iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34318

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 V May 2021- Available at www.ijraset.com

Smart Wearable Device

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***Abstract*: In the real world, the welfare of children is a major concern for all. Parents still want their children to live in a safe environment where they can enjoy their time and think freely. The key purpose of our paper is to develop a smart wearable interface that can be used to track physical and wellbeing metrics in small children and old age people's during unexpected circumstances.**

Real-time data will be gathered and transmitted to parent or other person, and the information can be accessible by a SMS or cloud linked smartphone application that can be used to display information about an individual or child.

One of the main purposes of this Prototype device is to make it easier for parents to find their children. There are many wearables on the market right now that can monitor a child's everyday activities and even help locate the child using the device's Wi-Fi and Bluetooth capabilities. However, Wi-Fi and Bluetooth tend to be unreliable communication networks for parents and children

Keywords: GPS, GSM, Oximeter, Raspberry pi.

I. INTRODUCTION

Smart Wearable technologies, wearables, smart wear, Fitness bands, or cultural features are smart electronic devices (electronic devices with microcontrollers) that are placed close to and/or mostly on surface of the skin, where they measure, monitor, and send information over, for instance, body signals such as vitals and/or external data, and in certain cases provide instant biofeedback to the wearer.

Devices like wearable devices are manifestations of the Internet of Things because "things" like electronics, smartphones, sensors, and networking are effectors that allow devices to transfer information (including quality performance) over the internet without needing human interaction with a creator, user, and/or other connected devices.

Wearable technology has a wide range of uses, and is the as the industry matures. With the popularity of the smartwatch's and fitness tracker, it has become a common feature of consumer electronics. Wearable hardware is being used in navigation devices, specialized textiles, and healthcare, in addition to industrial applications

II. LITERATURE SURVEY

Wearable technology is often used to monitor a person's fitness. Since it is in close proximity to the user, such a computer can quickly gather data. It all began in 1980 with the invention of the first portable ECG.

There are some previous works related to building of a device using microcontroller and Zigbee module A human subject's physiological characteristics, such as temperature and heart rate, may be monitored using the device. An at-risk individual wears an electronic monitor on their wrist and finger as part of the system. Similarly, there are few works using Arduino uno and other sensors, with the help of Esp8266 wi-fi module which is a wi-fi microchip integrated with TCP/IP stack used to transfer data wirelessly

III. PROPOSED SYSTEM

The proposed system employs general sensors for heart rate and oxygen saturation tracking, as well as the Global Positioning System (GPS) to determine the user's location and the Global System for Mobile Communications (GSM) / General Radio Packet Service (GPRS) technology to transmit user's location via SMS in case of emergency to emergency contact and with the implementation of gyro sensor we can detect fall/faint of the person.

The focus is on using an SMS text activated communication medium between the child's wearable and the adult since GSM mobile interaction can be made almost everywhere. The parent can also submit a text with keywords like "LOCATION," "STATUS" and so on to view them manually

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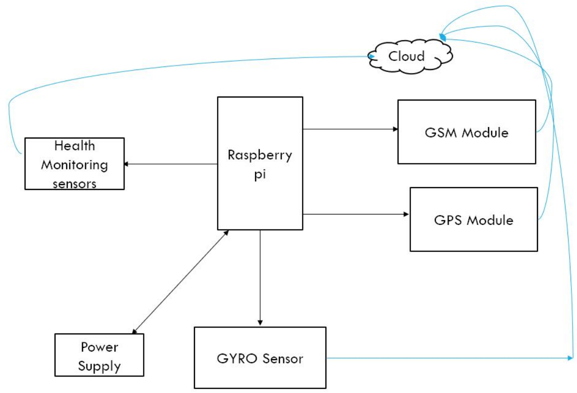
IV. HARDWARE DESCRIPTION

The below block diagram of the prototype, shows the heart of the project is the Raspberry Pi and the GPS module, GSM module combined hat for SMS alert, and health tracking sensors such as oximeter for Hr and spo2.



A. Raspberry PI Model B+

Raspberry Pi is a small device that can be wired to your TV or computer that can do all of the functions of a mini computer. It has a quad-core Broadcom BCM2837 processor clock speed of 1.3GHz, having 1GB of RAM, and four USB 2.0 ports.

The Raspberry Pi has no built-in room. The Raspberry Pi's operating system is mounted on an SD card with a storage capacity ranging from 8 to 64GB. It has 40 pins overall, with 26 of them being GPIO pins (General purpose input/output)

B. Location estimation using GPS Module

The United States Department of Defense developed (GPS), a radio navigation system which is satellite based. It consists of 32 satellites (24 active). A GPS receiver calculates a user's location by the process of trilateration which is determining a position from 3 known points. Each satellite transmits two PRN codes, namely the Coarse Acquisition (C/A) code and Precision (P) code, as well as navigation data, which includes the satellite ephemeris.

The Pseudorandom noise codes are used to determine the satellite's range/ distance from the receiver. The satellite location is calculated using the ephemeris data

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C. GSM Module Functionality

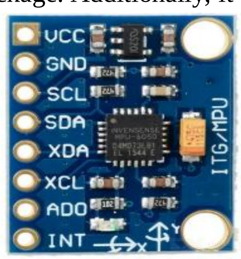
GSM stands for Global System for Mobile Communications, and it is a telecommunications network protocol that is found in 2G networks. In this case, the SIM 868 handheld networking module is used.

Here this Module allows the microcontroller (or a microprocessor) to communicate with a GSM / GPSR network.

A GSM module, also recognized as a GPRS module, is a hardware device that allows a mobile device or system to interact with a GSM or GPRS module The Narrow band Time Division Multiple Access (TDMA) technique is used to communicate. This hat will have a SIM card Antenna and port, into which the SIM card is inserted, and ATtention commands (AT) will be used to send SMS messages to the registered phone number. It runs on a 3-5 V DC supply voltage.

D. Featues of MPU 6050 and MAX30105

The MPU6050 sensor module is an all-in-one 6-axis motion sensing system. It is a system containing 3x3 Accelerometer and gyroscope with Digital Motion Processor in a small package. Additionally, it also has a temperature sensor.



The MAX30105 is a biosensor with pulse oximetry and heartbeat monitoring built in. Photodetectors, internal LEDs, and optical modules, all of this, as well as low-noise electronics and ambient light rejection, is included in the kit. The MAX30105 is a full framework solution that makes design-in for smartphone and wearable devices even easier.

SpO2, or oxygen saturation, is a measurement of the level of oxygen-carrying haemoglobin in the blood compared to the amount of oxygen in the blood haemoglobin not carrying oxygen. The amount of times one's heart beats per minute is known as heart rate. Photoplethysmography is used to calculate heart rate in this project (ppg)

E. GSM/GNSS/GPS/Bluetooth Hat

This is a compact, low-power Raspberry Pi HAT with GSM, GPRS, GNSS, and Bluetooth connectivity capabilities. It enables the Pi to make phone calls, send messages, link to the Internet wirelessly, track its location, and transmit data via Bluetooth, among other things.

The figure above represents the complete picture of the hat with all the parts connected.

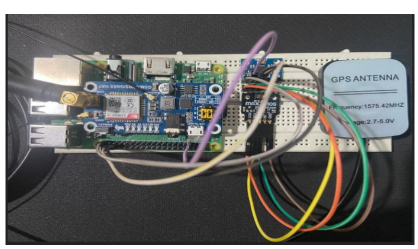
F. Features Of Hat

The GSM Frequency bands are 850/EGSM 900/DCS 1800/PCS 1900 MHz With Quad-band auto search, Data transmission through GPRS, Maximum downlink bandwidth is 85.6kbps, Maximum uplink bandwidth is 85.6 kbps. The GNSS receiver has 33 tracking channels and 99 acquisition channels. In acquisition mode, each channel performs a rough 2D scan of the signal (code delay and Doppler frequency) to determine if it is present or not. The channel tracks the accuracy of the tracking results in tracking mode to determine whether the signal is present and being monitored correctly. If the lock detection indicators drop below a certain level, the signal is deemed missing, and the channel returns to acquisition mode, restarting the operation

V. SOFTWARE DESCRIPTION

We used Python 3.7 to write the software code of the sensors and the Gsm, Gps modules. Raspberry pi supports c/c++, python and scratch but we have used python because It's incredibly simple to get started, it's ideal for prototyping because it allows you to do something in less code and its Versatile, simple to use, and quick to create. Along with python we have also used At commands, AT commands are instructions that govern a modem. ATtention is abbreviated as AT. Each command line begins with the letters "AT" or "at". Because of this, modem instructions are referred to as AT commands. To communicate with a computer system, both wireless and dial-up modems need an AT instruction Now Coming to the Cloud part we have used Thingspeak here ThingSpeak is nothing but a cloud-based IoT analytics tool that lets you compile, visualise, and interpret live data streams. You can upload data from your devices to ThingSpeak, generate real-time visualisations of live data, and send updates. Sign up for ThingSpeak for the first time. Open ThingSpeak and log in, Assign the Data to a Channel Give Your Project a Name Update Your Channel Obtain an API Key use python libraries like httplib and urllib. We can send sensor data to thinkspeak using the Api key and base URL Analyse the Graph. Libraries such as max3010x, Mpu6050 and httplib, urllib are to be installed before then only they can be imported in the program and using raspi-config go to interface and enable i2c similarly enable serial and mainly Vnc so that we can use our raspberry pi on laptop or pc using Vnc Viewer and Lan cable.

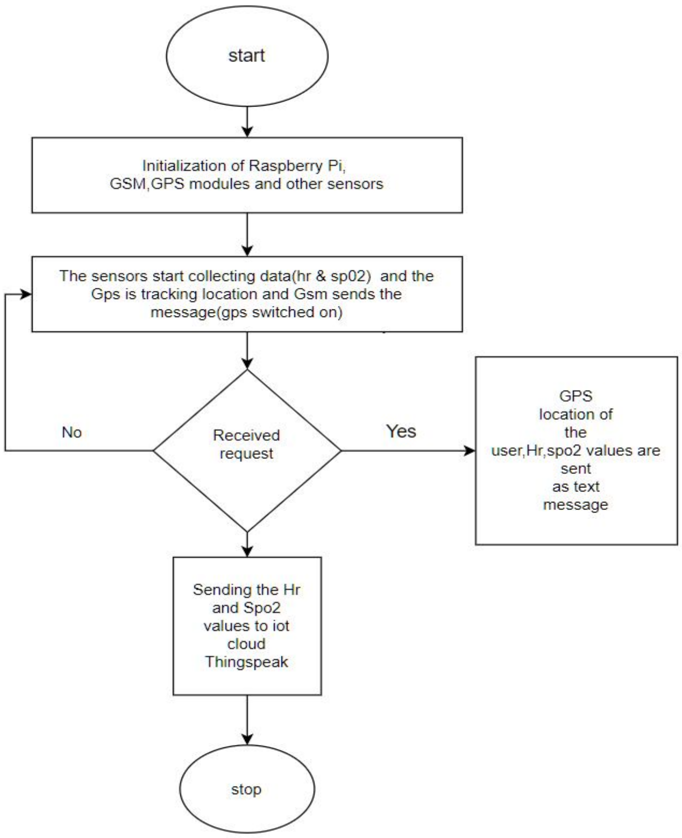
VI. CIRCUIT DIAGRAM & FLOWCHART



The above figure depicts the smart wearable device system's circuit diagram. It demonstrates how to connect various components to the Raspberry Pi board, including Gps, Gsm, other sensors placed on breadboard. The Raspberry Pi pins 2,3,5,6 is used in this instance. Pin 2 provides 5 volts to all sensors, while pins 3 and 5 (GPIO-2) (GPIO-3) provide Sda, Scl, and Ground is pin 6, respectively. These pins are commonly wired to both sensors, so jumper wires are used to link them. The hat is operated by a USB cable that is either attached to the Raspberry Pi or mounted over the Raspberry Pi's 40 pins. A USB cable connects the Raspberry Pi to a 5v Dc power source (it's also compatible with 3v). The sim card is inserted into the sim slot under the hat. The GPS antenna is attached to port 18 of the Hat, while the GSM antenna is connected to port 20 of the Hat.

VII. FLOWCHART

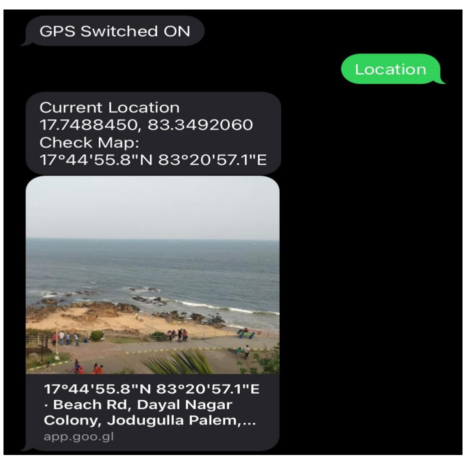
The fig below showcases the flowchart and the working of the prototype, what happens when a request is made and how the prototype responds by sending the information to user and then also keep sending the information to Iot based cloud (thingspeak).



When the prototype first begins, the raspberry pi, GSM, and Gps modules, as well as other sensors, are initialized, and then they begin gathering data. The Gps keeps track of the user, and when the Gsm module is ready, it sends a notification to the phone. If anyone requests the device, it sends the sensor values along with the Gps position to the assigned phone number, and the sensor values continue to update in the Iot cloud Thingspeak, where the data is plotted and can be displayed later.

VIII. RESULTS AND ANALYSIS

Here in the fig below we can see that once the program executes successfully, we receive a message that gps is turned on. After connection is established then we send specific terms to retrieve values like Ex: Location, in return we get the location coordinates and we also get the map link attached as well.



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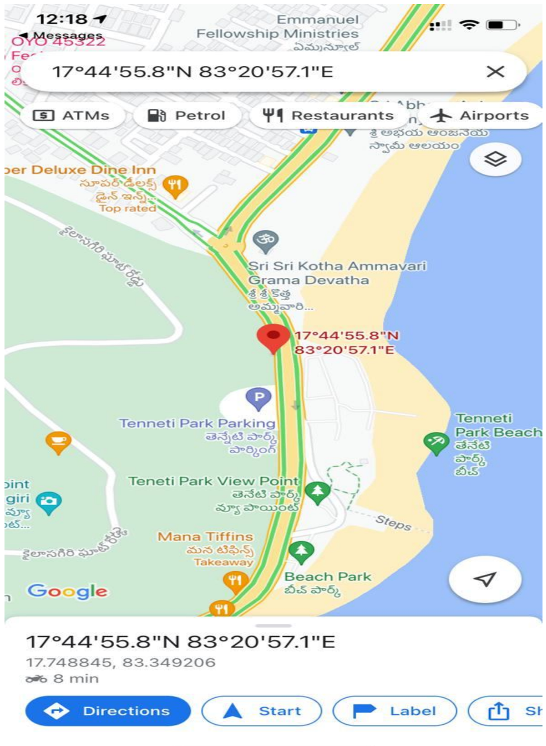
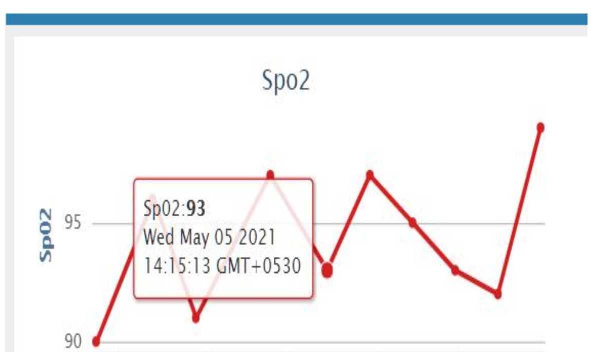


In Things speak we get the Heartrate and spo2 graphs from the Oximeter sensor as long as the persons is in touch with the sensor.



We observe that the X-axis on both the graphs is time and y-axis is Heartrate and Sp02. We see that starting 6-7 seconds heartbeat is showing garbage values and after that it starts showing correct values and we can see that for every 2 seconds the values are getting entered.

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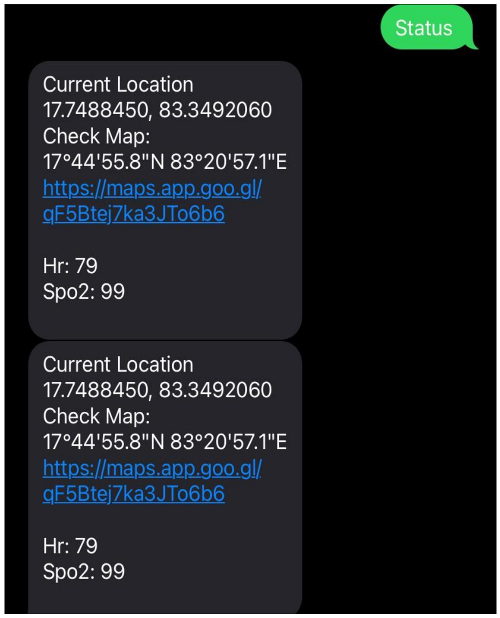
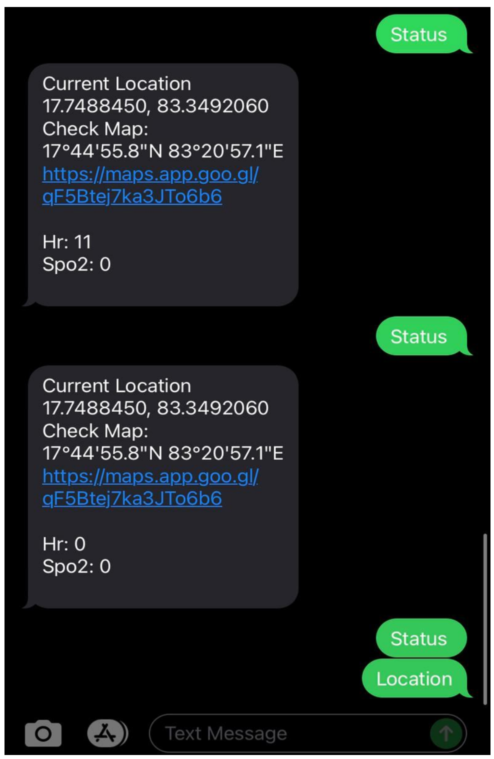


From the previous image we can also see that when we send the keyword "status", we get the persons overall status heartrate, spo2 values and location coordinates in longitude and latitude, and also google map links, by clicking on the link we can view it on map.



If the person removes the device then we see that the hr and spo2 values fall to zero and it's the same when the person gets in touch with the device as it takes few seconds to get right values.

IX. CONCLUSION

In this paper, we created a smart wearable interface prototype that does not rely on external communication such as Bluetooth or WIFI and can function individually and transfer information when requested using sensors and modules. Real-time tracking of pulse and spo2 are transmitted to an IoT-based server, and the person's Location is also monitored by the module. We have focused on fall detection but were unable to produce the desired results due to a high number of false alarms and a delay in alerting.

A. Limitations

Battery issues, they tend to have short span and overall setup might not be comfortable for all.

Since these wearable devices are in acting as medical devices, problems with accuracy and robustness can raise safety concerns.

B. Future Scope

Usage or smaller parts such as pi zero and small sensors, can make the overall circuit more user friendly and efficient. Addition of a touch sensor can be used to send alert when the device is forcefully removed.

Creating a mobile application interface and linking it would make it more convenient to view data.

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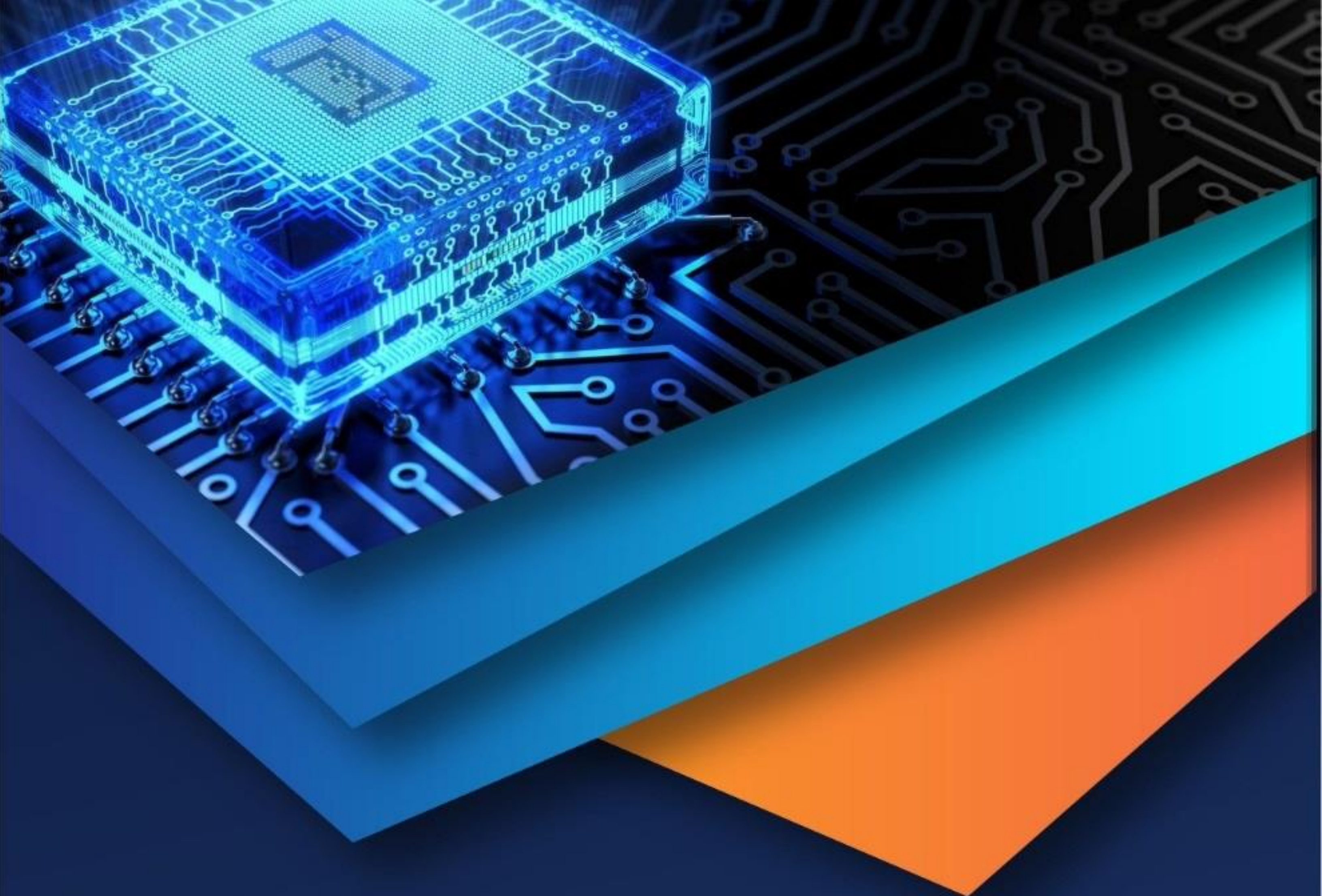

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