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Smart Parking System

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Abstract: ***Because of the increment in the quantity of vehicles on street, traffic will undoubtedly exist. Finding a protected parking spot is one of the difficulties experienced by the natives of any metropolitan or populated city and it is time and fuel devouring. Finding a respectable parking space turns out to be even more of difficult amid peak hours. This issue makes drivers get baffled and in the end despicable parking will shows up. Because of this inaccessibility the driver utilizes sides of working streets as its parking space which prompts issues like serious movement clog. Smart Parking System is a valuable answer for metropolitan urban communities to diminish clog, cut vehicle outflow aggregates and spare people's time usage by helping them in finding a spot to park. By intermittently taking in the parking status from the sensor systems used in parking areas, the reservation benefit is influenced by the difference in physical parking status. This paper proposes to make a model of a reservation based framework that is outfitted with sensors, 16x2 LCD (for display of spots) and LEDs. It gives a choice to pre-reserve utilizing a versatile mobile application based on android that can be accessed by the client. The application demonstrates the quantity of accessible and inaccessible openings. On pre-booking an empty slot a notice is sent to the enrolled client.***
Keywords*: *Android, Arduino, database, elevator, multi-level, reservation, sensor, Smart Park

I. INTRODUCTION

In the advancement of traffic administration frameworks, Smart Parking Systems(SPS) were invented to decrease the cost of contracting individuals and for ideal utilization of assets for the car-park proprietors. Presently, the basic technique for finding a parking spot is manual where the driver for the most part finds a space in the road through fortune and experience. This procedure requires some investment and exertion of energy and may prompt the most pessimistic scenario of failure to discover any parking spot if the driver is driving in a city with high vehicle thickness. The option is to discover a predefined car-park with high limit.

In the course of recent decades, traffic experts and authorities in numerous urban communities have grown purported Parking Guidance and Information (PGI) systems for better parking administration. PGI frameworks give drivers dynamic data on parking inside controlled regions and directs them to empty parking spaces. Parking data might be shown on Variable Message Signs (VMS) at major streets, roads, and crossing points, or it might be dispersed through the Internet. PGI frameworks depend on the advancement of independent vehicle recognition and parking spot checking, normally using sensors put in the region of parking spots for vehicle identification and surveyance. These sensors can be segregated as either "in-roadway" or "over-roadway". In-roadway sensors are either inserted in the asphalt or taped to the surface of the roadway; cases incorporate include loop detectors, pneumatic road tubes, piezoelectric cables, and so forth. Over road way sensors are mounted over the surface of the roadway; illustrations include video, image, and acoustic signal processors; microwave radar; ultrasonic, magnetic, and passive infrared sensors; and Radio Frequency Identification (RFID) readers. Expanding upon the targets of PGI frameworks, e-parking is an imaginative stage that enables drivers to get parking data previously or amid an excursion and to hold or reserve a Parking spot. Drivers get to the focal framework by means of a wireless or the Internet.

As indicated by a report, Smart Parking could bring about 2,20,000 gallons of powers sparing till 2030 and approx. 3,00,000 gallons of fuel spared by 2050 , if implemented effectively.

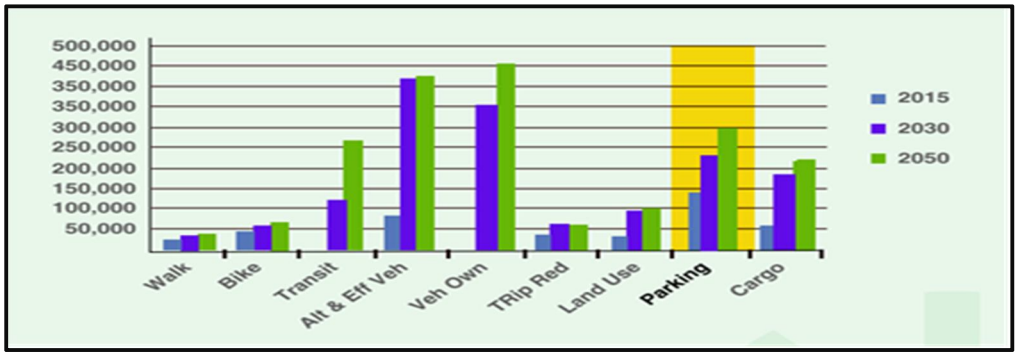

Fig. 1 Measure of fuel to be saved by implementing methods on various sources

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II. REVIEW OF RELATED LITERATURE

Various methods have been proposed for development of autonomous parking systems. Mingkai Chen [1] is a smart parking system which allots users nearest parking slot. It considers only minimum driving distance as allocation criterion.

Another proposed model based on Internet of things (IoT) by Iris-Net [2] uses Raspberry-pi and pi camera to continuously capture images of the parking slot to find empty ones. These sensing devices were used to detect the availability of parking spaces. The main limitation of this scheme was the large amount of power consumption and may suffer from technical aspects.

Also S.V. Srikanth [3] proposed a Smart Parking (SPARK) Management system which provides advanced features like remote parking monitoring, automated mechanism and parking reservation system. Though prototype system, they proposed the architecture which satisfies the car parking system requirement.

Vipin Kumar Verma [4], proposes distributed traffic monitoring and controlling model using sensors and dedicated traffic servers. This model is described as basic role-oriented processes communicating though primitive interaction protocols. The model is aimed to provide an enabling communications framework upon which multi agent system models can be organized and built to be used for an simulation of an road map and to estimate the traffic behavior (to provide information about the best routes). The model assists the drivers to get the desired destination taking into account the current situation of traffic characteristics.

III.PROCESS DESCRIPTION

A. Architecture

Smart Parking System as a domain has been divided into varied number of individual parts. Each part goes about as a sub-block of the domain area. It is obvious to see that, the components incorporate, 'activites' , 'connectivity', 'application', 'platform' and 'sensor nodes'. Each sub-block has components that constitute that piece as a whole, for eg. The connectivity sub-block which incorporates wifi as WiFi module (esp 8266) was utilized to associate the android application with the arduino, after this association the data that is recovered by the application is put away in a database that is composed in SQL, also the application sub-block incorporates java and xml on the grounds that they were utilized to code the application.

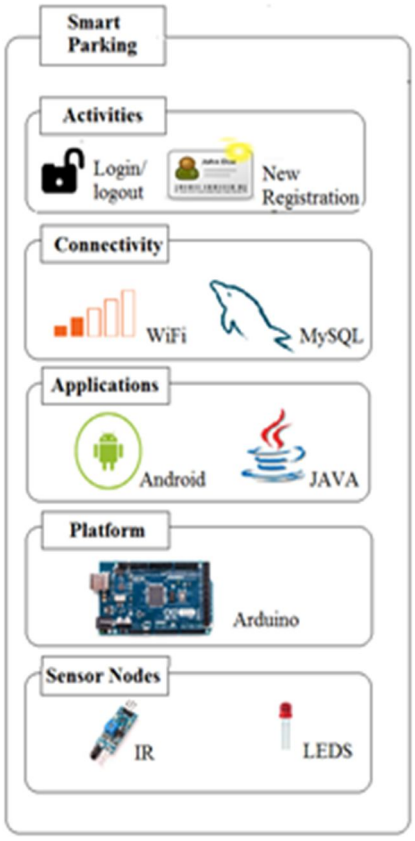

Fig.2 Diagramatic representation of the architecture

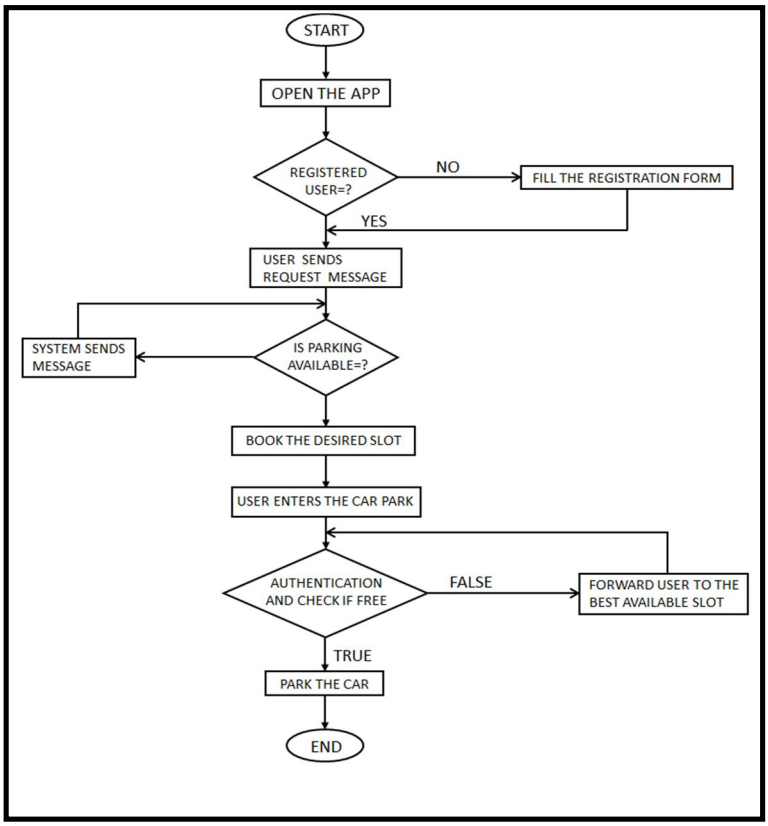

Fig.3 Flowchart of the process of SPS

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B. Components Used

1) *16x2 LCD Display:* A Liquid Crystal Display draws its definition from its name itself. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. It is used to display the slot numbers that are available to the user. Absence of a slot number on the LCD indicates it's unavailable to the user for parking. This makes it easier for the user to choose a slot that's favourable for them.
2) *IR Sensor Module:* An Infrared (IR) sensor is used to detect obstacles in front of the robot or to differentiate between colours depending on the configuration of the sensor. An IR sensor consists of an emitter, detector and associated circuitry. IR sensors are used to detect whether a car is already parked at a particular slot or not. This data is then provided to the LCD
3) *Arduino ATMega 2560:* The Arduino Mega is a microcontroller board based on the ATmega1280. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an adapter. It is the main hub for all the programming.
4) *Limit Switch:* A typical limit switch consists of a switch body and an operating head. The switch body includes electrical contacts to energize and de-energize a circuit. The operating head incorporates some type of lever arm or plunger, referred to as an actuator. The standard limit switch is a mechanical device that uses physical contact to detect the presence of an object (target). When the target comes in contact with the actuator, the actuator is rotated from its normal position to the operating position. This mechanical operation activates contacts within the switch body.
5) *Plastic Gear Mechanism:* Materials used in plastic gears are, in general, engineering plastics such as polyacetal (POM) and MC Nylon which is essentially polyamid resin. In addition, U-PE and PEEK can be used. KHK's fused gears are designed in such a way that the holding strength of the fused surface is stronger than the tooth strength. The positive characteristics of plastic gears include being lightweight, non-rusting, quiet, injection molding enabling low cost and large production, and able to operate without lubrication by mating with metal gears. On the other hand, low strength, tendency to hold heat, large dimensional change including backlash compared to metal, etc. are some of the points requiring caution. The degree of dimensional changes that occur with plastic gears depend on the ability to resist temperature change, moisture absorption rate and resistance to chemicals. These gears would be used to move the lift left, right, front and back; one for the front and back movement and another for the side to side, i.e., the right or left movement. The up and down movement of the elevator is also implemented using this very same mechanism.

Fig.4 Plastic Gear Mechanism

6) *DC Motor:* DC motors have been used in industrial applications for years. Coupled with a DC drive, DC motors provide very precise control. DC motors can be used with conveyors, elevators, extruders, material handling, plastics, etc. which is the main reason why DC Motors are preferred to be used.
7) *IC 555:* This simple LED driver circuit allows us to drive up to seven LEDs by using a single NiMH (Nickel Metal Hydride) AA cell. The circuit produces voltage pulses at a much higher level than the input supply voltage by pulsing the 220 uH inductor. The inductor must be a high Q (Q>90) power inductor. When the input is 1.25 V and the LEDs are connected, the voltage pulse level will be 23V. It is used to drive multiple number of IR LEDs simultaneously. The LED driver uses a CMOS 555 timer since it operated with low voltages and can work for about 190 hours when using a single NiMH battery cell rated at 2000 mAh. The 555 timer drives the transistor at 222 kHz rate. When a single 1.25V cell is used, the seven LED group will draw about 8mA from the battery. When the input value increases to 2.5V, the total drawn current will be 20mA.

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8) *Conveyer Belt:* A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. The belt consists of one or more layers of material. It is common for belts to have three layers: a top cover, a carcass and a bottom cover. The purpose of the carcass is to provide linear strength and shape. The covers are usually various rubber or plastic compounds specified by use of the belt. To make the up, down, left, right, front and back movement of lift more simpler, the conveyer belt is used.

IV. BLOCK DIAGRAM

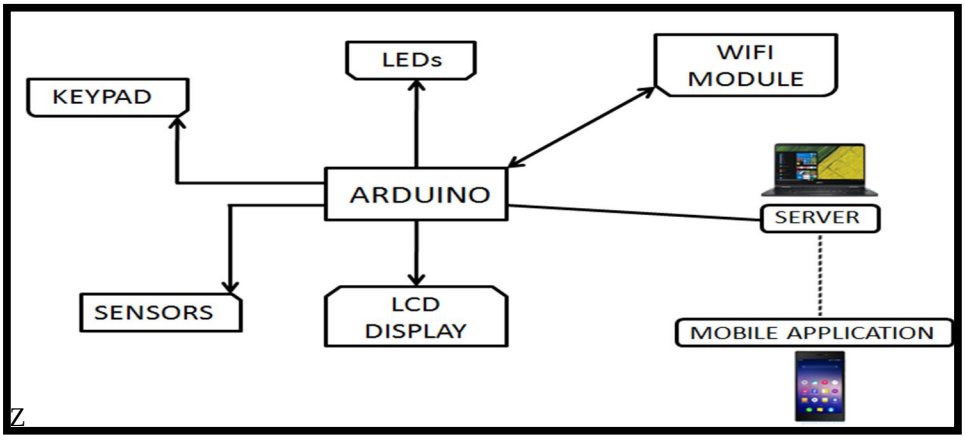

Fig.5 Block diagram of SPS

The block diagram represented in Fig. 5, clearly demonstrates that arduino (Arduino Mega 2650 in this case) is the parent component. IR sensor modules, LEDs, keyboard, console, LCD display and a WiFi module are all interfaced with the arduino board. They all have their own special purposes. IR sensor modules and LEDs are utilized for indication purposes, keyboard is interfaced to take slot number as input from the client, a 16x2 LCD is used to display the slot numbers of all the accessible openings and the WiFi module is utilized for connectivity purposes of the mobile application that is utilized for pre-hand reservation. Detailed portrayal of every single component utilized is mentioned in the sub-parts specified previously. The server is the main hub from where the program is fed into the database.

V. SYSTEM REALIZATION & WORKING

A. Parking Space Detection

The framework in itself has both, an equipment and programming part, ideally termed as the hardware and software part. They both work in a state of harmony and sync for the ideal working of the proto-type model of a Smart Parking System focused majorly on the reservation of slots. The whole framework is isolated into singular spaces. Each slot is outfitted with IR sensors and LEDs, the latter used for indication of accessible and non-accessible slots. As the car enters the system, the data about each of the slot number, whether accessible or not is displayed by the LCD display. The input from the user, of the desired slot number is considered into the database using the interfaced keyboard. If a car is present at slot number 5, the display indicating the available slots would not be displaying the slot number 5 and the LED indicating the availability of that slot will be OFF. The process trailing the reservation of slots through the mobile application is comparatively similar.

B. Working Of The Elevator

The lift is controlled by the DC motor and plastic gear mechanism. As the client enters the slot number, the dc motor with customized programming through arduino will move towards the coveted opening of the slot entered. The elevator movement is in the rightward and leftward bearing, along with a front and back bearing and a belt is utilized to lift the elevator in upward and descending directions. As the elevator reaches the desired slot the car is parked in the desired slot and the same process is followed in the reverse format while retrieving the car.

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C. Software Prototype

The android application developed in Arduino Studio will have its own database which is connected to a local host network. The data from the sensor regarding the availability of slots is then retrieved from the Arduino. Each time a car enters or exits the system, the database of the application will be updated. The interface will get updated when the mobile enters the proximity level of the wifi module esp8266.

VI. MERITS

1) *Optimized parking:* Users locate the best spot accessible, sparing time, assets and human efforts. The parking garage fills up effectively and the total space can be used in a better way by business and corporate entities.
2) *Reduction in traffic:* Traffic stream increases as less number of cars are required to drive around looking for an open parking spot.
3) *Reduced contamination:* Searching for parking spot consumes around one million barrels of oil a day. An ideal parking arrangement will essentially diminish driving time, along these lines bringing down the measure of day by day vehicle outflows and at last lessening the global environmental footprint.
4) *Upgraded User Experience:* A brilliant parking arrangement will coordinate the whole client encounter into a unified action. Payment by the user, spot recognizable proof, area pursuit and time notifications all flawlessly turn out to be a part of the destination arrival process.
5) *New Revenue Streams:* Many new income streams are conceivable with smart parking system. For instance, the lot owners can empower layered payment alternatives reliant on parking lot locations.
6) *Increase in Safety:* Parking lot workers and security guards contain real-time lot information that can help forestall parking infringement and other suspicious activities. Important footages can be gathered by using license plate recognition cameras. Additionally, diminished spot-searching movement in the city can decrease accidents from occurring mainly caused by the diversion of looking for parking spot.
7) *Real-Time Data and Trend Insight:* Over time, a smart parking system can gather data that reveals connections and patterns of clients and lots. These patterns can turn out to be extremely useful to lot owners in the matter of how to make alterations and enhancements for drivers.
8) *Management Costs Decreases:* More automation and less manual activity saves on labour cost and asset depletion.

VII. CONCLUSION

We have proposed a "smart parking" system with technologies for parking space availability detection, driver confinement and one that dispenses parking space to drivers rather than just providing direction to them. In this, we have built up another Reservation-based Smart Parking (RSP) framework to enhance parking management. The proposed design for aa parking detection system would diminish time used in hunting down empty spaces and decrease instances of single cars improperly parking across two spaces. This framework can conquer problems of traffic blockage and it additionally offers time saving and reliability; likewise fuel utilization which emerges because of the undesirable searching of a parking spot is decreased. Future research may inspect car park booking procedures and improvement of sensor utilization. Cost adequacy and advertising could be examined as well.

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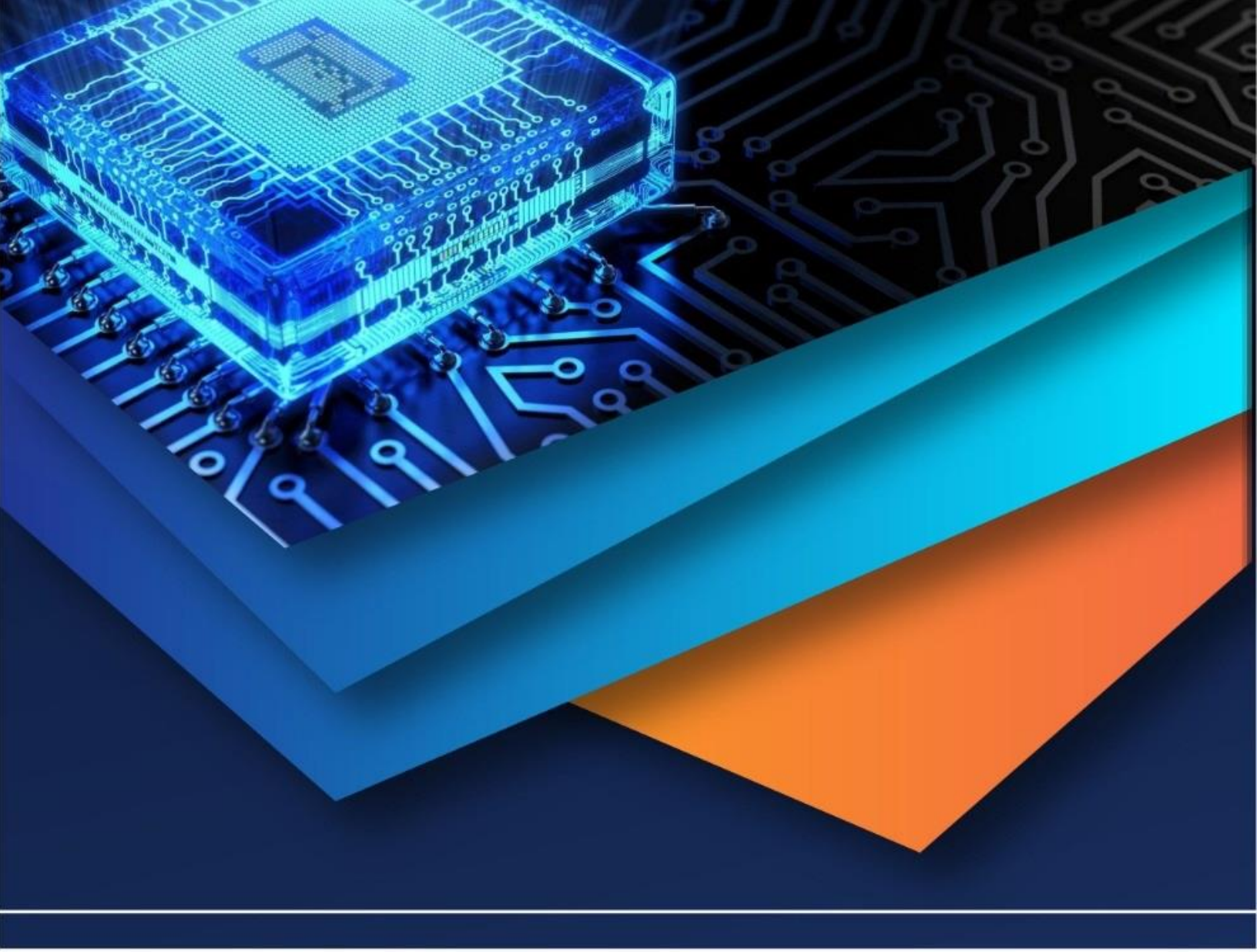

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