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ARM Hardware Platform for Vehicular Monitoring and Tracking in Road Accident

J.Naskath[#1], G.Jeya Bharathi[#2], A.Subbulakshmi[#3]
Professor[#1], Research student[#2, 3], Computer Science and Engineering Department,
National Engineering College, India. [#1, 2, 3]

Abstract-Technological developments are available for vehicular networks however, the accidents are happens .This project proposed to reduce the accidents death rate. In the existing system, there is a problem of conveying the accidental hazardous situations (alert messages) to the neighbours or nearby health centres. In this proposed system sensors are used to find the hazards situation on the road and create awareness to nearest neighbours about the surrounding. Crash sensor is used to detect the accident by its Vibration value. MEMS sensor is used to detect when a car rolls over, then intimation sends to the ARM controller and takes the coordination from GPS and send to the care centre. And also accident information will sent to the other vehicle through Zig-bee device using ad-hoc method for avoiding the jamming of vehicles. Advantage of proposed system fast response, easy to rescue, advanced collision avoidance is possible.
Keywords: Micro electro mechanical system (MEMS), Advanced RISC Machines (ARM), Global Positioning System (GPS)

I. INTRODUCTION

Now a days the vehicle accident rate has been increasing as compared to previous decade. The accident rate has increased by 54%. Previously, we were focused on how to build efficient highways and roads. Over time, the focus shifted to mechanical and automotive engineering, in the pursuit of building faster cars to surmount greater distances. Later on, electronics technology impacted the construction of cars, embedding them with sensors and advanced electronics, making cars more intelligent, sensitive and safe to drive on. Now, innovations made so far in wireless mobile communications and networking technologies are starting to impact cars, roads and highways. Vehicle accident detection system minimizes the action time after an accident. This paper deals with such system to detect possible collision and prevent it. The aim of this work is to provide security to the people inside vehicles. Moreover the system can be design which automatically shutoff vehicle engine while accident occurs. GPS module used to track the vehicle anywhere on the globe. GSM is used to send the exact location of the vehicle and also send alert or relax messages to the remote device (mobile phone). To detect an accident, crash and MEMS sensor is used. Crash sensor is used to find the accident. Tilt sensor is used to estimate the severity of accident and the information will sent to the other vehicle through Zigbee device using ad-hoc method. So, when accident happens, this sensor will be activated and the information is sent to ARM Processor. At the same time, GPS and GSM modem will also gets activated which are interfaced to the same ARM Processor. Through GPS, the latitude and longitude of the accident location are obtained. Through GSM modem, the same data is sent to the contacts which are stored in the database of the system. With this system, information details can be sent to the Care centres and surroundings.

II. LITERARY SURVEY

There are many efforts, applications; approaches have been proposed to provide security and safety in case of accidents. A novel approach to increase the safety of road travel using the concepts of wireless sensor networks and the Bluetooth protocol has been proposed. It discussed, how vehicles can form mobile ad-hoc networks and exchange data sensed by the on-board sensors [8]. The platform of the android operating system (OS) and software development environment proved optimum solution for the public safety in case of road accidents [9]. A good survey of using personal mobile phone, microcontroller, Bluetooth and Java technology has been provided in [10]. It developed integrated system to manage, control and monitor all the accessories inside the vehicle in order to achieve the idea of an intelligence car with ability to uses personal mobile hand phone as a remote interface. Smart phone-based accident detection can reduce overall traffic congestion and awareness of emergency responders. This approach also has been proposed [11]. A new design was developed containing vehicle tracking and control system to control the vehicle through an android based Smartphone [12]. Again, one application provided a solution with the use of a mobile phone for monitoring an SMS-based

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GPS tracker especially in locations where GPRS may not be available [13]. The general mechanism is to provide the real time position of a vehicle using GPS receiver and send this information to GSM center through the software, this is all done by the monitoring center which is working as a control unit that is connected not only by optical cable but also connected wirelessly through TCP/IP protocols. The monitoring center distributes the data to the client in the understandable format and it also stores the travelling records and displays the information about vehicle on electronic map through GIS system [14]. Another approach is that, vehicle terminal includes a GPS receiver which extracts information about position through GPS satellites and sends it through GSM network and to the control center which reads the information and saves it in the data base system and on user demand displays it on electronic map [15]. Different application of localizing the vehicle system by receiving the real time position of the vehicle through GPS and send this information through GSM module via SMS service with an added feature of GPRS transmission to the monitoring center through usage of internet [16]. This project has been designed using microcontroller AT89S52, too. It used EEPROM to store the phone numbers.People also designed a mobile technology using smart phones to find the leading vehicle, allowing the possibility to make collisionwarningsystems more affordable and portable.A smart approach consisting efficient driving assistant that uses the features of the Smartphone to accurately figure out the driver's driving style from point of view of energy consumption and generate eco-driving tips to correct the bad driver's driving .

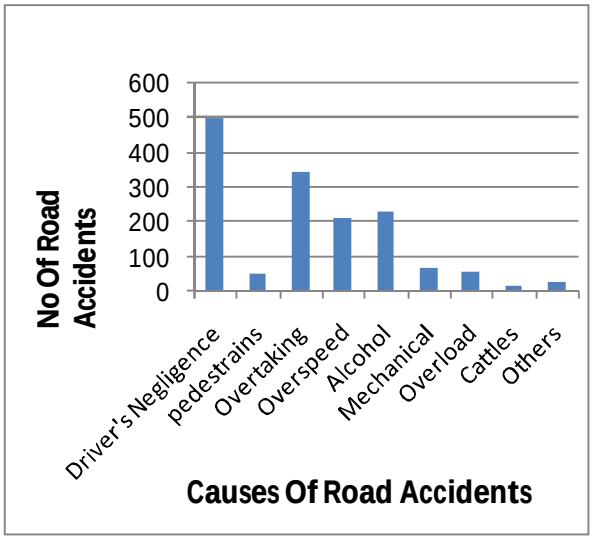


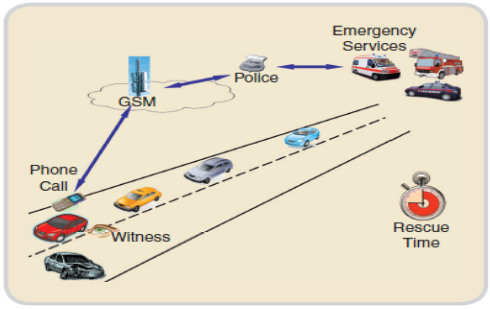
Fig 1: Causes of road accidents

III. EXISTING SYSTEM

VANETs consist of On-Board Units (OBUs) and Road-Side Units (RSUs).Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communications are the two communication modes, which, respectively, allow OBUs to communicate with each other and with the infrastructure RSUs. Since vehicles communicate through wireless channels, many attacks such as injecting false information, modifying and replaying the disseminated messages can be easily launched. The method for seeking help when an accident occurs has changed over the years. Figure 2: shows the old method of accident notification, where a witness of the car accident calls the police for help. The witness gives information about the location of the accident and the fatalities involved. Once the police is notified, they coordinate the rescue effort by alerting the fire department and medical services, summoning for an ambulance to the accident site quickly.

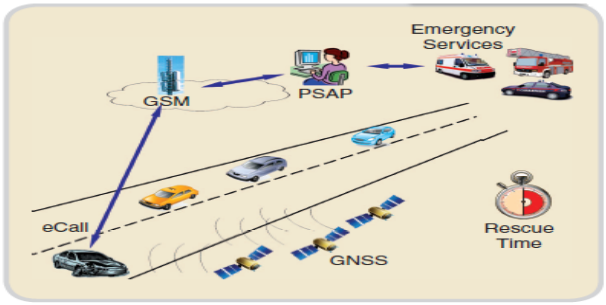
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Old method of rescue using a cellular phone when an accident occurred.

Fig 2: Eye witness



Current method of rescue when an accident occurs (e.g. eCall and OnStar).

Fig 3: E-Call

Figure 3: shows the current method of accident notification. When an accident occurs, a call is made to an "answering point" in order to send information about the accident and to ask for help. eCall is one of the most important road safety efforts made under the European Union's eSafety initiative. eSafety seeks to improve road safety by eCall devices will be made available as an option for all new cars, starting from September 2009. Secondly, there is a need for the single European emergency number 112 to be operational for both fixed and mobile calls throughout the European Union. Unfortunately, not all EU member states are able to support the full 112 emergency services. Presently, it is working in 12 out of 27 EU member states. Thirdly, emergency centres and all rescue services must be capable of processing the accident location data transmitted by eCalls.In an existing system, there are no Sensor networks available to detect and rescue the accident and cannot track the vehicle.Drawbacks of existing system, More time consumption, Automatic alert is not possible, Possibilities for traffic collision.

IV. PROPOSED SYSTEM

A. System Block Diagram

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set.

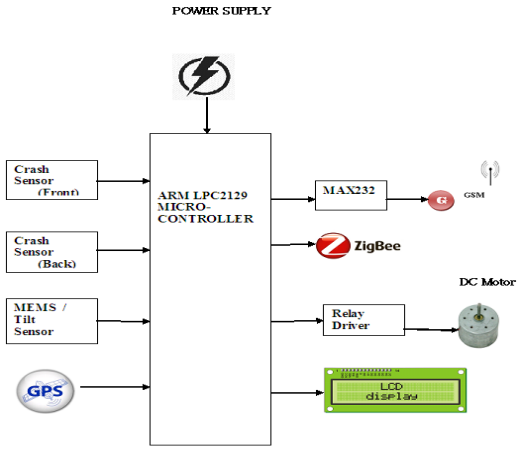


Fig 4:vehicle accidental section

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A piezoelectric sensor is used as accident detection sensor. A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source and filter network. The voltage V at the source is directly proportional to the applied force, pressure, or strain. The output signal is then related to this mechanical force as if it had passed through the equivalent circuit.Accelerometers can be used to measure vehicle acceleration. They allow for evaluation of overall vehicle performance and response. This information can then be used to make adjustments to various vehicle subsystems as needed.Accelerometers can be used to measure vibration on cars, machines, buildings, process control systems and safety installations. They can also be used to measure seismic activity, inclination, machine vibration, dynamic distance and speed with or without the influence of gravity. Applications for accelerometers that measure gravity, wherein an accelerometer is specifically configured for use in gravimetric, are called gravimeters.The Global Positioning System (GPS) is a Global Navigation Satellite System (GNSS) developed by the United States Department of Defense. It is the only fully functional GNSS in the world. It uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their current location, the time, and their velocity. Its official name is NAVSTAR GPS.Although NAVSTAR is not an acronym, a few backronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing. GPS is often used by civilians as a navigation system.After Korean Air Lines Flight 007 was shot down in 1983 after straying into the USSR's prohibited airspace, President Ronald Reagan issued a directive making GPS freely available for civilian use as a common good. As suggested by physicist D. Fanelli.When people talk about "a GPS," they usually mean a GPS receiver. The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else.

GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. The working of GSM modem is based on commands, the commands always start with AT (which means ATtention) and finish with a <CR> character. For example, the dialing command is ATD<number>; ATD3314629080; here the dialing command ends with semicolon. The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the help of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM modem.

Zig-Bee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer.The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. ZigBee is a low-cost, low-power, wireless mesh networking standard. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. Third, the mesh networking provides high reliability and more extensive range. ZigBee can activate (go from sleep to active mode) in 30 msec or less, the latency can be very low and devices can be very responsive — particularly compared to Bluetooth wake-up delays, which are typically around three seconds. Because ZigBees can sleep most of the time, average power consumption can be very low, resulting in long battery life. Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.A 230v, 50Hz Single phase AC power supply is given to a step down transformer to get 12v supply. This voltage is converted to DC voltage using a Bridge Rectifier. The converted pulsating DC voltage is filtered by a 2200uf capacitor and then given to 7805 voltage regulator to obtain constant 5v supply. This 5v supply is given to all the components in the circuit. A RC time constant circuit is added to discharge all the capacitors quickly. To ensure the power supply a LED is connected for indication purpose. A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices, calculators, and telephones. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology. Its low electrical power consumption enables it to be used in battery-powered electronic

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equipment. It is an electronically-modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. LCD accepts two of signals. There are Data, Control. These signals are recognized by the LCD module from status of the RS pin. Now the data can be read also from the LCD display by pulling the R/W pin high. As soon as E pin is pulsed, LCD display reads data at the falling edge of the pulse and executes it same for the case of transmission. LCD display takes a time of 39 to 43µs to place a character or execute a command. Except for clearing display to seek cursor to home position it takes 1.53ms.Any attempt to send any data before this interval may lead to failure to read data or execution of the current data in some devices.Some devices compensate the speed by storing incoming data to temporary register. Microcontrollers as the name suggests are small controllers. They are like single chip computers that are often embedded into other systems to function as processing/controlling unit. For example the remote control you are using probably has microcontrollers inside that do decoding and other controlling functions. They are also used in automobiles, washing machines, microwave ovens, toys ... etc, where automation is needed. Embedded system means the processor is embedded into the required application.

An embedded product uses a microprocessor or microcontroller to do one task only. In an embedded system, there is only one application software that is typically burned into ROM. Example: printer, keyboard, video game player. Microprocessor - A single chip that contains the CPU or most of the computer, Microcontroller - A single chip used to control other devices . The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.

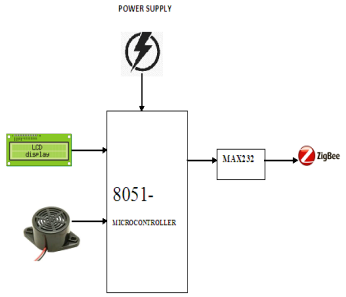


Fig 4:Other car section

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC.

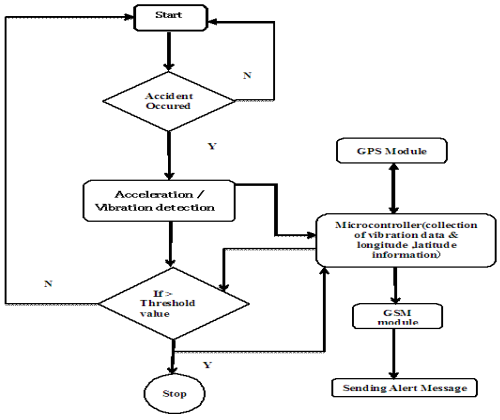


Fig 5:System flow diagram for traffic accident report

The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is

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provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R_1 & R_2) can accept ±30V inputs. The drivers (T_1 & T_2), also called transmitters, convert the TTL/CMOS input level into RS232 level. The transmitters take input from controller's serial transmission pin and send the output to RS232's receiver. The receivers, on the other hand, take input from transmission pin of RS232 serial port and give serial output to microcontroller's receiver pin. MAX232 needs four external capacitors whose value ranges from 1µF to 22µF. Alarm is used for indicating the accident alert sound. It is enabled by 8051 microcontroller. Fig 5 shows flow diagram of system.

V. CONCLUSION

With the advent of science and technology in every walk of life the importance of vehicle safety has increased and the main priority is being given to reduce the time for searching the location of accident occurred. The platform of the system is ARM along with MEMS, Vibration sensor, GPS and GSM, interfacing which shortens the alarm time to a large extent and locate the site of accident accurately and it can overcome the problems of lack of automated system for accident location detection. The proposed Vehicle accident detection system can track an exact location of the accident with the help of GPS service automatically and GSM sends an alert Message regarding accident to particular contact numbers eg.,108 ambulance or medical rescue team will help us to provide high priority is given to the lives of the people. Hence, this paper provides a feasible solution to traffic hazards and it gives security to vehicle and reduces loss of valuable lives and property.

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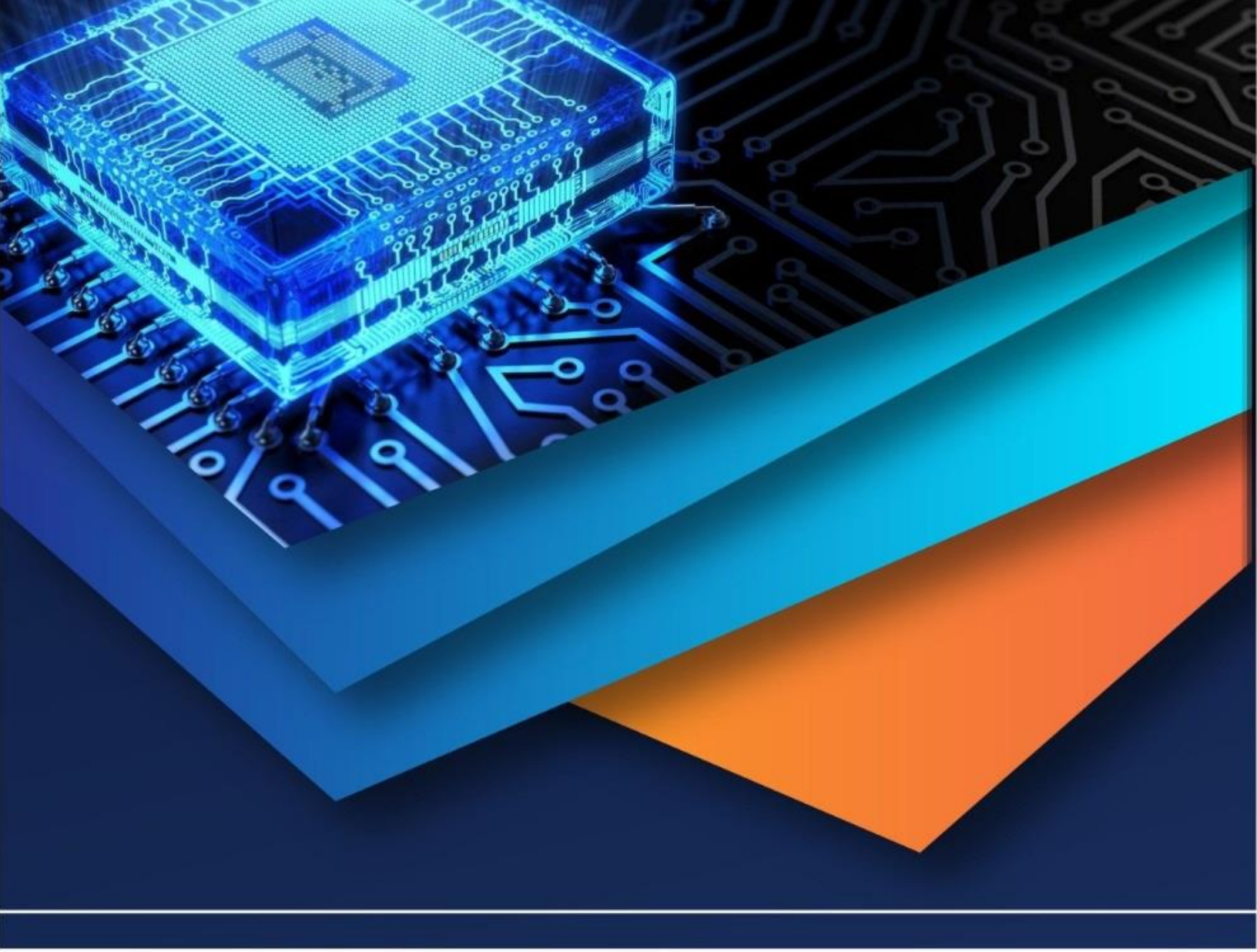
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