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Smart and Secure System for Geriatric, Mentally and Physically Challenged People

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Abstract— Nowadays thefts have become very common thing in our daily lives. It's too hard to monitor houses in which elders live. Through this project these problems can be reduced to maximum extent. By using simple components like LPG sensor, fire sensor, accelerometer we can design a circuit that can reduce the problems like gas leakage, fire accidents, and robberies. The total process can be monitored and communicated through GSM module through which we can alert the house owners to take further actions. Fall detection systems are designed as small, wearable pendants that can send alerts to emergency services automatically in the event of a fall. Especially when you are often on your own, this can be a handy device both around the house and when you're out and about.
Keywords— Accelerometer, GSM module, Pendants, Computational, Protocol, Trilateration, Scalable.

I. INTRODUCTION

With an enormous development of nation the overall human living standards and health care levels are progressively improving, subsequently the population of elder people has been steadily increasing. If anyone falls, then they become unsettled, powerless, or unconscious and unable to call for help. By using this project we can able to respond to the needy who are seeking for the help in the event of a fall with by using Lifeline Auto Alert system. This section describes the main procedures required to set up and start the Human Fall Detection using 3-axis Accelerometer demo board. The demo is designed to show basic and advanced functionalities of the Human Fall Detection using 3-axis Accelerometer. In addition, our solution features low computational cost and real-time response.

II. BLOCK DIAGRAM AND DESCRIPTION

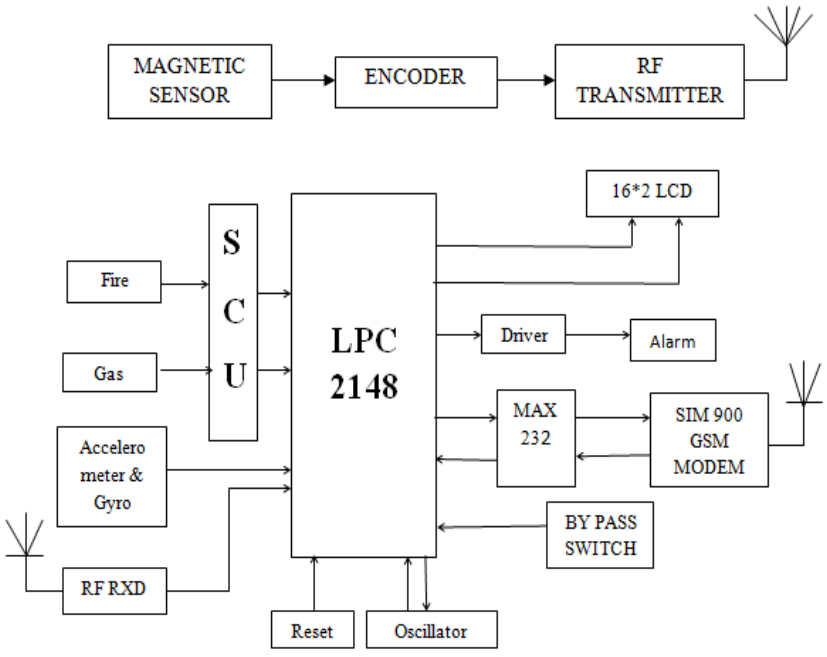

Fig 1. Block Diagram

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A. LPG Sensor

Liquefied petroleum gas sensor is used to detect the gas leakage. A gas detector is a device that senses the presence of gases in an extent. This sensor kit is used to sense a gas leakage and it was interfaced with a control system and it generates an indication signal. A gas sensor can generate an alarm signal to operators in those surroundings where the leakage is occurred. This type of device plays a significant role because there are many gases that can be harmful to organic life, such as humans, animals and to the nature.

Fig 2. MQ-5 SENSOR

B. Fire Sensor

A fire sensor is a device which is intended to sense and react to the occurrence of a spark or fire. Responses to detect a flame depend on the mechanism, although we can comprise sounding an alarm, deactivate a fuel content (such as a propane or a natural gas line), and activate a fire suppression system. When used in applications such as industrial furnace, their role is to provide confirmation that the furnace is properly lit; in these cases if any connections are mismatched and chance for short circuits then there will be delay problem to communicate with the operator. So to overcome this we are using a fire sensor which can easily respond quickly and more accurately than a smoke or heat detector due to the mechanism it uses to sense the fire.

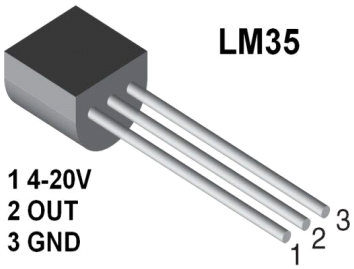

Fig 4. LM35 SENSOR

C. LPC2148 ARM Controller

We use ARM controller to control all the peripherals. LPC2148 is used as MCU in this design. Because of the advanced 32 bit architecture, it can detect changes as low as 3 mill volts, faster compared to PIC's and other 80series micro controllers. Inbuilt ADC was an added benefit of LPC2148. Hence we used this as our micro controller unit.

Fig 3. LPC2148 ARM

A Microchip microcontroller LPC2148 is used to collect, process the data and then stores it in a serial buffers. The LPC2148 is a 32k instructions program buffers, 512 kb bytes of RAM, three timers, and a 32-bit A/D converter microcontroller. It has RISC

architecture and can use oscillators, thus it is ideal to be used as an embedded system.

D. I2C

Inter-Integrated Circuit Bus invented by Philips. A protocol for providing serial communication between integrated circuits.

E. GSM Modem

GSM modem gives capability to send SMS without any mobile operating system. SIM can be read with MCU and can be used to send SMS by micro controller. Hence a GSM modem was employed its main function here was when the parameters are over threshold limits it sends a text message to predefined contacts about the situation of the person thus alerting them to proceed for further actions.

Fig 5. GSM MODEM

F. Accelerometer

The ADXL335 is a slight, low power package, 3-axis sensing along with signal condition voltage outputs. It calculates the acceleration with a least amount full-scale range of ±3 *g*. The Accelerometer can conclude the fixed acceleration of gravity in tilt-sensing application, as well as dynamic acceleration consequential from the movement, upset, shaking, shocking etc.

The user has the facility to select the bandwidth of the accelerometer by make use of CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Based on our application we have to select the Bandwidth within a frequency range varies between 0.5 Hz to 1600 Hz for the X and Y axis, and for Z axis the range is from 0.5 Hz to 550 Hz. It is available in the size of a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

G. Gyroscope sensor

A gyroscope is a rotating disc or a wheel in which the rotation of axis is free, so that we can easily measure the angular velocity. While rotating, the direction of the axis is unchanged by tilting angle or rotation of the mounting, according to that we can maintain the angular velocity. For this reason gyroscopes are used to measure the rotational velocity in 3 directions and 3 axis accelerometer that will measures the 6 degree of freedom and motion tracking of the body. Gyroscopes is also based on other working principles such as the electronic, microchip-packaged MEMS gyroscopes found in customer electronics devices, solid-state ring lasers, fiber optic gyroscopes, and the extremely sensitive quantum gyroscope.

Fig 6. MPU6050 SENSOR

III.WORKING

The designed system comprises of LPC 2148 Micro Controller, Fire sensor, LPG sensor, Accelerometer and gyro sensor. In this Proposed System we will fix a belt to the person waist which has different types of sensor like Gas sensor, Fire sensor, Accelerometer & Gyro sensor etc. If any fire accident occurs immediately the fire sensor gets activated, with the help of signal conditioning unit information is sent to Micro controller(LPC 2148) ,it activates the alarm and message is sent to family members using GSM Modem and the information is displayed in LCD. Similarly, if a gas leakage occurs the sensor gets activated and information is sent using GSM modem. Bypass switch is used in the case of if any UN authorized person enters into the house this switch activates the alarm and after entering into the house within 10 seconds we can off the bypass switch so to ensure safety to our house bypass switch is used. Accelerometer is used to measure the rate of increase or decrease in the velocity of moving body. The ADXL335 uses a complete 3-axis acceleration measurement system. The ADXL335 has a dimension of range ±3 *g* minimum. It contains a poly silicon surface which covers the micro machined sensor and signal conditioning circuitry to implement open-loop acceleration measurement architecture. The output signals are analog voltages that are proportional to acceleration. The accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration. Polysilicon springs suspend the structure over the surface of the wafer and provide a resistance against acceleration forces. The deflection value of the moving object is calculated by using a differential capacitor that consists of independent fixed plates attached to the moving mass. The demodulator output is amplified and carried to off-chip through a 32 KΩ resistor. The user then groups the signal bandwidth of the device by adding a capacitor. This filtering improves measurement resolution and helps prevent aliasing. The ADXL335 uses a single structure for sensing the X, Y, and Z axis. As a result, the three axis sense directions are highly orthogonal and have little cross-axis sensitivity.

Misalignment of mechanical parts of the sensor die to the package is the chief source of cross-axis sensitivity. Rather than using additional temperature compensation circuitry, innovative design techniques ensure that high performance is built in to the ADXL335. As a result, there is no quantization error or no monotonic behavior, and temperature hysteresis is very low (typically less than 3 m*g* over the −25°C to +70°C temperature range).

Here we are using Gyroscope sensor to measure the angular velocity and speed of a moving object. The MPU-60X0 consists of three independent vibratory MEMS, which detect rotation at X, Y and Z axis. When the gyros are rotated in any of these three axes, the Carioles Effect causes a vibration that is detected by a capacitive pickoff. The resulting signal is amplified, demodulated, and filtered to produce a voltage that is proportional to the angular rate. This voltage is digitized using individual on-chip 16-bit Analog-to-Digital Converters (ADCs) to sample each axis. The range of the gyro sensors may be digitally programmed to have values of ±250, ±500, ±1000, or ±2000 degrees per second. The ADC sample rate is programmable to range the samples per second values from 8,000 samples per second to 3.9 samples per second. By using the low-pass filters we can enable a wide range of cut-off frequencies. Here we use Max-232 to convert TTL format to RS-232 format.

IV.FLOWCHART

A. Firstly initializing and configuration of LCD, ADC, I2C, serial ports is done.
B. After configuring RF receiver it will be activated and then the data from the sensors is received.
C. The LPG sensor will activate first and displays the data on LCD and compares with the limits and if the limit exceeds then it will sends an SMS alert to the pre-fixed mobile number and sounds the alarm.
D. Similarly when a fire sensor is activated then the controller displays the data and sends the SMS alert to the pre-fixed mobile number and sounds the alarm.
E. The accelerometer sensor activates when a person position is changed. Suppose if the person fell down then it the position is changed from the actual position then the sensor will activate and sends the data to the processor.
F. Thus the data from accelerometer is converted to digital form and sends to micro controller, there it process the data and converts it into ASCII code and displays on LCD, sends a SMS alert to the mobile numbers from data base and then sounds the alarm.
G. If any of the sensors are activated then the message will send to the pre-fixed mobile number and the alarm will buzzer automatically.
H. We used the Flash Magic for loading the program into microcontroller.
I. The system uses a compact circuitry built around LPC2148 (ARM7) Microcontroller and programs are developed by using Embedded C.

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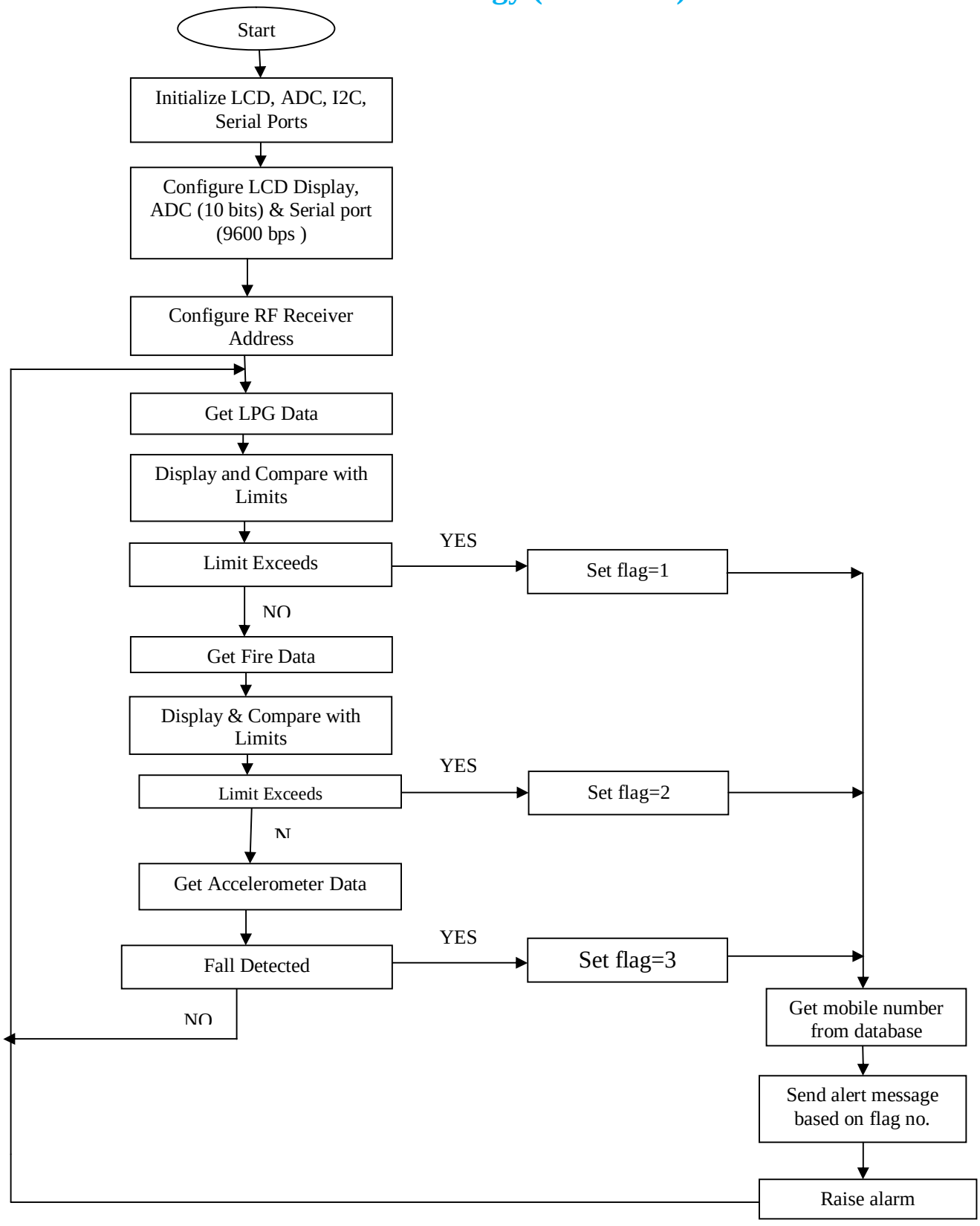

Fig 7. Flow Chart

V. RESULTS AND FUTURE SCOPE

The above designed embedded system results in minute to minute monitoring system for the elder people who are staying alone in home. If any unexpected situations are faced by them then automatically we can share the information by sending an alert SMS to their family members. Moreover it has wide range of applications in different fields like medical, Industrial areas etc. This system is useful for not only the geriatric people but also useful for the mentally & physically challenged people who are living alone in home. From this Project what I observed is that we are using Panic sensors, gas sensor, fire sensor and door open sensor which are very powerful and efficient in nature. In future we may enhance the project by interfacing different type of sensors for monitoring the entire system which plays a major role in our society.

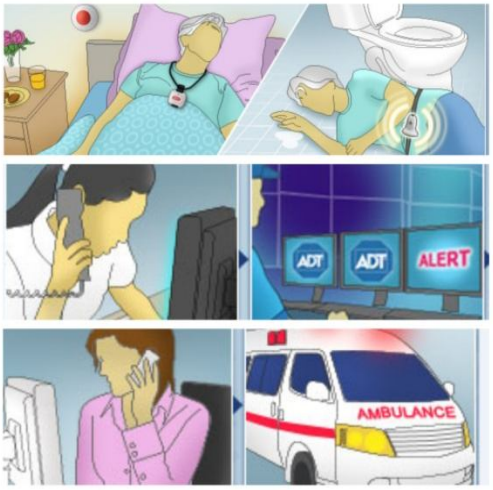

Fig 8. Fall Detection

VI. ACKNOWLEDGMENT

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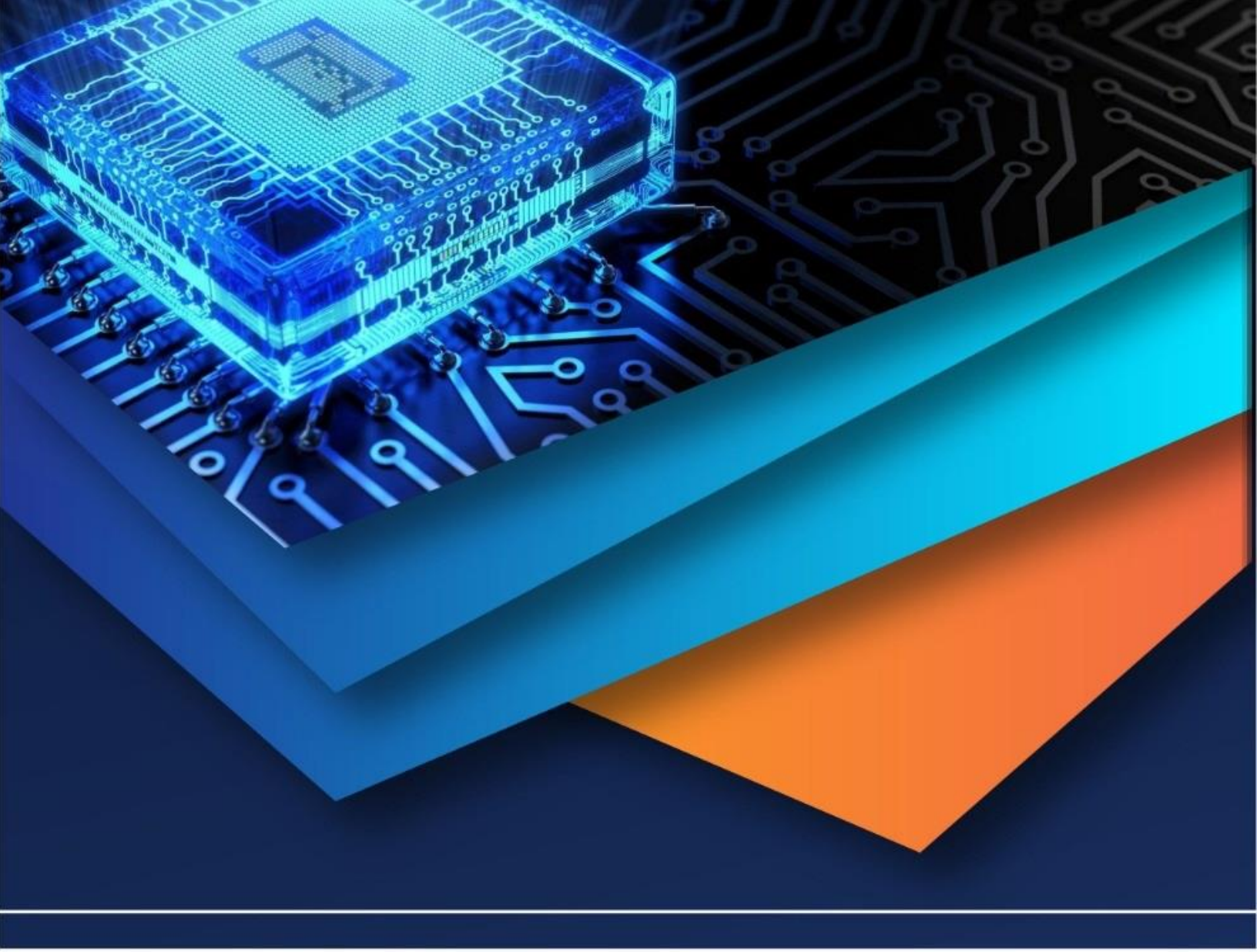

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