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IOT based Driver Assistant System

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Abstract: This paper is focused on automation process of driving system of vehicles. In case of public transport systems, the small negligible errors can cause a massive disaster. To mitigate this problem AI and IOT can be implemented. In this work we describe how a supportive system can detect the unnatural behaviour of the driver of public transport and will take regulatory action immediately in autonomous manner. In this article we will discuss on a model to overcome the problem with the help of IOT and AI. The only solution is the behavioural detection of the pilot/driver while driving and we have to be careful about the cost of the product so that it can be successfully implemented in reasonable price.
Keywords: IOT, UART, LDR, Automation, SCADA

I. INTRODUCTION

In present era IOT and AI has a massive impact on society. the Internet of Things is the concept of connecting any device (so long as it has an on/off switch) to the Internet and to other connected devices. The IoT is a giant network of connected things and people. which collect and share data about the way they are used and about the environment around them. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure in simple terms more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. It can be found easily in any newspaper or articles that there are numerous road accidents or train accidents or even plane crash due to sleeping of driver or pilot. In many cases the driver was in drunk condition. A small mistake causes a huge impact on passenger safety and life. Drowsy driving often goes unreported. Unless the driver admits falling asleep, drowsy driving. It is difficult to detect. Accidents are most common late at night and early in the morning. This is the body's natural sleep period. In this article we will discuss on a model to overcome the problem with the help of IOT and AI. Basically, most of the researches are based on self-driving system and increasing the accuracy. Here this paper is totally based on driver behaviour detection and predicting the chances of accident and to take precautionary measures to stop the unwanted accidents.

II. METHODOLOGY

It can be found easily in any newspaper or articles that there are numerous road accidents or train accidents or even plane crash due to sleeping of driver or pilot. In many cases the driver was in drunk condition. A small mistake causes a huge impact on passenger safety and life. The National Highway Traffic Safety Administration of India reports that drowsy driving is related to at least 100,000 motor-vehicle crashes and more than 2,500 deaths per year. About 50,000 drowsy-related crashes involve non-fatal injuries. The estimated annual loss related to drowsy driving is about Rs 10 billion. Drowsy driving often goes unreported when police complete an accident report. Unless the driver admits falling asleep, drowsy driving can be difficult to detect. Accidents are most common late at night and early in the morning. This is the body's natural sleep period. In this article we will discuss on a model to overcome the problem with the help of IOT and AI. A driver or pilot can be affected by Drowsiness/sleep, Heart Attack, Drunk.So, we have tried to find all possible solutions for those problem in single Device. We are focusing on the behavioural detection of the condition of driver. There should be a local data logger which continuously monitors the driving patterns, Heartbeat sensor, Speed sensor and motion sensor and eye blink detection system. Here in this project we have used all these things. We have tried to reduce the cost of the setup as well so we have neglected the image processing idea to detect the unnatural movement of the driver. This complete setup consists of several parts but the driver just has to wear a wrist band and a glass. Here we are categorizing the system into some distinct parts.

A. Detection system
B. Processing system
C. Communication system
D. Alert system
E. Control System

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III.DETECTION SYSTEM

In this part it consists of all the sensors and Inputs. The devices we are using as inputs it can provide Analog input as well as Digital inputs.

A. IR Sensor

IR (Infra-red) sensor. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED Light emitting diode and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED.

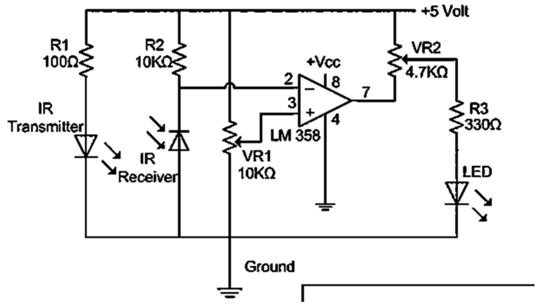

Fig1 : IR sensor internal circuit

It nearly same as LDR (light dependent resistor). The value of output signal changes as per the intensity of received IR radiation. Here we will use IR sensor in a glass to detect the eyeball movements and eye palpitations.

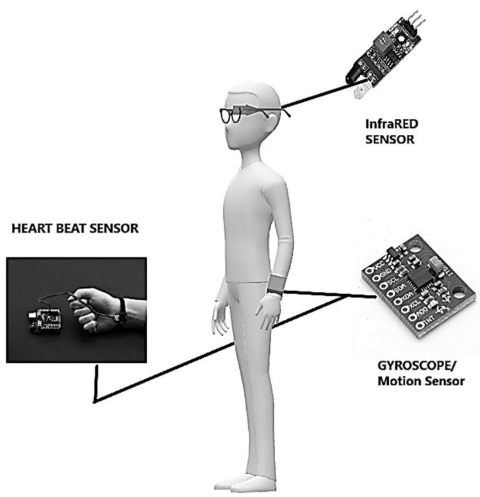

Fig 2 : All sensors attachments

B. Gyroscope Sensor

Gyroscope sensor is a device that can measure and maintain the orientation and angular velocity of an object. These are more advanced than accelerometers. These can measure the tilt and lateral orientation of the object whereas accelerometer can only measure the linear motion. Depending on the direction there are three types of angular rate measurements. Yaw- the horizontal rotation on a flat surface when seen the object from above, Pitch- Vertical rotation as seen the object from front, Roll- the horizontal rotation when seen the object from front. We are using this device to detect the hand movement of the driver. If it detects null values that means the person became idle means sleeping or in critical situation. It is connected as per the Fig 3.

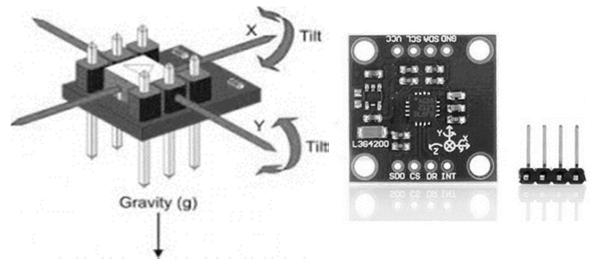

Fig 3: Gyroscope module and axis measurements

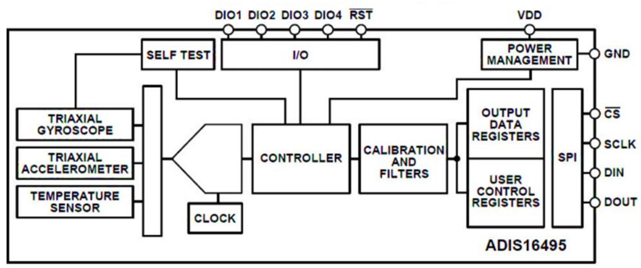

Fig 4: Block diagram of Gyroscope

C. Heart Beat Sensor

This sensor is used to monitor the rate of heart beat. Light beam with high intensity is passed through the fingertip or any body part. Now, when the heart pumps blood through the blood vessels, the finger becomes slightly more opaque; due to this, less amount of light reaches from the LED to the detector. With every heart pulse generated, the detector signal gets varied. The varied detector signal is converted into an electrical pulse. This electrical signal gets amplified and triggered through an amplifier which gives an output of +5V logic level signal. The output signal is also directed by a LED display that blinks on each heartbeat rate.

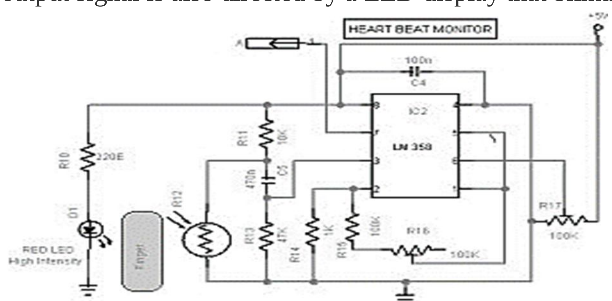

Fig 5: circuit diagram of Heartbeat sensor

It is connected in same hand band where the gyroscope is attached. The main reason to use this device to detect the abnormal pulse rate.

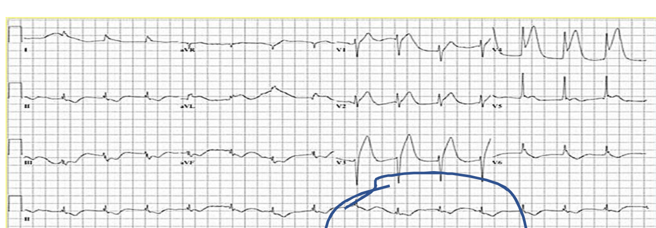

Fig 6: Sudden spike of heart rate before heart attack

By the sensor we will get to know about it in beforehand that the driver is going to have heart attack. Fig :6 represents the unnatural growth of ECG spikes which are signs before heart attacks. So heart beat sensor will detect the abnormality and send the signal to the main processing unit.

IV. PROCESSING SYSTEM

It is the heart of the IOT system where all the input values are analysed and the corresponding signal is transmitted to the output control units. Here for processor we are using ATMEGA 328 Microcontroller ATMEGA 328 is an eight (8) bit micro-controllers. It can handle the data sized of up to eight (8) bits. It is an AVR based micro-controller. Its built-in internal memory is around 32KB. It operates ranging from 3.3V to 5V. It has an ability to store the data even when the electrical supply is removed from its biasing terminals. Microchip Technology ATmega328 8-bit AVR Microcontrollers (MCUs) are high-performance RISC-based devices that combine 32KB ISP Flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, serial programmable USART, and more. ATmega328 MCUs execute powerful instructions in a single clock cycle, allowing the device to achieve throughputs approaching 1 MIPS per MHz while balancing power consumption and processing speed. These Microchip MCUs are designed for use in industrial automation and home and building automation. UART: 1, ADC: 8 channels, 10-bit resolution, Analog Comparators: 1, Flash (Kbytes): 32, EEPROM (Kbytes): 1, SRAM (Kbytes): 2, Temp. Range: -40 to 85°C

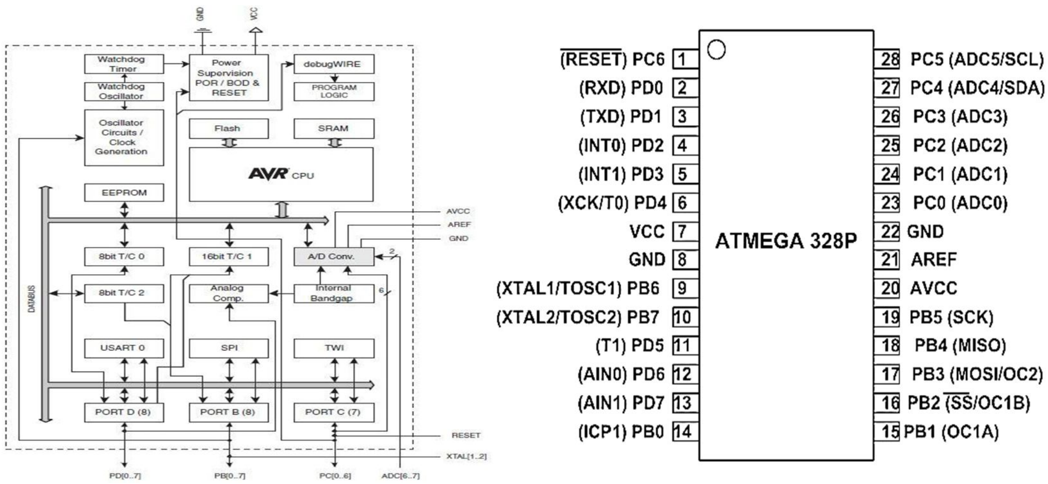

Fig 8: ATMEGA 328 circuit diagram.

ATmega-328 Microcontroller having twenty-eight (28) pins in total. In market this microcontroller is widely available it is available as embedded system also. It can be used as SPI (Serial peripheral interference). We have used this microcontroller to make the device work faster and can handle numerous operations at a single time.

V. COMMUNICATION SYSTEM

A. Node MCU

Here we are using WIFI or Bluetooth communication system between the components with each other. Node MCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. It is based on the Eula project and built on the Espressif Non-OS SDK for ESP8266. Here MCU means Microprocessor unit so, this means it has numerous CPUs .

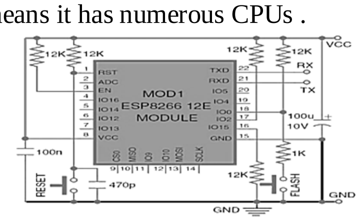

Fig 9: Node MCU ESP8266

Features: Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106, Operating Voltage: 3.3V, Input Voltage: 7-12V, Digital I/O Pins (DIO): 16, Analog Input Pins (ADC): 1, UARTs: 1, SPIs: 1

I2Cs: 1Flash Memory: 4 MB, SRAM: 64 KB, Clock Speed: 80 MHz, USB-TTL based on CP2102 is included onboard, Enabling Plug n Play, PCB Antenna.

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B. XBEE Module

We are using this device for 2-way communication system between the components and to transmit the data to a local data logger. As of secondary backup we will use XBEE wireless communication protocol systems. **XBee** – According to Digi "XBee modules are embedded solutions providing wireless end-point connectivity to devices. These modules use the IEEE 802.15.4 networking protocol for fast point-to-multipoint or peer-to-peer networking. let's look at why we would set up a network of XBee modules over a standard Wi-Fi network. Wi-Fi is the standard for wireless Internet connection because of it's high data transfer rate (54MBits/s); the real downside being it has a high power consumption. If you only wanted to have a collection of micro-controllers attached to a network to share sensor data or something similar, standard Wi-Fi might be too thirsty for this project. Xbee is a lot more reasonable; it's got a much lower power consumption (25% of standard Wi-Fi) and similarly a lower data transfer (250kbit/s). Additionally, the ability to create a mesh network of XBee devices means each device can transmit and receive data through itself, acting as a node for the network. We call this network topology a mesh, and it's an entirely different take on a network system.

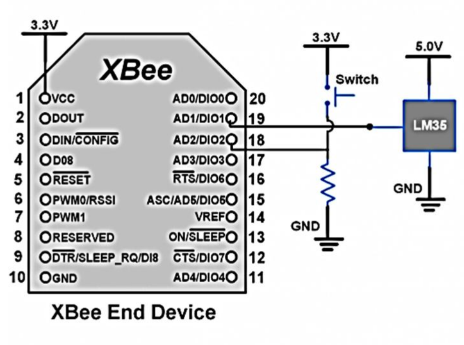

Fig 10: XBEE Module

The two modules are used for internal communication between the sensors and processing unit and actuators.

VI. ALERT & CONTROL SYSTEM

As a alert system we are using the high frequency buzzer and vibration will be initiated in the steering wheel so that it can draw the attention of the driver and the timer will be set for 3 Sec. If no action is been taken then the brakes of the car will be automatically deployed. This system is connected with the car braking system and main control unit. After deploying the brakes it will turn on the damper lights of the car on.

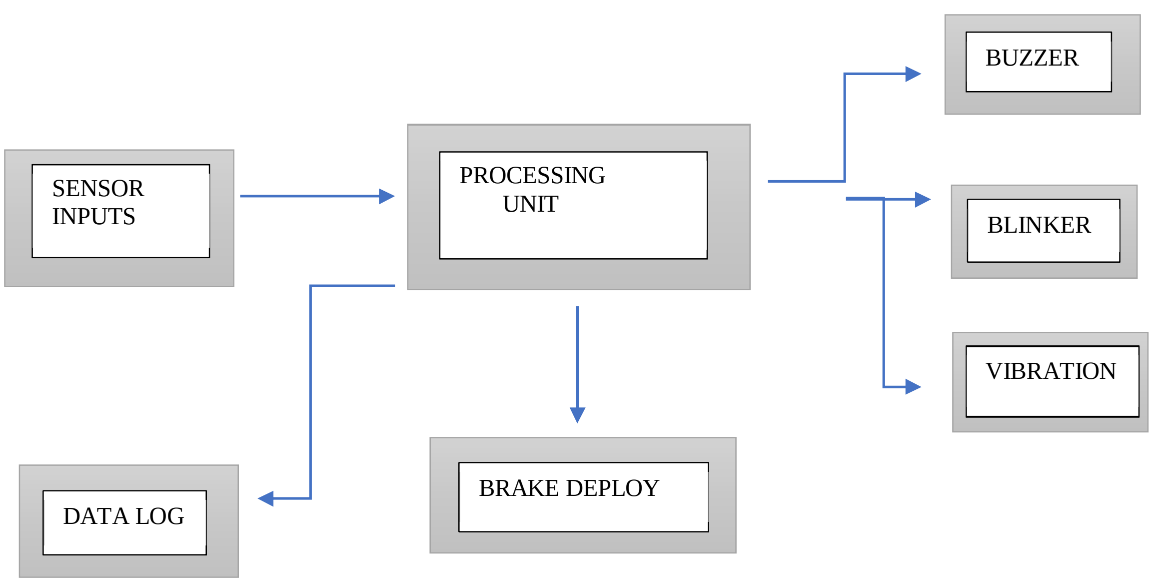

Fig 11: Fundamental Block Diagram of Control System

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VII. RESULTS & DISCUSSION

It is found that the system is working well along with the components. The receiver section is decoding the sensor data and analysing it in its CPU. It is a behavioural detection setup so it continuously detects the normal movements of the driver and saves the data in local data logger. Whenever it detects the drastic change in values with respect to time it will work as it is pre-programmed. Here the representation of the graphical plots of danger detection.

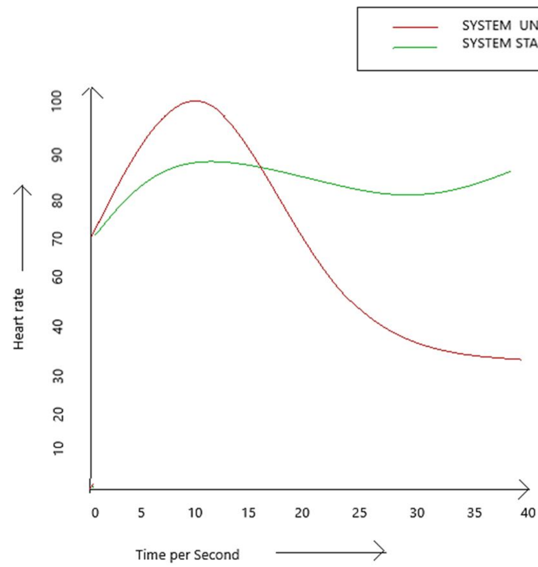

Fig 12: Heart rate vs Time Graph

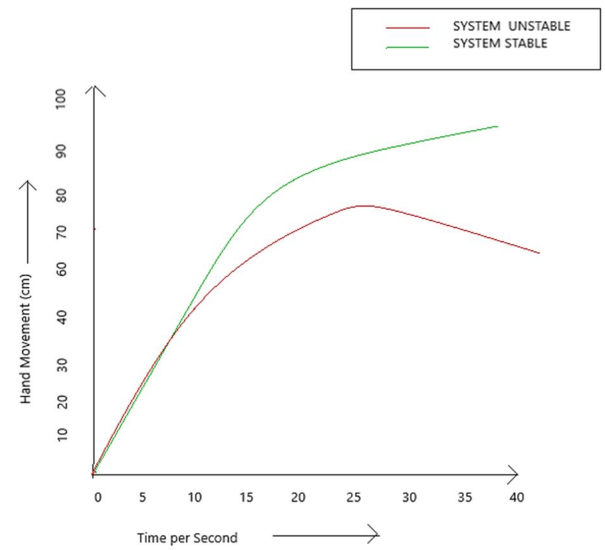

Fig 13: Hand movement vs Time graph

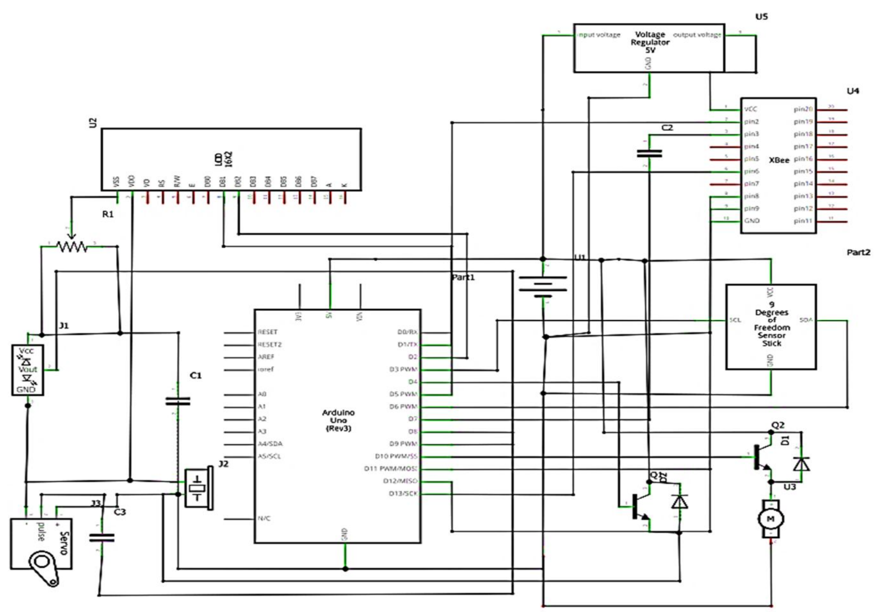

Fig 14: Circuit diagram of the setup

This system is capable of fulfilling the goals of the project with the added focus on human safety. From all the observations it is found that the system is working properly. As in Fig :15 it is a experimental design of the setup a more like prototype of the whole system. The efficiency, precision, accuracy can be increased by using appropriate sensors and processors with high efficiency and frequency. This device does not consume very much power, it can get the supply from the car battery. This Fig: 4 is the circuit setup for the receiver and processing part as well as the output actuators which are directly connected with the processing unit.

VII. FUTURE SCOPE

The use of device and the components makes the safety system of car powerful and cost- effective and also easy to be operated and maintained. Further developments can be made on the system by:

A. Using collision detection system and fog detection technology. It is efficient and robust by upgrading its response to sudden accidental situations.
B. In this system we can use global position system. (GPS) and GSM communication system so that a particular person will receiving message and alert through mobile.
C. Not everyone can afford autonomous vehicles. So, if we can implement this cheaper setup in any vehicle it will be much more beneficial for the public transport.
D. Passenger safety will also be increased.

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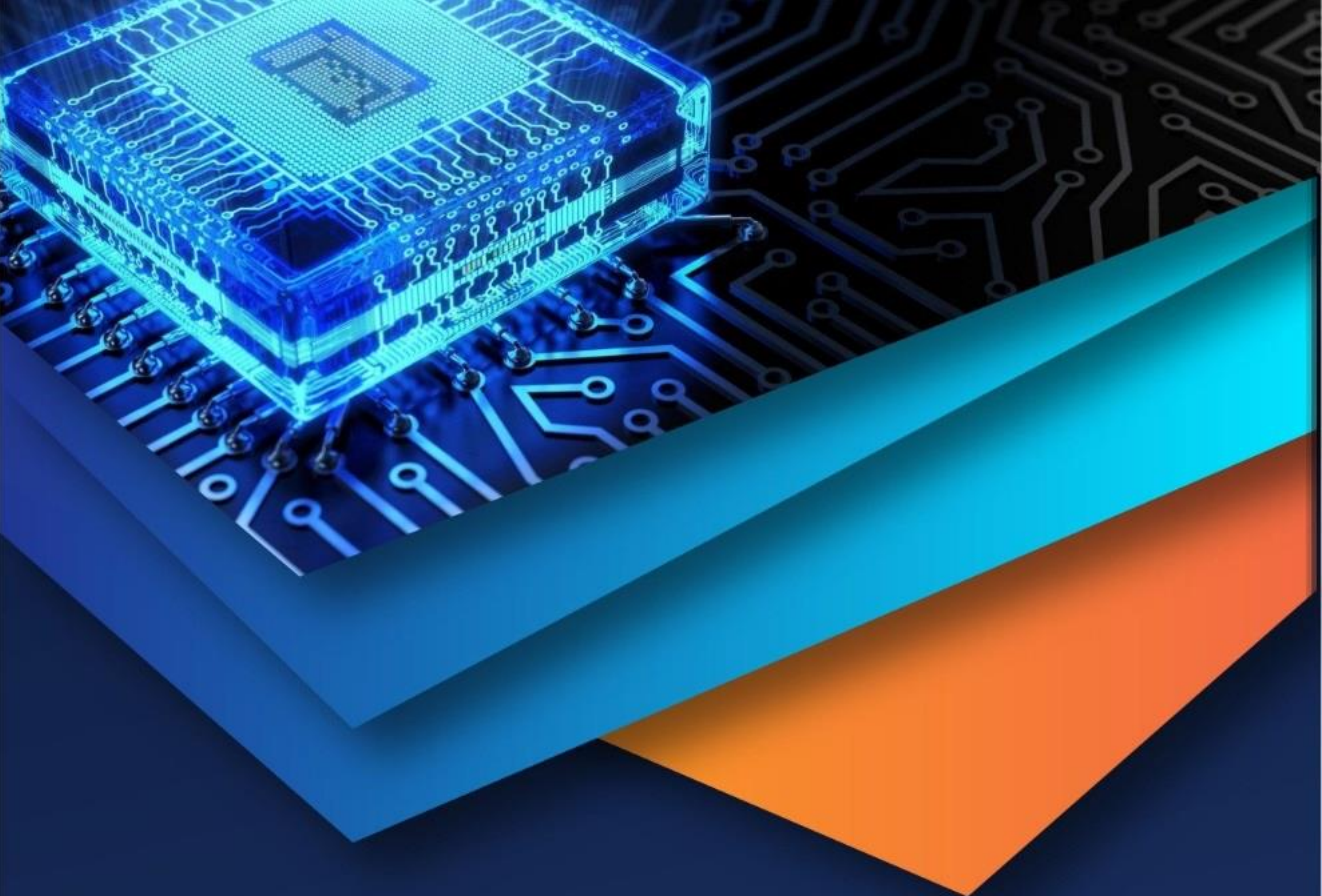

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