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Automated Board Duster

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***Abstract:** An automatic blackboard duster is an instrument, used to clean the board automatically with the help of duster. During teaching, the chalk dusts cause respiratory problem of the teacher as well as the student in the classroom environment. As per current state of knowledge on particulate matter, it remains suspended in the air for some time before settling on the surface. In the existing system involves a moving cradle, which houses a duster to erase the board . This design is usually bulky and consumes a lot of space surrounding the black board and it needs regular maintenance was also required to keep the system functioning efficiently. A huge variety of board cleaners had been developed. However, all the commercially available versions were derived from a basic design. They all had a belt pulley mechanism driven by a commutated electric motor , which powers the system. A major disadvantage of the whole belt-pulley mechanism was that, after being used for a sufficient time , the belt from the pulley wear out , which cause the belts to slip off the pulley. The proposed system overcomes the disadvantage of the present blackboard duster. A tiny, high rpm motor is used to rotate plate which holds the duster. The dust will be collected in the separate container made of transparent plastic material to help the user to easily identify the dust level. This invention saves time and help to maintain a clean classroom environment. The collected dust is bleached and recycled to make a new chalk piece. The board automation is controlled by PIC Microcontroller. Then each and every process is controlled by interfacing with Programmable Logic Controller.*

I. INTRODUCTION

A black board is a reusable writing surface on which text or drawings are made with chalk sticks of calcium carbonate or calcium sulphate. Black boards were originally made of smooth, thin sheets of black slate stone. Modern versions are often green because the colour is considered easier about the eyes. A more modern variation consists of a coiled sheet of plastic drawn across to parallel rollers, which can be scrolled to create additional writing space while saving what has been written. The highest grade boards are made of rougher version porcelain enamelled steel. Porcelain is very hard wearing and black boards made of porcelain usually last 10-20 years in intensive use.

The chalk marks can be easily wiped off with a sponge or a special eraser consisting of a block of wood covered by a felt pad. By the use of the automatic board duster we can save time and energy. It is a new methodology that is generally used now a day. Where in an automatic board duster, a duster is mounted on longitudinal movement towards the black board and has a 12V DC motor placed thereon that is mechanically interconnected with a drive assembly for producing erasing operation.

In schools, colleges and other educational institutions, Blackboards are used in the class room for teaching purpose. These blackboards form the basis of an effective learning in the class room environment. Chalk pieces are used to write the texts or drawings on the board . The conventional blackboard duster creates an untidy environment in the classroom. While cleaning the blackboard, the chalk dusts spread over the place and cause breathing problems like wheezing, asthma etc. A conventional duster consumes long time to clean the board and need to be dusted frequently. On the other hand , chalk produces dust, the amount depending on the quality of chalk used. Some people find this uncomfortable or may be allergic to it, and according to the American Academy of Allergy, Asthma and Immunology (AAAAI), there are links between chalk dust and allergy asthma problems.

II. EXISTING METHODOLOGY

In existing methodology, warm gear and spur gear system were used which provides noise during erasing operation. Also it was not that much efficient in cleaning the board and time consumption is high. This system does not collect the dust which in turn creates an untidy environment in the classroom and also causes skin disease to the teacher. To overcome these disadvantages this project has been proposed. In our proposed project, only spur gear mechanism alone is used which reduces the time consumption and noise of the system with increase in efficiency.

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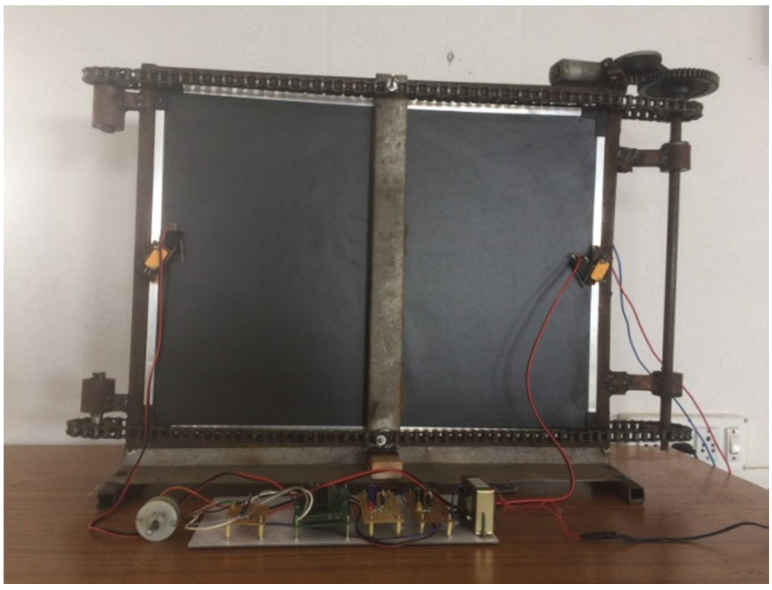
III. PROPOSED METHODOLOGY

This system is proposed to interface the mechanical aspects of the mechanical erasing system with micro controllers so as to enhance it into automation rather than manual. Atmel micro controller is used to interface the board erasing mechanism. This automated black board erasers is used to clean the board automatically and to collect the dust produced during erasing the board. The model consists of a DC motor which is used to move the entire erasing apparatus from one end to the other end to complete erasing operation . A DC Motor is used to rotate the spur gear that is wound with the erasing material. The erasing material which consists of sponge, which is used to erase the board and the dust settles at the bottom of the board after erasing. A scrubber is placed at the bottom of the erasing material to collect the dust settled at the bottom. Finally the chalk dusts which can be collected in a box.



A. Design Of Automated Blackboard Duster

This chapter deals with the design of automated blackboard duster. This gives a brief of components used and the entire process development. All operating device and their ranges are specified in this chapter. This explains in brief about the working of the circuit and the elements used in it.

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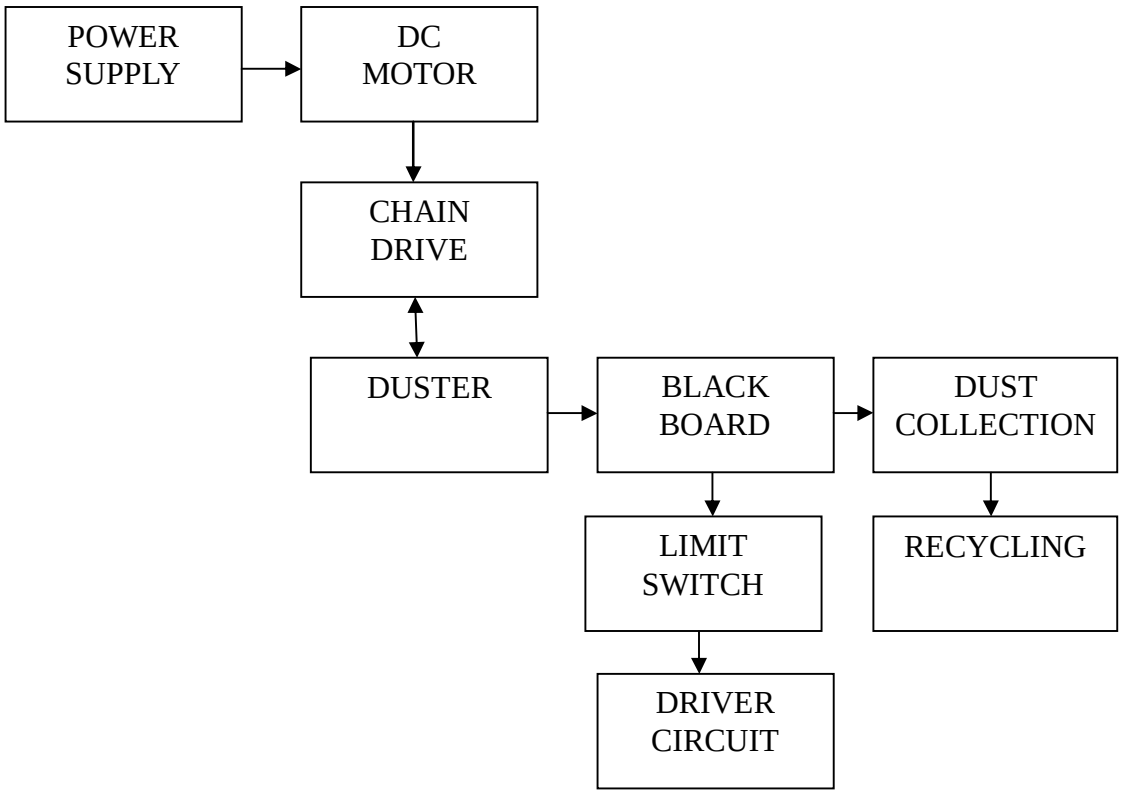
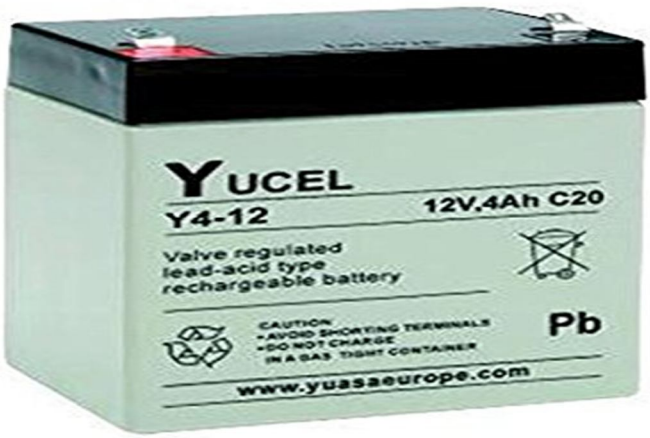
B. Block Diagram



The above block diagram which clearly explain in detail about the project. where the power supply (battery) is one of the most important component in this project. A battery of 12v DC supply, is directly connected to the positive and negative terminal of the DC motor. DC motor which converts the electrical energy into mechanical energy and the output of the DC motor is given as an input to the chain drive with spur gear arrangement which is in contact with the top of blackboard. A duster with the length of 12 inches and width of 1 inch is attached directly towards the chain drive for the cleaning operation. A Limit switch is placed at the both ends of the blackboard and which is interfaced with the driver circuit. It gives a signal when the duster in the blackboard reaches the end of the board to the microcontroller for the to and fro motion of the duster. Atmel Microcontroller is the important component of the driver circuit which is programmed to perform to and fro motion of duster attached to the chain driven.

C. Component Description

1) Power Supply: below figure 12v battery shows the power supply of the automated blackboard duster.



12V Battery

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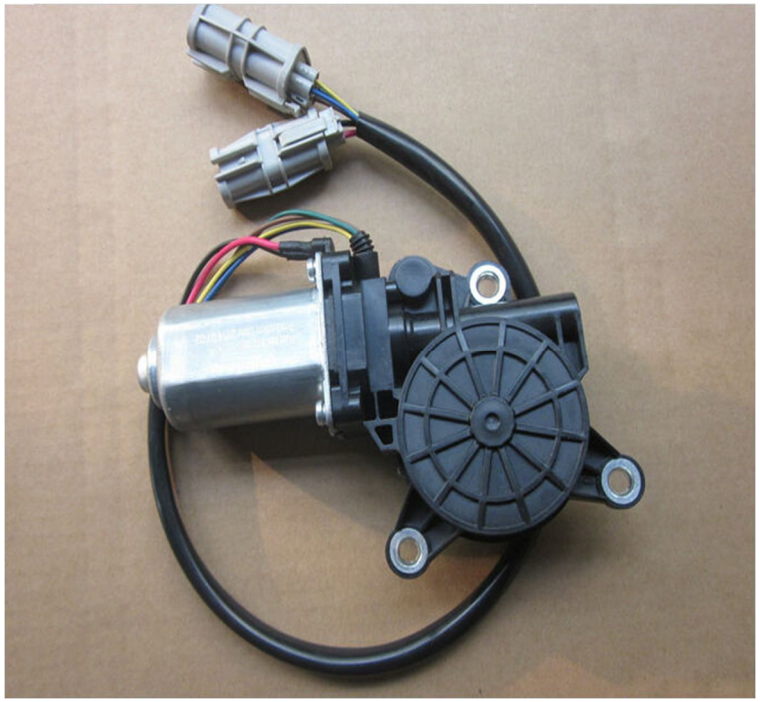
A battery which converts chemical energy into electrical energy by a chemical reaction. Which can be one cell or many cells. Each cell has an anode, cathode and electrolyte. The electrolyte can be a solid or liquid. Exothermic reaction is occurred in a battery. This type of battery is reliable because it is recharged by reversing the chemical reaction that occurs to the battery. It gives 12v DC supply, which is directly connected to the positive and negative terminal of the DC motor.

D. DC Motor

In any electric motor, operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor ,and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current carrying conductor and an external magnetic field to generate rotational motion.



Power window DC Motor

The direct current (DC) motor is one which converts electrical energy into mechanical energy. It is widely used in the to and fro motion of different applications. It is 12 volts and 4 Amps, which is operated in the load speed at 48 rpms. In this project, the output of the DC motor is given to the chain drive for the to and fro movement towards the duster.

E. Chain Drive

Chain drives is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth. Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered.

The output of the DC motor is given as the input to the chain drive .Where the chain drive can be used for the forward and

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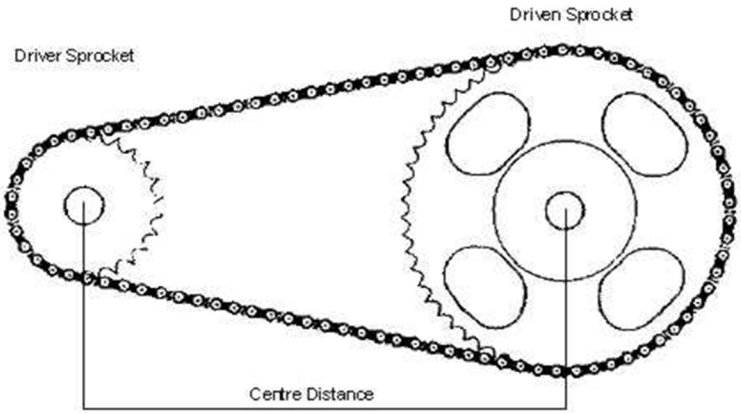
backward movement of the duster which is connected with the chain.



Chain Drive

F. Duster

A Duster is a special type of eraser specifically used to erase chalk markings on slat paint (used on chalkboards and slates). It is most commonly made of felt strips attached to a handle. where the length and width of the duster in the automated board duster is 12 inches and 1 inch .

Duster

G. Blackboard

A blackboard can simply be a piece of board painted with matte dark paint (usually black or dark green). A more modern variation consists of a coiled sheet of plastic drawn across two parallel rollers, which can be scrolled to create additional writing space while saving what has been written. The highest grade blackboards are made of rougher version porcelain enamelled steel (black, green,

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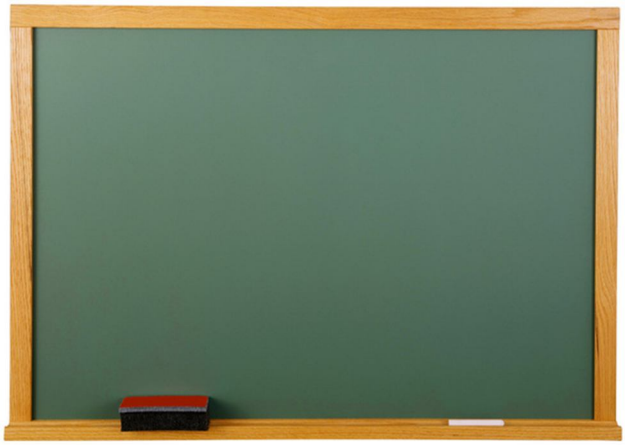
blue or sometimes other colours). Porcelain is very hard wearing and blackboards made of porcelain usually last 10–20 years in intensive use.



Modern Version Board

H. Limit Switch

A limit switch is a switch operated by the motion of a machine part or presence of an object. A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection.

Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object. They were first used to define the limit of travel of an object; hence the name "Limit Switch". They are used for controlling machinery as part of a control system, as a safety interlocks, or to count objects passing a point. In this project , the limit switch is placed at the ends of the blackboard and which is interface with the driver circuit. It gives a signal when the duster reaches the end of the board to the Atmel Microcontroller for the to and fro motions of the duster.

Limit Switch

I. Microcontroller

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

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1) The CPU core
2) Memory(both ROM and RAM)
3) Some parallel digital i/o

where controller Delivering ease-of-use, low power consumption and a high level of integration. These devices offer a unique combination of performance, power efficiency and design flexibility. Optimized to reduce time to market, they are based on the industry's most code-efficient architecture of C and assembly programming. No other microcontroller delivers more computing performance with better power efficiency. In this project , the microcontroller plays a major role in the to and fro motion of the duster. Which is interface with the limit switch, it operates the contacts to make or break an electrical connection when the duster reaches the end of the blackboard.

IV. RESULT AND DISCUSSION

Implementation of automated board duster using spur gear mechanism, Atmel microcontroller and dust collection operation is displayed in this project. This project gives better solution for board cleaning operation. The spur gear mechanism is used in this project for the better efficiency of cleaning the blackboard. where this project which is used for the blackboard cleaning and a improved version of collecting the chalk dust. This method is finally help in keeping the healthy classroom environment. Thus, the automated board duster is made more efficient.

Designing of automated board duster

Obtained Output

V. CONCLUSION

Using the advantages of microcontroller we proposed system which includes implementation of chain drive and dust collection. Automatic blackboard duster mechanisms have been studied and implemented for erasing the blackboard automatically. when there is a text written in the blackboard, it automatically clean the black board. It provides a better solution to the skin problems, time constraints on the class rooms. The basic methodology to use DC motors so as to initiate movement of gear and microcontroller to control the movement of the gear. Thus, the automatic blackboard duster is also a new technology for cleaning the board

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automatically in minimum time period with more effectively. These blackboards form the basis of an effective learning in the class room environment. In this proposed method , the dust collection system is placed at the bottom of the black board. Where this dust collection operation which is automated with the help of microcontrollers for its advantages of low power consumption and high level of integration. which is mainly used to reduce the untidy environment in the classroom and also for the chalk recycling operation.

VI. FUTURE WORK

In future, this project can be modified by using recycling operation. Where the collected chalk dust which is used for the recycling of chalk piece. Then the system is fully automated with the help of Programmable Logic controller. A PLC which is interface with the Microcontroller in the duster automation and the recycling operation system.

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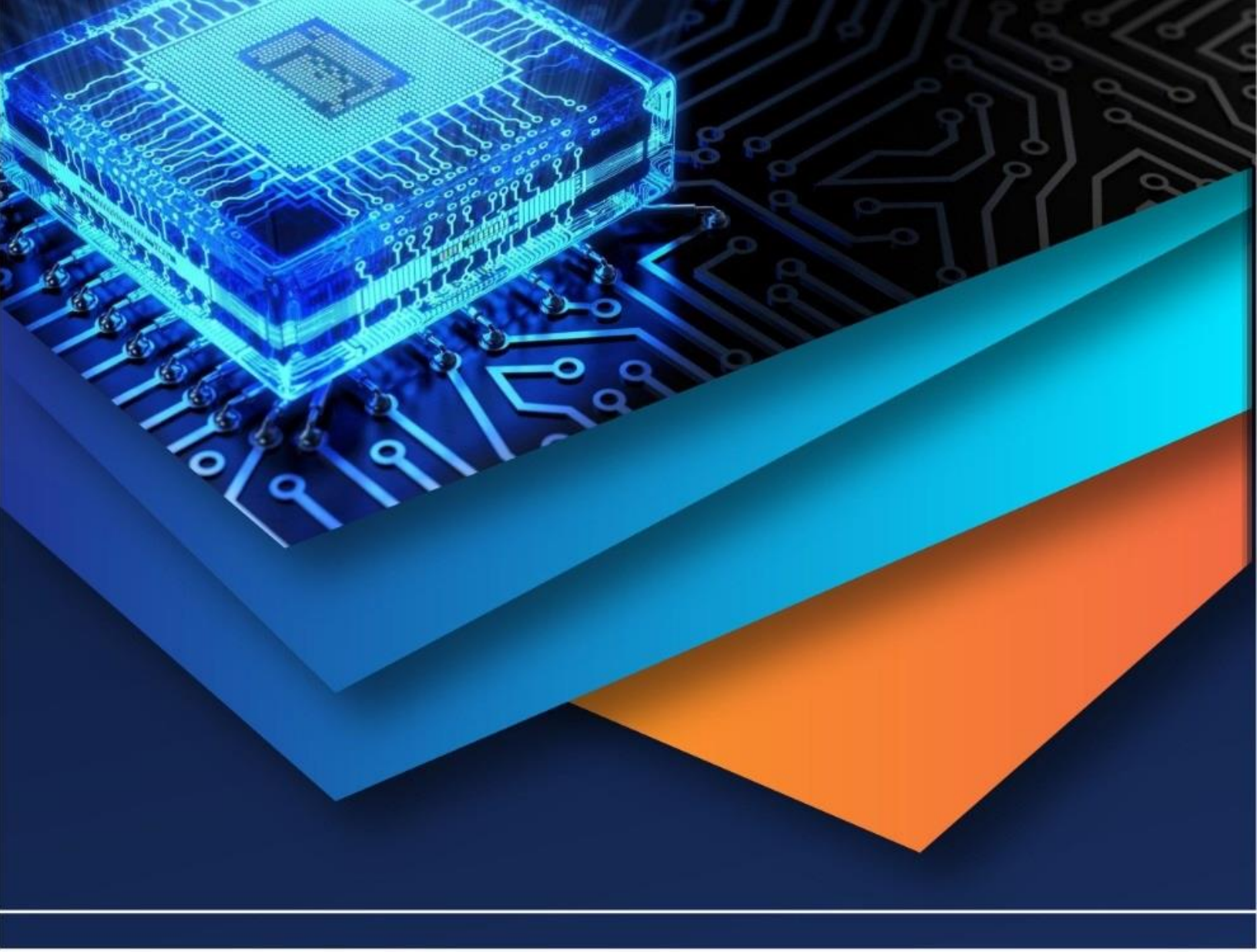

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