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Automation of Manually Operated Devices

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Abstract: ***Water is an essential resource in the world and currently household drinking water is an important asset to save the life due to shortage of water on the earth. In this fast world is looking at options to make routine works automated and help elderly people and patients at home through automation. This system describes the design and development process of an automatic control system for tap water using IR sensor and DC motor which can avoid wastage of water. The physically disabled persons require special assistances from caretakers or other persons to lead their normal life even at home. It is not convenient for them to control the house apparatus system according to their wish. In this project, automation system is implemented which consists of automating manually operated electric switches using mobile as controller. The project is implemented using low-cost components and based on microcontroller platform with an aim to develop a system which will be effective to reduce water wastage in real time.***

Keywords: Automation, IR sensor, Microcontroller, DC motor, Water Wastage.

I. INTRODUCTION

Water is a fundamental human need. Each person on Earth requires at least 20 to 50 litres of clean, safe water a day for drinking, cooking, and simply keeping themselves clean. This is an era of automation. Overuse and misuse of potable water are the common problem in our daily life, sometimes we go out after keeping water tap open (while absent mind and forget to close), which causes a wastage of water. To overcome or minimize this problem we build an automatic control system for water taps using sensor and motors. Implementation of an automation system will help physically disabled people become self dependent. Where in this project, it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. The working principle of water taps is very simple and effective. Taps are normally constructed from solid brass for a longer life and then chrome or gold plated to add an easy to clean finish. The water pipe is connected to the bottom. Water is then held in a chamber until required. When you want water all you need to do is turn the handle anticlockwise which unscrews an internal valve and starts the flow of the water. In our project we design and implement an external adapter to control the electrical switches through controller. The role of the electrical switch is to regulate the current that travels between the load and the power source. The power source is what pushes the electrons through the circuits. The familiar on/off toggle switch is the most common. Apart from this, three way circuits and dimmer circuits, three-way circuits are made up of two separate switches that control the same device (like a lamp); whereas a dimmer circuit merely regulates the amount of electricity that gets through. Electrical circuits only work when the electricity is free to move through in a continuous loop. Once that loop is broken, the electricity is cut off. This is where the switch comes in. An on/off toggle circuit breaks the current when it's in the "off" position. When it's in the "on" position, the current or loop is completed.

II. LITERATURE SURVEY

Water is an essential resource in the world and a precious resource which sustains our lives. Therefore, if sustainably is not done properly then it can be devastating to our communities. The ability to closely monitor water level and to protect water from wastage is an important issue through the fields of engineering as well as environment. A research proposed on the design of automatic controlling system for tap-water using float less level sensor. This automatic system consists of a solenoid valve; relay, float-less level controller and electrodes. When the electrodes are in contact with liquid, the circuit is closed (the liquid completes the path for electricity to flow) and the electrical current that flows in this circuit is used to detect the level of the liquid. [1]. The systems that can automatically control the water tap accordingly when level sensor can sense the lower level of water tank and have ability to activate the relay which starts solenoid valve. This system uses three level sensor at different positions, if one of the sensors fails then solenoid valve is not controlled properly. A paper on automatic voice based home Navigation system for the elderly and the physically challenged person has been discussed in [2]. If obstacle is detected then it takes left and moves in straight line until it detects the line. If the line is detected then the wheelchair follows the line till it receives any signal from IR TSOP. By analysing the data received from the TSOP the system determines if the destination is the particular room in the house dictated by the voice and then enters the room and stops. However, the main defect of this system is that it is applicable only for wheelchair used persons.

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The GSM and internet modules are designed to access the home appliances from a remote place and the speech controlled module is designed when someone wants to control the appliances from inside the house without using hand to save time [3].In this system internet facility to obtain connectivity and design is complex and costly. The main objective of this paper is to develop a home automation system for a physically disabled person who will ensure no water wastage and develop an automatic control system for electrical apparatus of light, fan and water pump along with Bluetooth remote access and solar charging unit. A solar charge controller will be used to power the complete system to reduce power consumption.

All the necessary peripheral will be interfaced with the microcontroller unit and programmed to execute different operations [4]. A bi-directional counter is used with Two IR sensor modules which contain IR diodes, potentiometer and a Comparator (Op-Amp) to control automatic turning on and off of light and fan. A Bluetooth module HC05 has been interfaced with the system to control the system with remote access from android mobile.

The sensor tap system must have power, whether battery or a transformer. With electricity supply, the sensor can detect an object, like a hand opposite the basin tap. Price range is wide and sensor taps probably imply more initial investment than traditional taps, plus a remote control is necessary to change the default settings. If there is a water cut, one cannot use the faucets. If there is a power cut, mains operated sensor taps will not work either [5]. A system is designed for a real-time measurement system for flood monitoring and warning applications using sensor networks. A model-based flood warning system, for mitigating the effects of flooding on life and property, incorporates a catchment model based on observed/forecasted rainfall and telemeter observations of hydrologic state variables at various locations within the catchment area [6]. Another researcher proposed a design for coal mine water level measuring and monitoring system based on wireless sensor networks. The safety monitoring system of coal mine based on wireless sensor networks is mainly made up of four parts: sensor node, Sink node, transmission networks and monitoring center, the system architecture. The mine safety monitoring system consists of large numbers of dense wireless sensor nodes which are widely distributed in coal mine in order to ensure high precision and reliability of data acquisition [7].Another literature that has emerged concerns of GSM based water level monitoring in the tank as well as in the bore well system. This project has achieved its objectives and provides solution in the form a system that can monitor water level and sensing temperature via SMS by using GSM technology. This system has capability to detect water level of the tank and sense the temperature of the tank. For sensing the sensing the temperature we use sensor LM35. It notifies GSM modem to send SMS to intended user phone or you can say person in charge [8]. Likewise, some other research work has done to monitor the water level as well as control the wastage of water using different techniques. Sensor taps most likely infer more starting speculation than conventional taps, in addition to a remote control is important to change the default settings. In any case, touchless tapware spares costs over the long haul, particularly for business washrooms, and only one remote control can change a boundless number of good programmed taps. If there is a water cut, one can't utilize the faucets. In the event that there is a power cut, mains worked sensor taps won't work either.

Sensor faucets are automated by electric power. So an outage in electrical power or a power cut implies no water. If your home is located to an area that usually experiences this kind of problems, then sensor taps are not for you [9].

This paper is on automatic plant watering method. At a specified time interval water was fed into the pots by sensing the moisture level of the plants. In addition to watering the plants remotely by using a Smartphone and internet connection we have also implemented the tap control in kitchen and bathroom for the safe living of the elderly people and patients. The project is designed to function as an automatic irrigation system which turns the pump/motor ON/OFF depending upon the humidity content of the soil. The project uses ATMEGA 328 microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. This is achieved by using an op-amp as comparator which acts as interface between the sensing arrangement and the microcontroller [10]. This system along with the camera based video surveillance system helps to monitor the requirements of elderly people and patients and help them to switch ON/OFF the taps when required [11]. Authentication details help us to allow the intended person only to control the taps. In the first screen the display of different rooms of the smart home will be displayed. After selecting the appropriate room the display of different taps in the selected room will be displayed. To install this type of system costs more and recording of the clips should be maintained in proper order and require memory to store these files.

A paper on a ZigBee-based voice controlled wireless smart home system for an elderly and disabled person has been presented in [12]. In these paper two main systems has been proposed by the authors. One is voice recognition system and other is a wireless system. The basic system operation of the proposed system is that the user has two options for controlling the home appliances by using manual switching and by using voice recognition. The control unit is an interface program that must satisfy the following two conditions the output from the interface program is forwarded to a wireless transmitter and sent to a receiver through wireless channel, and the receiver at the appliances accept the receive signal to turn ON or OFF the device.

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III. GAPS IN LITERATURE

Technology used in all the above papers is complex and requires internet facility for the working. Sometimes connection problems may occur and is applicable for only certain class of people. People from rural areas may not be able to use this technology because they may not be having smart phones to operate them. When relays are used in the automation of electric AC appliances like lights, fans etc, there will be shunt current present in relay even when power is off, which result in waste of power. In one of the paper solar charger is used, which may not be efficient in cloudy days, and then other alternative source has to be considered. What is missing in the literature is automating existing manually operated devices such as electric switches and water taps.

IV. PROPOSED WORK

The proposed work involves two parts: firstly, automating manually operated water taps with the help of an electromechanical adopter which will be designed using motor and sensor. Secondly, automatically operating the existing manual electric switches with the help of electromechanical adopter designed using motors and levers controlled using mobile commands. The work proposed is different from existing devices or technology. If one needs sensor taps then entire existing setup need to be changed and cost for installation and maintenance is more. The proposed work involves low cost automation and is easy to install with high accuracy. Simple working procedure is followed and power consumption is low. We are controlling the electric switch to turn ON/OFF using mobile commands through an application, using simple DC motors and microcontroller. The most important aspect of this work is that we are not disturbing the existing switch box or system; we are only fixing external adapter type controller system for turning the switches ON and OFF.

V. METHODOLOGY

A control system is designed and developed based on an intelligent electronic control system to convert manually operated devices to automatic. To control automatically the manual components like water taps and manual switches using controller. Reducing wastage of water by automatic control of water taps based on human hand detection and conserves energy by automatic ON-OFF of the manual electrical switches by using mobile control.

A. Automatic Control of Water Taps

Microcontroller is used to control the action to be performed by the system. IR sensor detects the presence of human hand (obstacle), sends signal to microcontroller which in turn rotates the DC motor to turn ON water tap. In absence of human hand (obstacle), DC motor made to rotate in anticlockwise direction to turn OFF water tap.

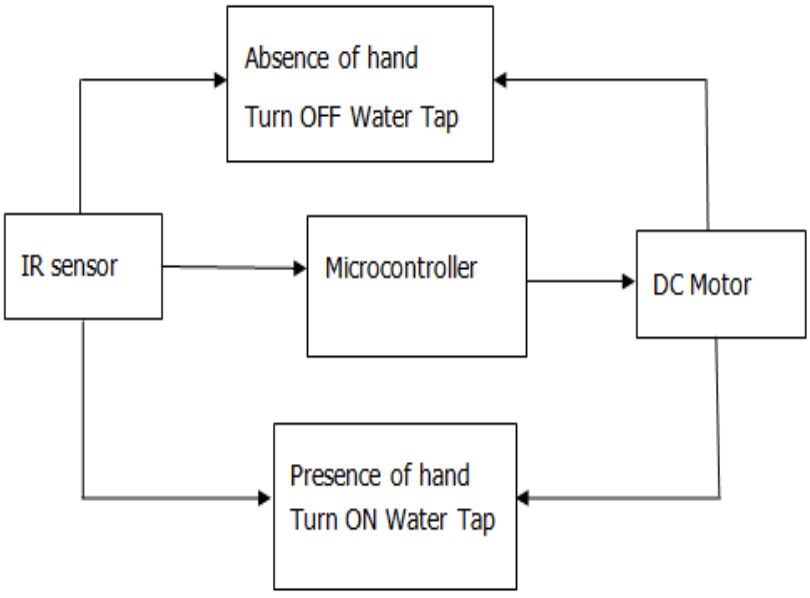

Figure 5.1 Block Diagram of Automatic Control of Water Taps

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1) Flowchart

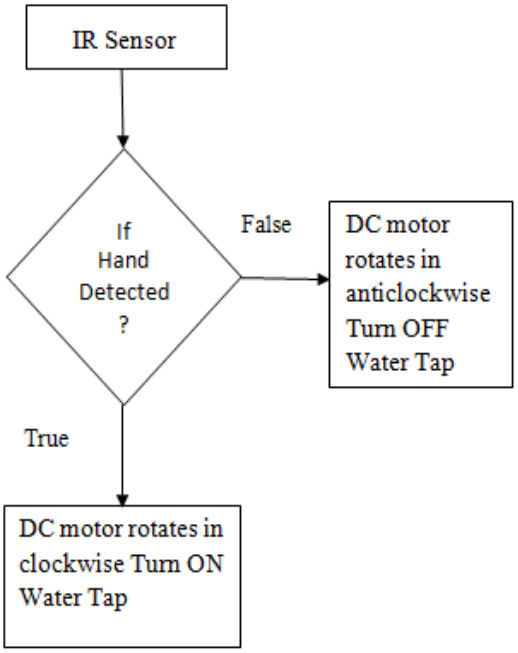

Figure 5.1.1 Automatic control of manual water tap

IR sensor detects the presence of obstacle, if the hand is detected, IR sensor signals microcontroller to rotate the DC motor in clockwise direction to turn ON water tap otherwise in anticlockwise direction to turn OFF water tap.

B. Automatic control of Electric Switches

Each switch on the board is assigned a particular command through mobile application. When a particular command is given from application, the WiFi module receives the signal and feeds it to microcontroller. The microcontroller drives a DC motor based on the commands given, which in turn makes particular switch to ON/OFF by pointing to the switch position.

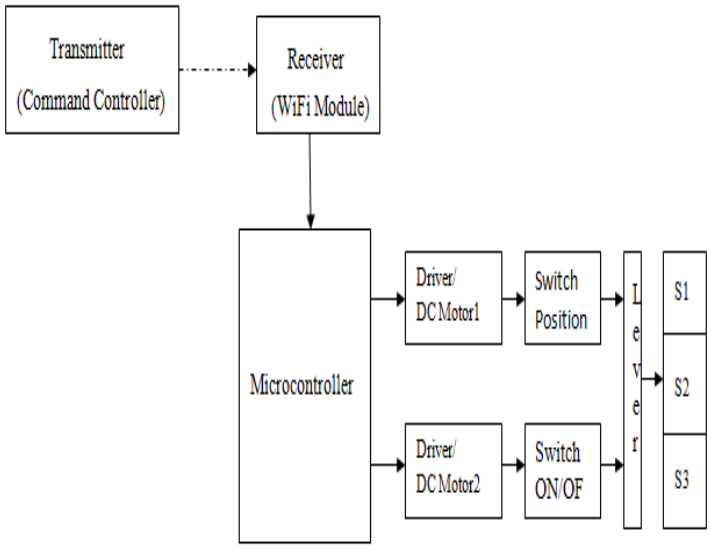

Figure 5.2 Block Diagram of Automatic Control of Electric Switches

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1) Flowchart

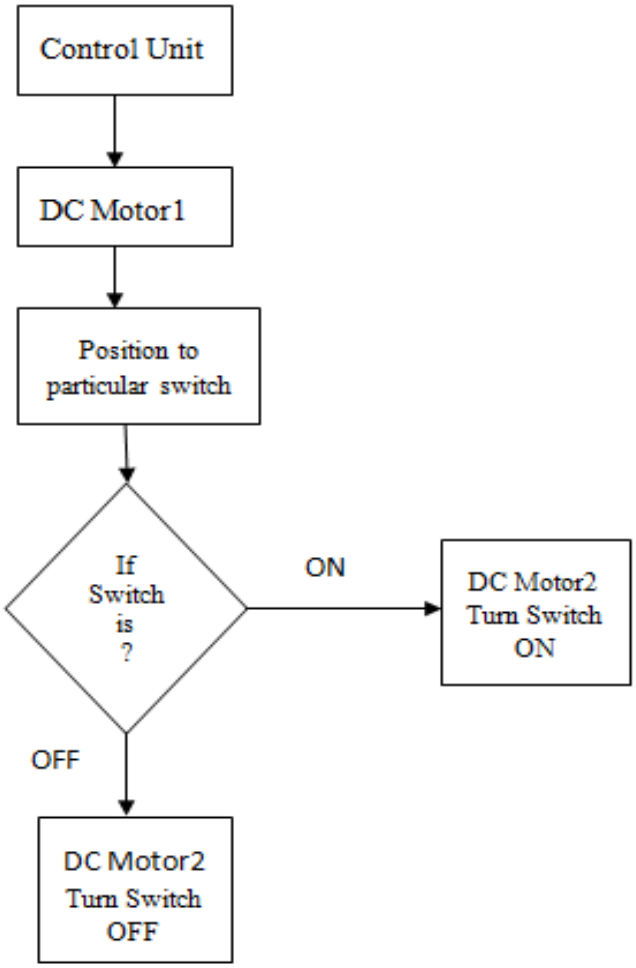

Figure 5.2.1 Automatic control of Electric Switches

Based on the command given from mobile application, microcontroller which keeps track of status of switches drives DC motor1 which is used to control the lever to go to the switch position then moves the other lever using a second dc motor to toggle the selected switch. Based on the key pressed on the remote, first DC motor1 is ON to move the lever to a particular switch position in forward direction if positive polarity is given to DC motor1. Similarly the lever moves in reverse direction if negative polarity is applied to DC motor1. DC motor 2 is responsible for turn ON and OFF of the electric switches.

VI. RESULTS

The system has been implemented and tested on existing manual water tap. DC motor converts the electrical energy into motion which can physically start and stop the water flow. IR sensor detects the hand then DC motor is rotated in anticlockwise and turns ON the water tap. If hand is detected by IR sensor then water tap turns OFF and all these actions are controlled by Arduino.
Expected result for automatic control of electric switches using two DC motors, one for adjusting for the position to particular switch and other for action to be taken that is ON or OFF.

VII. CONCLUSIONS

The product developed controls manual water taps automatically and electrical manual switches to turn ON or OFF automatically using command control system. This product helps physically disabled people to use water taps at ease and to maintain hygienic in general and specifically in rural areas. This project is also helpful to medically ill and old aged people in helping them to operate manual components automatically.

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A. Applications

It is very useful in Hotel and restaurant.
Home Application
College and Industrial Application

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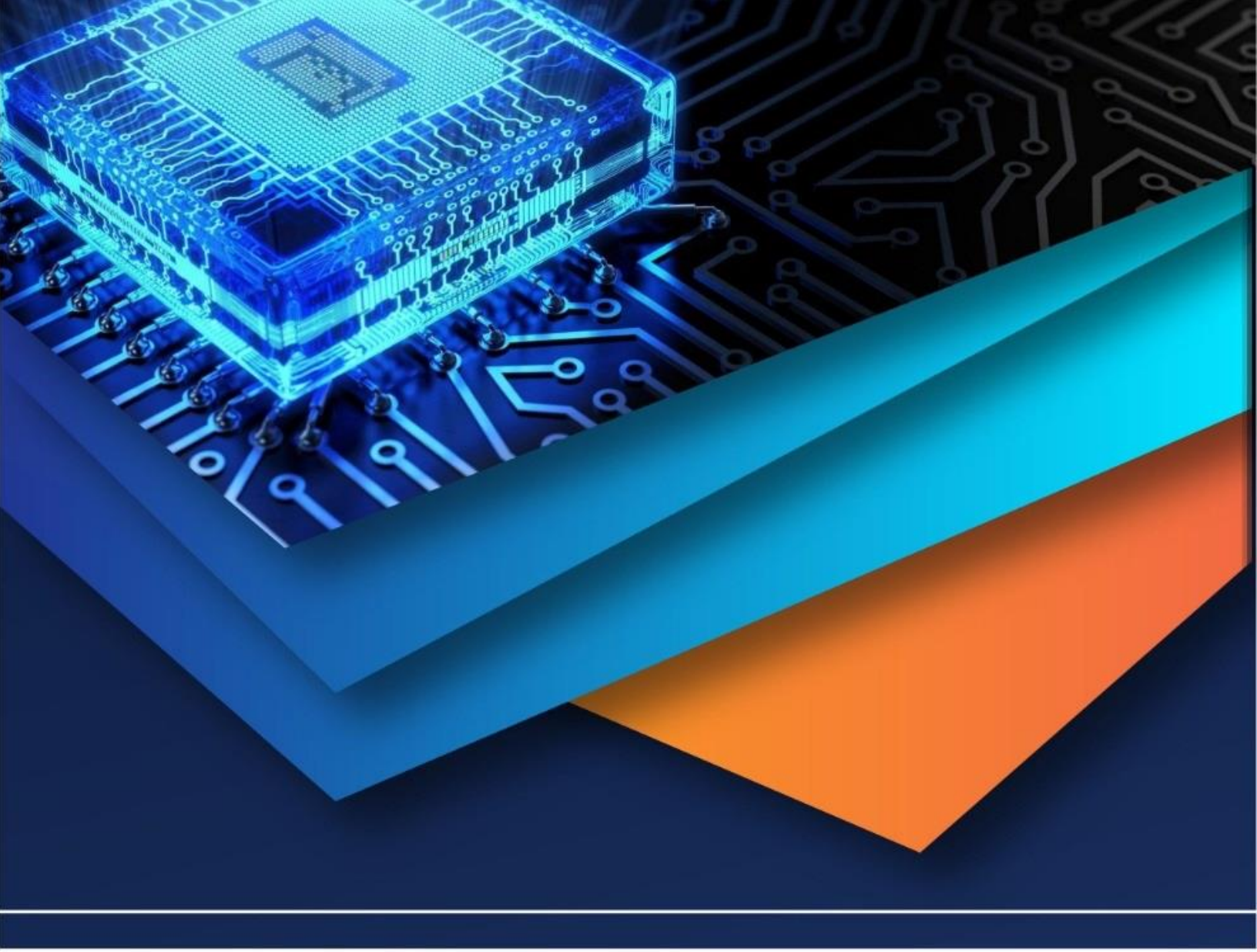

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