iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35933

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

Intelligent Accident-Detection and Ambulance - Rescue System

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Abstract: ***Accidents are the major causes of death, be it in today's most technologically advanced world. Road accidents and traffic congestion are the major problems in urban areas. Currently there is no technology for detection of accidents. Also due to the delay in reaching of the ambulance to the accident location and the traffic congestion in between accident location and hospital increases the chances of the death of the victim. There is a need of introducing a system to reduce the loss of life due to accidents and the time taken by the ambulance to reach the hospital. Yearly lots of visually impaired people lose their lives by being victims of such accidents. To overcome the drawback of existing system we will implement the new system in which there is an automatic detection of accident through sensors and it will send the location of the accident to the Nearest Hospital, Police station and to the family members which will rush an ambulance from a nearest hospital to the accident spot. This will minimize the time of ambulance to reach the hospital. To achieve this we are using like MEMS (Micro Electro Mechanical Systems) (MPU6050), And using GPS module we will get the location where the accident took place and by using NODEMCU and IFTTT messaging protocol we will send the message of obtained location. Along with this there would be control of traffic light signals in the path of the ambulance using RFID TECHNOLOGY. This system is fully automated, thus it finds the accident spot, controls the traffic lights, helping to reach the hospital in time.***
Keywords: NODE MCU, MPU6050 (MEMS SENSOR) (ACCELROMETER TILT SENSOR), IFTTT, NEO6M GPS MODULE, RFID TECHNOLOGY.

I. INTRODUCTION

This is a project about Intelligent Accident Detection and Ambulance Rescue System. In this chapter the problem and motivation, research objectives, project scope, project contributions and the background information of the project will be discussed in detail.

A. Problem Statement and Motivation

1) To overcome the drawback of existing system we will implement a system in which there is an automatic detection of accident through sensors (MEMS) (Micro Electro Mechanical Systems) (MPU6050) and NODEMCU in the vehicle. A GPS module in the concerned vehicle will send the location of the accident using the IFTTT protocol to the Nearest Hospital, Police station and to the family members which will rush an ambulance from a nearest hospital to the accident spot.
2) Along with this there would be control of traffic light signals in the path of the ambulance using RFID TECHNOLOGY.
3) This will minimize the time of ambulance to reach the hospital. A patient monitoring system in the ambulance will send the vital parameters of the patient to the concerned hospital.
4) This system is fully automated, thus it finds the accident spot, controls the traffic lights, helping to reach the hospital in time.

B. Components and Tools

1) NODEMCU
2) MPU6050(MEMS SENSOR) (ACCELROMETER TILT SENSOR)
3) ARDUINO IDE
4) NEO6M GPS MODULE
5) MFRC522 RFID READER AND TAGS

II. LITERATURE REVIEW

International Journal of Science & Technology Research volume 3, issues 6, JUNE 2014, "Intelligent Accident-Detection and Ambulance- Rescue System", Bhandari Prachi, Dalvi Kasturi, Chopade Priyanka, To overcome the drawback of existing system we will implement the new system in which there is an automatic detection of accident. A sensor, GPS, GSM unit fitted in the vehicle detects the accident and sends the accident location to a main server unit which houses the database of all the nearby hospitals. An ambulance is rushed to the accident spot which carries the patient to the hospital and simultaneously monitors the vital parameters like temperature and pulse rate and conveys them to the concerned hospital. Along with this there would be control of traffic light signals in the path of the ambulance via RF communication to provide a clear path for the ambulance. This will minimize the time required by the ambulance to reach the hospital. Intelligent accident-detection and Ambulance-rescue system.

The system consists of three main units, which coordinate with each other and make sure that the ambulance reaches the hospital without any time lag. Thus our system is divided into following four units:

1) The vehicle unit.
2) The ambulance unit.
3) The traffic junction unit.
4) The control unit.

A. Vehicle Unit

For implementation of this project, vehicle unit should be installed in every vehicle .It consists of microcontroller along with the accelerometer, GPS and GSM module and sensors to sense the accident. On impact on the vehicle, information about accident is send to the main server. This information consists of the location of accident detected by GPS module installed in vehicle. The GPS system finds out current position of vehicle (latitude and longitude) which is the location of accident spot and gives that data to GSM module. This information to the main server is conveyed by GSM module. There is also provision of avoidance of accident by using accelerometer (ADXL 335). Accelerometer alerts the driver by turning on the buzzer whenever the position deviates from the normal.

Control unit is the brain of our system. Practically, the control unit will house all the database of all the nearest hospitals in order to send an ambulance to the accident spot. It receives the message about accident location from the GPS and GSM module installed in vehicle unit and responds accordingly.

B. Ambulance Unit

Control unit sends the ambulance to the accident location. Ambulance collects the victim from the accident location. While in the ambulance the vital parameters of the patient temperature and pulse rate are continuously monitored and conveyed to the concerned hospital. We are using LM35 temperature sensor whose output voltage is linearly proportional to the Celsius (centigrade).For measuring pulse rate we are using IR based obstacle sensor. Normally there is delay in ambulance reaching the hospital due to traffic congestion. To overcome this delay, the traffic signals in the path of ambulance are controlled via RF communication. The ambulance section consists of an RF transmitter and the traffic unit will consist of the RF receiver. The RF transmitter on the ambulance will communicate with the RF receiver of the signal section and make the signal green whenever it is within a 100m radius. As a result of which the ambulance will have a clear path all along its way to the hospital without any traffic congestion.

C. Traffic Junction Unit

Whenever the ambulance reaches to the traffic signal (approximately 10m) the traffic signal will be made to green through RF communication. Thus the ambulance will have clear path to reach the hospital without any traffic congestion along the way. This system is fully automated, thus it finds the accident spot, controls the traffic lights,helping the victim to reach the hospital in time.

III. METHODOLOGY

In the process of detecting the accident we are using MEMS MPU6050 sensor, as it contains both gyroscope and accelerometer, and to get the location of the place where the accident occurred we are using GPS module and to send the location we are using IFTTT messaging protocol. And in the detection of the ambulance in the traffic signal we are using RFID.

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.
It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.
If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output.
Let's see MPU6050 inside sensors.

A. 3-Axis Gyroscope

The MPU6050 consist of 3-axis Gyroscope with Micro Electro Mechanical System (MEMS) technology. It is used to detect rotational velocity along the X, Y, Z axes as shown in below figure.

1) When the gyros are rotated about any of the sense axes, the Coriolis Effect causes a vibration that is detected by a MEM inside MPU6050.
2) The resulting signal is amplified, demodulated, and filtered to produce a voltage that is proportional to the angular rate.
3) This voltage is digitized using 16-bit ADC to sample each axis.
4) The full-scale range of output is +/- 250, +/- 500, +/- 1000, +/- 2000.
5) It measures the angular velocity along each axis in degree per second unit.

B. 3-Axis Accelerometer

The MPU6050 consist 3-axis Accelerometer with Micro Electro Mechanical (MEMs) technology. It used to detect angle of tilt or inclination along the X, Y and Z axes as shown in below figure.

1) Acceleration along the axes deflects the movable mass.
2) This displacement of moving plate (mass) unbalances the differential capacitor which results in sensor output. Output amplitude is proportional to acceleration.
3) 16-bit ADC is used to get digitized output.
4) The full-scale range of acceleration is +/- 2g, +/- 4g, +/- 8g, +/- 16g.
5) It measured in g (gravity force) unit.
6) When device placed on flat surface it will measure 0g on X and Y axis and +1g on Z axis.

a) Calculations

Note that gyroscope and accelerometer sensor data of MPU6050 module consists of 16-bit raw data in 2's complement form.
Temperature sensor data of MPU6050 module consists of 16-bit data (not in 2's complement form).
Now suppose we have selected,
- Accelerometer full scale range of +/- 2g with Sensitivity Scale Factor of 16,384 LSB (Count)/g.
- Gyroscope full scale range of +/- 250 °/s with Sensitivity Scale Factor of 131 LSB (Count)/°/s.

Then,
To get sensor raw data, we need to first perform 2's complement on sensor data of Accelerometer and gyroscope.
After getting sensor raw data we can calculate acceleration and angular velocity by dividing sensor raw data with their sensitivity scale factor as follows,

➢ *Accelerometer values in g (g force)*

Acceleration along the X axis = (Accelerometer X axis raw data/16384) g.
Acceleration along the Y axis = (Accelerometer Y axis raw data/16384) g.
Acceleration along the Z axis = (Accelerometer Z axis raw data/16384) g.

➢ *Gyroscope values in °/s (degree per second)*

Angular velocity along the X axis = (Gyroscope X axis raw data/131) °/s.
Angular velocity along the Y axis = (Gyroscope Y axis raw data/131) °/s.
Angular velocity along the Z axis = (Gyroscope Z axis raw data/131) °/s.

➢ *Temperature value in °/c (degree per Celsius)*

Temperature in degrees C = ((temperature sensor data)/340 + 36.53) °/c.

➢ *For example,*

Suppose, after 2' complement we get accelerometer X axes raw value = +15454
Then Ax = +15454/16384 = 0.94 g.

C. What is GPS System & Its Working

The navigation system based on satellite like Global Positioning System (GPS) is made up of a 24 satellite network located into orbit through the U.S. DoD (Department of Defense). This system is mainly designed for military applications; however, the government made the system accessible in the year 1980 for civilian use. This system performs in any kind of environment around the world for 365 days at any time. The GPS includes 24 satellites that rotate around the sphere one time for every 12 hours to offer worldwide time, position & velocity information. The main function of GPS is to identify the locations on the globe precisely by determining the distance from the satellites. This system lets you create otherwise record exact locations on the globe & assist you to navigate from those locations. Basically, this system was mainly designed for military applications but in the year 1980, it was made accessible for civilian use. This article discusses an overview of the GPS system and its working & uses.

D. RFID Technology

RFID is abbreviation of Radio Frequency Identification. RFID signifies to tiny electronic gadgets that comprise of a small chip and an antenna. This small chip is competent of accumulating approx 2000 bytes of data or information. RFID devices is used as a substitute of bar code or a magnetic strip which is noticed at the back of an ATM card or credit card, it gives a unique identification code to each item. And similar to the magnetic strip or bar code, RFID devices too have to be scanned to get the details (identifying information). A fundamental advantage of RFID gadgets above the other stated devices is that the RFID device is not required to be placed exactly near to the scanner or RFID code reader. As all of us are well aware of the difficulty which store billers face while scanning the bar codes and but obviously the credit cards & ATM cards need to be swiped all though a special card reader. In comparison to it, RFID device can function from few feet away (approx 20 feet for high frequency devices) of the scanner machine.

Fig1: Implementation in Traffic

IV. IMPLEMENTATION AND APPROACH

For the implementation of the system here we are first dividing the whole system in to two parts one is detection of the occurrence of the accident and the other part is making the way for the ambulance easy at the traffic junctions. In the process of detecting the occurrence of the accident we are using NODEMCU along with MEMS MPU 6050 sensor which will enable us to detect the accident occurrence and from there we will be sending this information to the GPS module which will generate the location of the place of accident occurred and from there through IFTTT message protocol we will be sending the location of the accident occurred to the chosen one in our family and to the nearest hospital, So that it will enable the arrival of the ambulance to the accident sport faster. From here the second part of the implementation will start, in the second part of implementation we will make the rout from the accident sport to the hospital easy so that it can arrive to the hospital as soon as possible, which could increase the chances of victim to be rescued. In this second part of evaluation we will be using RFID TEDCHNOLOGY and we will be detecting the ambulance which is standing at the junction waiting for the signal to be green and immediately will turns the signal green so that the ambulance can reach to the hospital

Components used

1) NodeMCU
2) MEMS MPU 6050
3) IFTTT Messaging Protocol
4) GPS Module
5) Arduino IDE
6) MFRC522 RFID READER AND TAGS

A. Our Approach

1) We will be interfacing NODEMCU with MEMS MPU6050 sensor, So that if the tilt occurs then the sensor will detect an accident and it will activate the GPS module and through the IFTTT protocol it will send the location where the accident occurred to the desired destination.

2) The location obtained can be sent to the nearest hospital or the family members so the there will be no delay in ambulance approaching to the accident location and as a next step we are using RFID TECHNOLOGY to detect the ambulance as it approaches to any traffic junction to make its way clear. So that there will be no delay in ambulance approaching the accident location and the ambulance approaching the hospital.

3) We will implement the whole system by dividing it into two units

a) vehicle unit

b) traffic unit

4) In vehicle unit we will be using NODE MCU, MEMS sensor, Ublox -Neo 6M GPS, IFTTT protocol. Here in vehicle MEMS sensor will detect the accident and send the information to the NODE MCU and using IFTTT protocol we will send the location to the ambulance and to the family members.

5) Along with this there would be control of traffic light signals in the path of the ambulance using RFID TECHNOLOGY.

6) RFID is used to detect the emergency vehicle. If any ambulance comes near when the ambulance at emergency comes to any traffic post the traffic signal automatically stop the signals and give green signal for the ambulance with the use of RFID module.

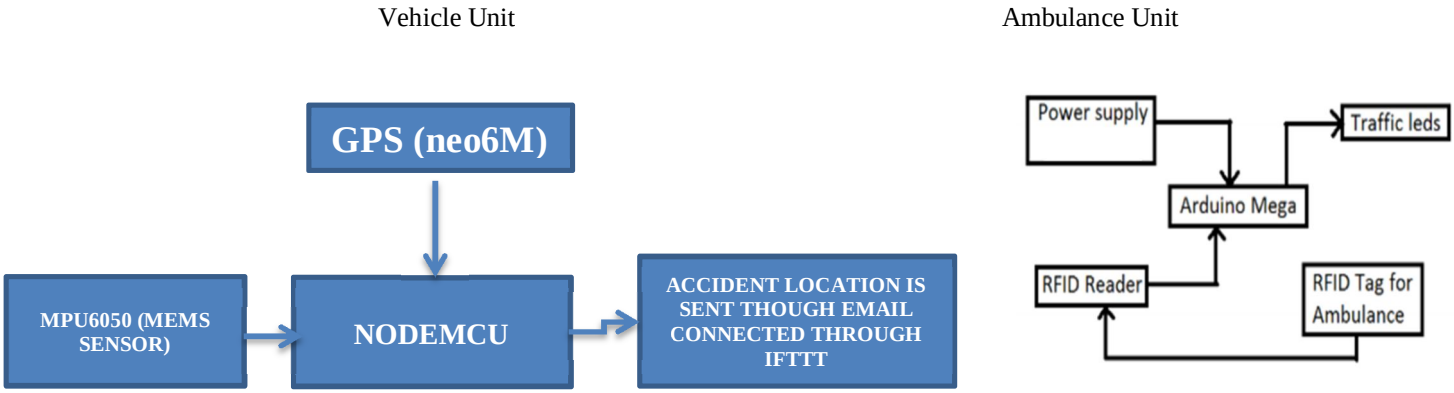


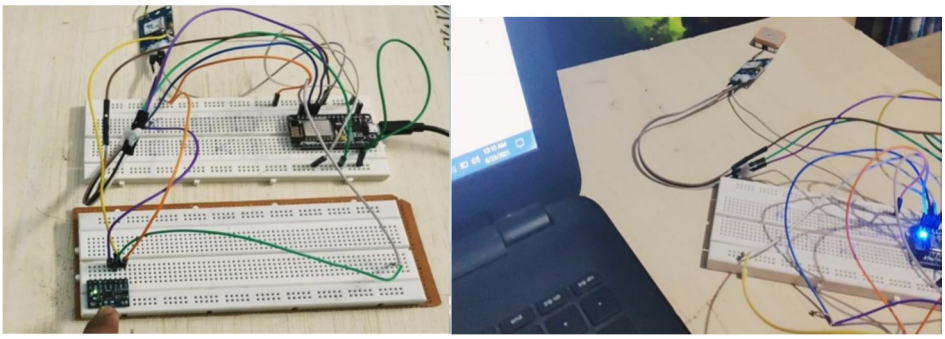
Fig2: Block Diagram Of Vehicle Unit And Ambulance Unit

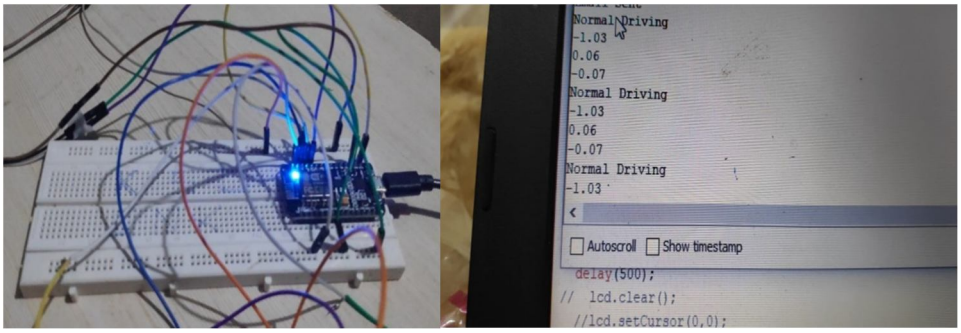
V. SIMULATION RESULTS

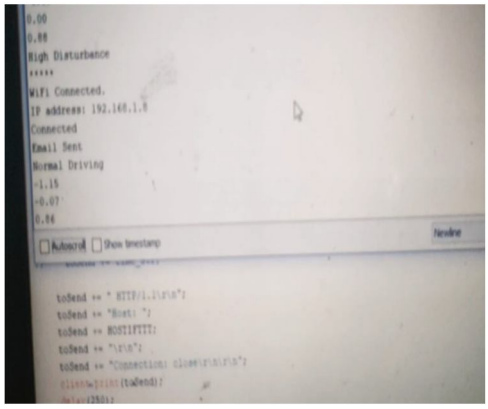
Here we are executing our project using nodeMCU ESP8266 and MPU 6050sensor first according to the circuit diagram we will making all the connection, but here we will be not connecting the RX,TX pins of GPS and SDA,SCA pins of MPU 6050, Now we will be writing our code in Arduino IDE in our PC using usb pin we will connect out NodeMCU with our PC and we will be dumping the code written in our PC onto NodeMCU now we will connect RX,TX pins of GPS module and SDA,SCA pins of MPU6050 to NodeMCU as we have dumped The code onto NodeMCU, now we will be waiting for GPS signal now the code will start executing.

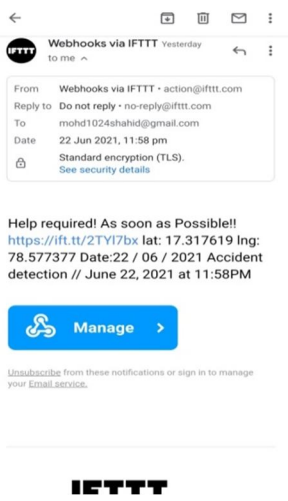
According to the inputs from the MPU6050 we can see the output on our PC, if there is no disturbance detected by the MPU6050 sensor then PC will display normal drive if there is a disturbance in the MPU6050 sensor the PC will display heavy disturbance and then the NodeMCU will connect to our mobile hotspot and it will generate the IP address and as per the code written in the GPS function NodeMCU will send a mail to the Gmail address in the IFTTT key. As IFTTT standards for if that then this when the MPU6050 will detect the disturbance then GPS will generate the location as it generated the location, date, time of the disturbance occurred IFTTT will send that to the Gmail present in IFTTT key. In this way we will be determining the accident location and we will be sending it to the desired person.

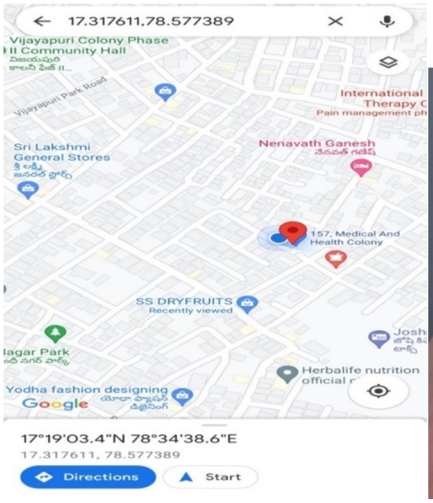
RFID is used to detect the emergency vehicle. If any ambulance comes near when the ambulance at emergency comes to any traffic post the traffic signal automatically stop the signals and give green signal for the ambulance with the use of RFID module.

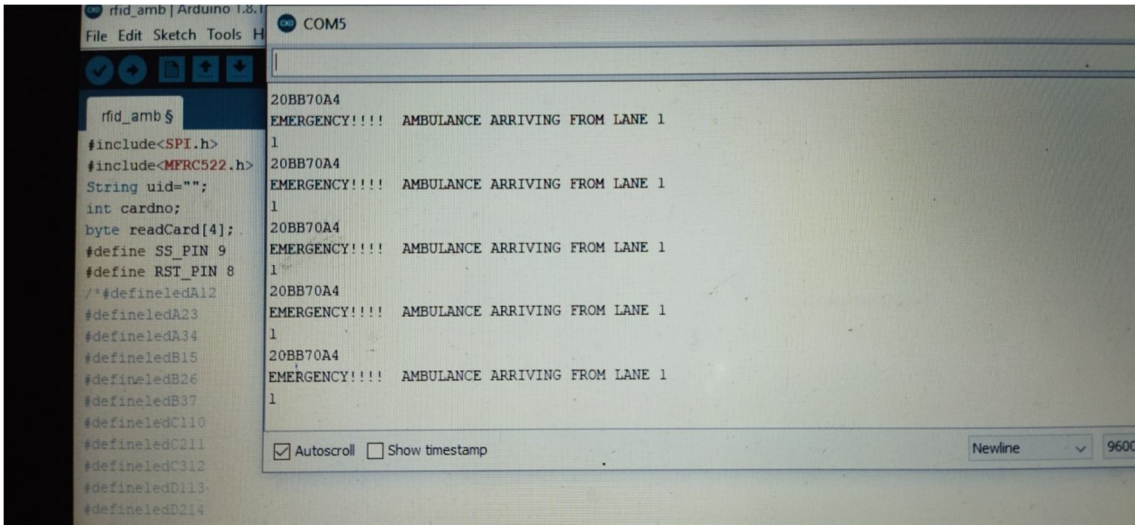












VI. CONCLUSION AND FUTURE WORK

A. As a conclusion we in this project We have implemented the Intelligent Accident-Detection And Ambulance- Rescue System using NodeMCU Module for detecting the accident using MPU6050 sensor interfacing GPS module for getting Location of accident vehicle is sent using IFTTT, Along with this there would be control of traffic light signals in the path of the ambulance using RFID TECHNOLOGY.

B. This will minimize the time of ambulance to reach the hospital.

C. This system is fully automated, thus it finds the accident spot and sends it to the ambulance, controls the traffic lights which helping to reach the hospital in time.

D. Thus we have presented a system to detect accident automatically and give a clear way to emergency purpose vehicles on road so that they can reach their destination in least time without stopping at traffic intersection. This system can be effectively implemented for an entire city or countries with large population like India for better results.

E. The accident alert system works well to avoid worst situations. In future the Project can be enhanced by adding some more advanced features like accuracy of geo location and accuracy of giving way to ambulance which would guide the visually impaired to any location.

F. Also we will extend this project further for Density Based Congesting system and for clearing the traffic problems in the bigger cities.

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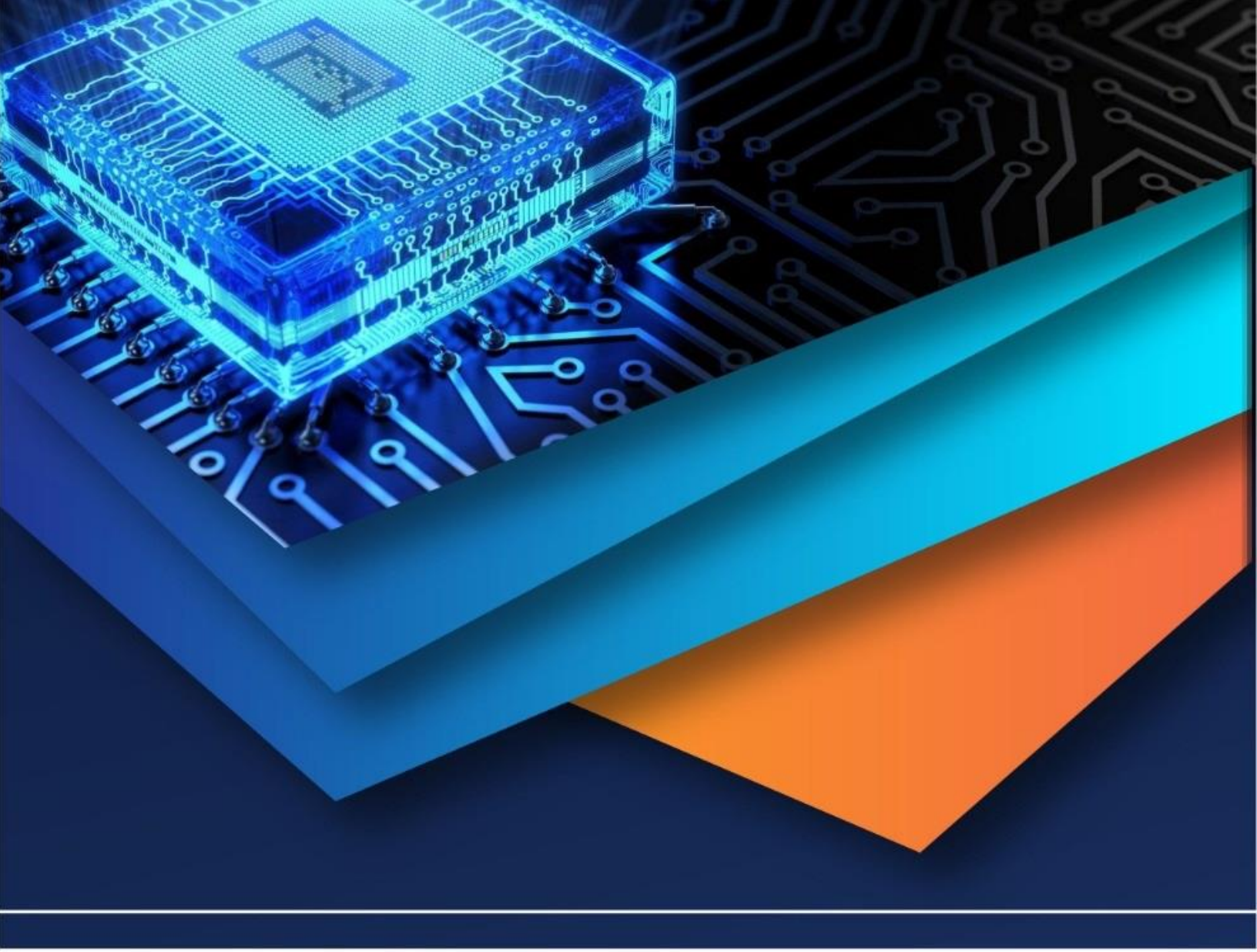

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