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Fig 9: Remote Controller

III. WORKING PRINCIPLE

All DC brushless motor attached by parallel connection with other motors. Power distributed to power distribution board from battery. Further the power distributes equally to four electronic speed controllers and then goes in to each DC brushless motors. Accelerometers will measure the angle of Quadrotor in terms of X, Y and Z axis and accordingly adjust the RPM of each motor in order to self stabilize by it self. The stability is provided by setting the direction of rotation clockwise of one set of opposite motors and counter-clockwise of other set of motors which nullifies the net moment and gyroscopic effects. By using this principle one is able to adjust the speed and can get desired speed of each individual motor in order to get desired yaw, pitch and roll. RPM of the shaft of a motor is a function of voltage provided to that motor. Roll and pitch can be controlled by changing the speed of the appropriate motor, while yaw control involves proper balancing of all four motor results in to change in moment and force applied to take appropriate turn. Controlling of quadrotor involves different four states.

A. Upward motion (Z direction)

The force required for this motion is known as lift force and generated by thrust produced by four propellers rotating at same speed**.**

B. Yaw Motion (ψ)

This motion is attained by increasing speed of appropriate set of motors. By generating couple of force from two neighbour motors, yawing can be achieved.

C. Pitch Motion (ɵ)

This motion can be attained by generating couple of forces from the set of motors in the direction of the movement (Front and rear motor).

D. Roll Motion (Φ)

This motion can be attained by generating couple of forces from the set of motors in the direction other than the direction of motion (Left and Right side).

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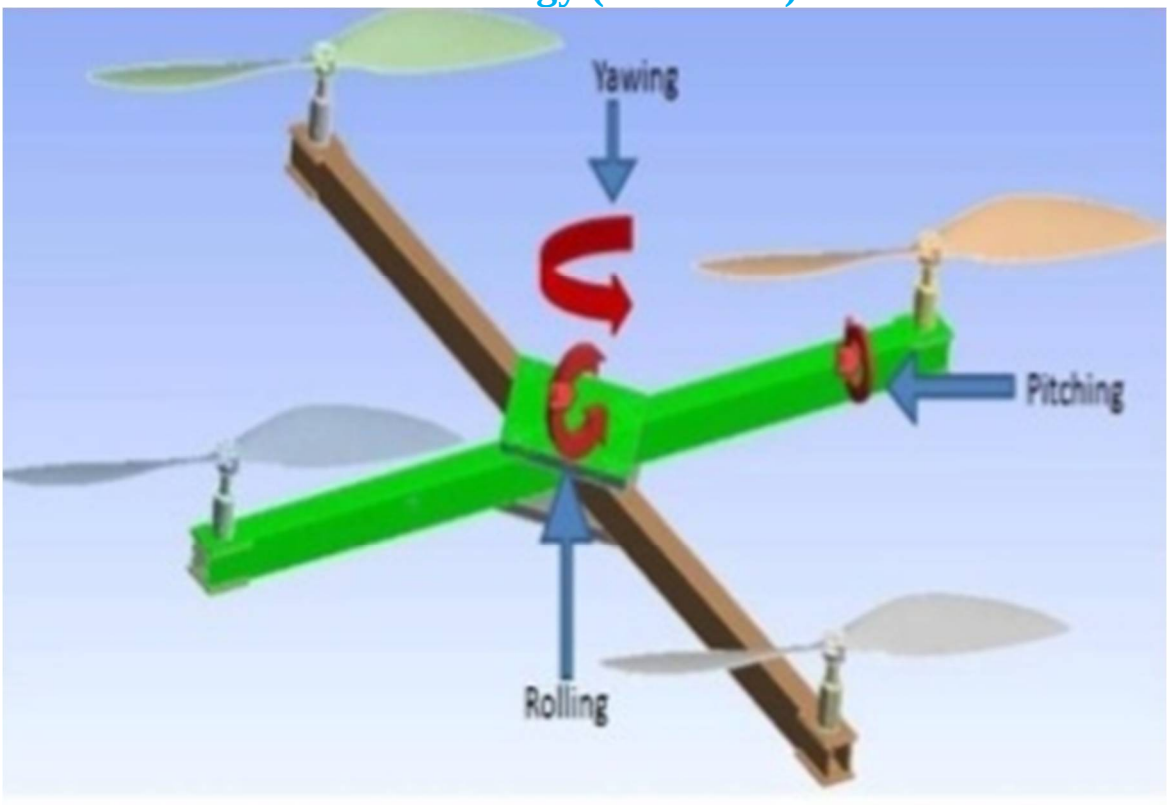

Fig 10: Gyroscopic Effects

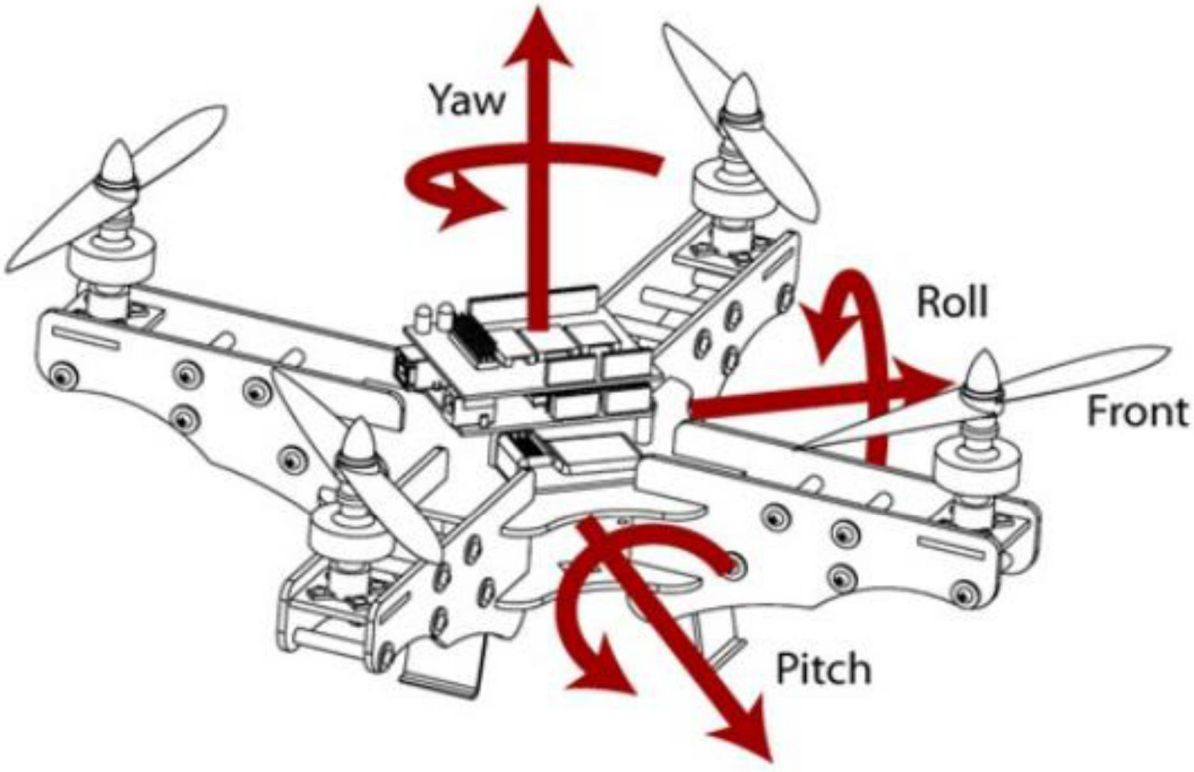

Fig 11: Axes of Quadcopter

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IV. COST ESTIMATION

Name of Component	Cost of Unit Component(Rs)	No. of Component	Total
BLDCMotor	650	4	2600
Frame	1100	1	1100
Esc's	550	4	2200
Propeller	200	4	800
Battery	3000	1	3000
Microcontroller Board	2000	1	2000
Remote Control	3000	1	3000
Extra Material			300
Total			15000

V. APPLICATIONS

A. Military use (provide necessary materials during war)
B. Covert operations
C. Traffic surveillance
D. For checking the gas levels in industries
E. Unmanned military warfare
F. For construction purpose
G. Geo physical survey
H. Railway track bed inspection
I. Coastal mapping
J. Preventing Diseases

VI. CONCLUSION

The quadcopter is a novel design which can be easily controlled when it is compared to a helicopter. We have fabricated the frame and the arms of the quadcopter in such a way that its weight should be low as possible.We used latest parts on the basis of our research to improve its efficiency.

The knowledge we have gained is valuable but the quad copter is vast topic and the time was not sufficient to calculate all the aspects of the quad copter. We plan to do further research in the future as we now know the various problems faced by the quad copter. It has fixed rotors and their movement can be controlled just by changing the speed of the blades. The applications of the quad copter are numerous and with the requirement and advancement of UAV's , the scope for its use has increased drastically.

However, yet some issues are to be decoded completely such as the short flight time, balancing and the weight carrying capacity which have to be further investigated. But we have showed that the advantages outweigh the disadvantages. A lot of research needs to be done on the quad copter for the best results in the future. Considering the financial aspects in designing the Quad copter initial cost is high as the parts purchased are genuine, but if we manufacture these quad copters in mass cost can be minimized, based upon the type of applications, cost may increase or decrease.

VII. FUTURE SCOPE

A. Quadcopter principles can be used to fly a car.
B. Quadcopter can be controlled with smart phones.
C. Also we are thinking of using GPS for long range and ultrasonic sensors for object avoidance.

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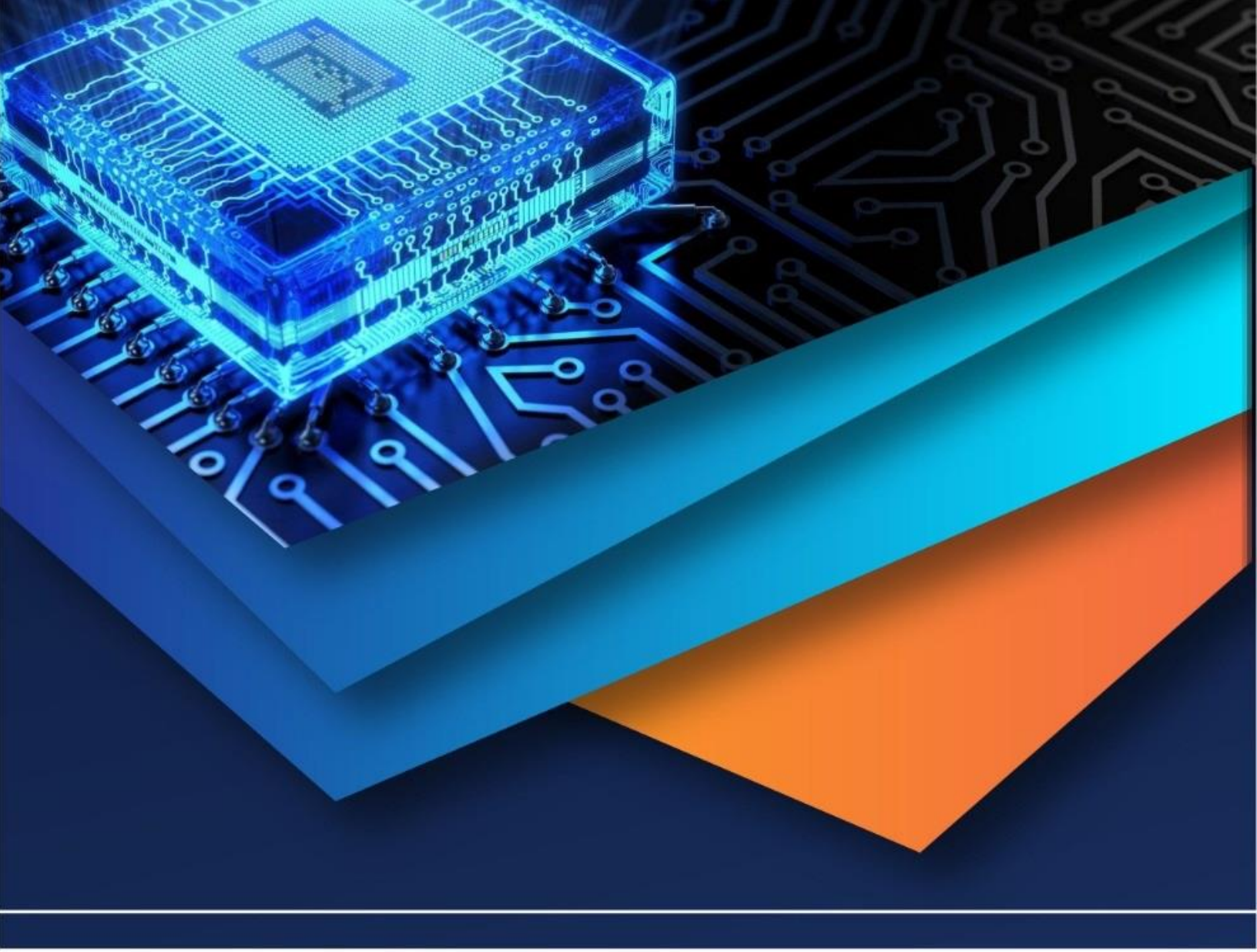

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