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Real Time Automatic Paint Job Quality Inspection System

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Abstract: ***Paint is on important education process & which highly affects a products aesthetics & acceptability. Automation of paint job by using industrial robots & tools have been achieved since last decades, but inspection and quality control of paint job is still a tedious manual test performed by human inspection. The author proposed a fully automated paint job inspection system using by hybridization of image processing & ultrasonic sensing techniques. Ultrasonic surface profiling is employed to measure paint surface irregularities & image processing is used to determine any visual defects in the paint job. An 8-bit low cost microcontroller is employed for ultrasonic profiling using linear actuator mounted ultrasonic sensor with embedded 'c' code. MATLAB is employed for image processing as well as a master controller for embedded hardware acquire ultrasonic profiling data results from both the techniques combined to achieve accurate paint job quality inspection.***

Keywords: ***MATLAB, Ultrasonic sensor, Image processing, Defect detection***

I. INTRODUCTION

This method is employed for paint defects**.** It is a dye or liquid composition The paint consists of following components i.e. pigment or liquid and additives. When it is applied on anything a thin layer coverts into solid film. That is generally used as a shield which protects the texture of objects. The paint has been provided in many colours with different composition such as watercolour, synthetic, etc. It is generally used in liquid form. But most types are dried in a solid.

II. LITERATURE SURVEY

In this paper, the properties and kind of paint defects are examine. In addition, the procedure of classifying of coating defects in image processing is proposed. The image optimization algorithm is studied on the basis of morphology and the optimized algorithm based on graph theory .The support vector machine (SVM) is used to identify and classify film defect. Experimental results have shown that the accuracy of the method exceeds 90% for the particle, scratch, sag, orange peel. Although recognition accuracy of bubble and small hole is low, further useful to improve recognition accuracy of sensor accuracy and increase the number of machine vector training . traditional procedure have low efficiency so this procedure improve detection efficiency. [1]

The aim of paper is to automate the spray coating process for the casing of pumps that are mass produced in industries. Currently, two workers work in one paint booth, one to handle the component while the other one draws the component. In this proposed paper, pump casings are cylindrical components drawn as they are rotated by a three-phase induction motor. A pneumatic cylinder is used to lift the paint gun so that the paint is applied to the height of the entire pump casing. The paint gun is operated by another air cylinder. The process is controlled by an ATmega16 microcontroller. The infrared sensor located at the top of the paint gun is used to detect whether the pump casing is positioned or to detect the upper limit of the pump casing so that the spray can be stopped when the paint gun reaches the top of the pump casing. Pneumatic cylinders are controlled using two pneumatic electric solenoid valves, one for expansion and the other for retraction. When the pump casing is laid, the paint spray starts and the paint gun is lifted. When the paint gun reaches the desired height, the spray stops and the paint gun drops. Finally, the pump casing is ejected. Paint spray system that can paint a cylindrical component with a maximum of 30 cm and a maximum diameter of 20 cm. Only one agent is needed to handle the component, thus reducing the number of workers in the paint booth by one, as well as reducing the time spent in the coating. [2]

This proposed work is an overview of how a servo motor is used to make and control robotic arm joints using a voltage gauge and an Adriano UNO. It is also used in high load industrial applications. [3]

In this paper, Automatically paint of the given dimension was plan and execute. To detect the presence of the wall use infrared transmitter and infrared receiver. To manage the motion of DC motor used microcontroller module. Robot is beneficial, decrease the labour force and time consumption. Chemical paint affect human painters organs. In the upcoming time, robot painter may be improved with image processing to clear hurdle of the wall. These things may be automatically deleted throughout painting. [4]

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In this study, an advanced algorithm is proposed and evaluated to discover and classify small stickers affixed to the objects to be drawn. The correct detection algorithm achieved 98.33% for all color labels in different scenarios. Also, the algorithm has shown that it can work successfully under different lighting conditions without losing its efficiency. This is because the average taken images are taken and predefined ranges are used for detection. Furthermore, the proposed system can recognize labels at different angles while available commercial color sensors such as Color MAX 1000 are sensitive to angle changes. Therefore, errors resulting from not placing the barrier / object (colored sticker) vertically on the sensor are eliminated without the need for any external devices [5]

There was an advanced method for the mechanization of painting of unknown parts. This machine is very useful for painting in any way with less time compared to manual paint, and it also saves labor cost and the total cost of painting any jobs. [6]

In this paper presentation, we present a robot for walls equipped with suction cups attached to the walls, and this prototype is very useful for paint companies to execute their contracts in a very short time. [7]

The paper provided effective algorithms for point selection using quick access to the appearance of colors. The system is inexpensive because it depends on commodity hardware. The detection accuracy is very high and works under different light intensity. The system finds application not only in the ship repair industry but generally in any sheet metal fabrication process where automatic surface inspection is required. [8]

III. METHODOLOGY

A. System Architecture

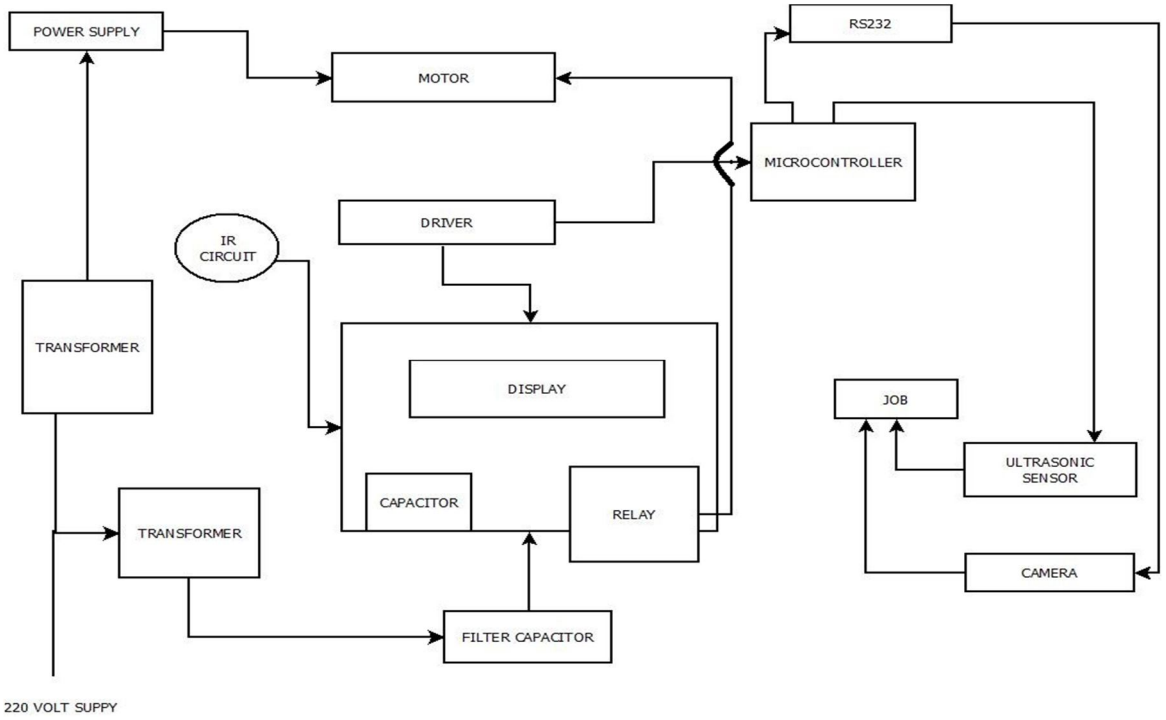

Fig 1.1: System architecture

Two transformer are used one transformer for dedicated motor power and another transformer dedicated for electric circuit power.

We step down the voltage form 220v to 12v, after that bridge rectifier convert into full wave and rectifier made by four diode, main capacitor and used two regulator(9v) in parallel because motor take extra load. These capacitors change voltage into DC, small ceramic used for filtrations of 12v. Pic60F73 IC is main microcontroller are used with crystal oscillator for provide clock frequency. LCD is use for local display. MAX2 32N are used for TTM to RX232 converter and it work on +9v.ULN2003 IC used for relay.

We used four relays for move motor clockwise and anti clock directions. Ultrasonic sensors used for check product profiling and camera is used for image processing, in this image processing it convert image of product into grey image and binary image for calculating total defected area.

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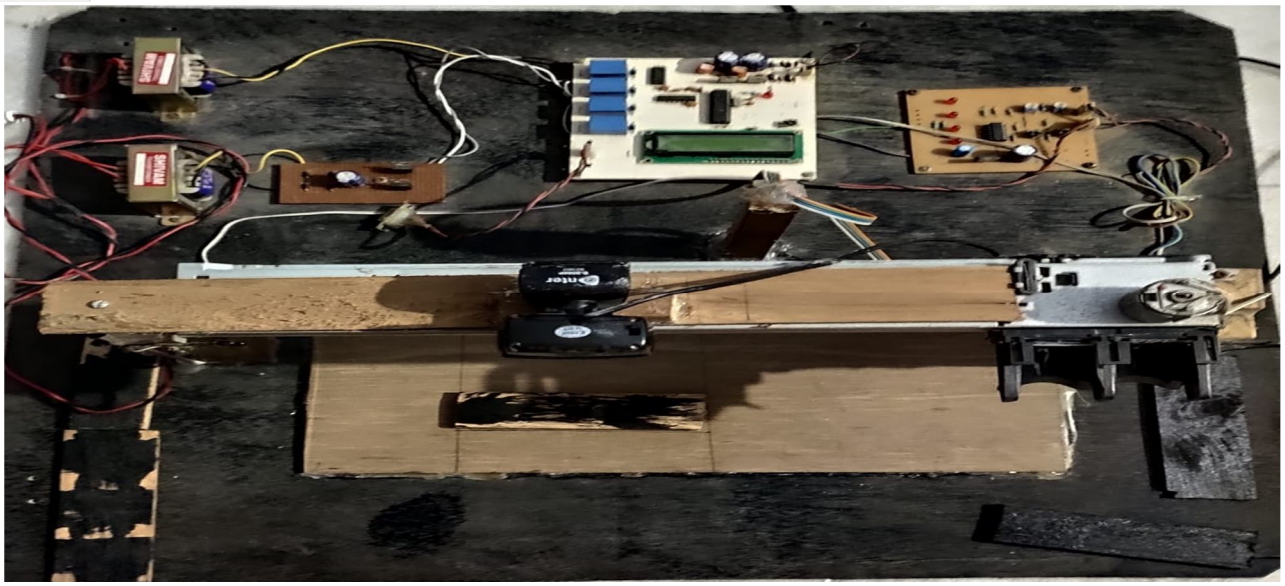

Fig 1.2: Experimental Setup

IV. RESULT

In this process we used ultrasonic sensor and image processing for find the defect of an product. ultra sonic sensor is used for profiling check of an product, it match the product pattern with predefine pattern of ultrasonic sensors and show co-relation matrix and image processing is to find the total defect area, image processing first convert image of defected area into grey and binary image in this image defect area is shows. Total defected area is calculated in pixel square and it also shows that product is good or bad.

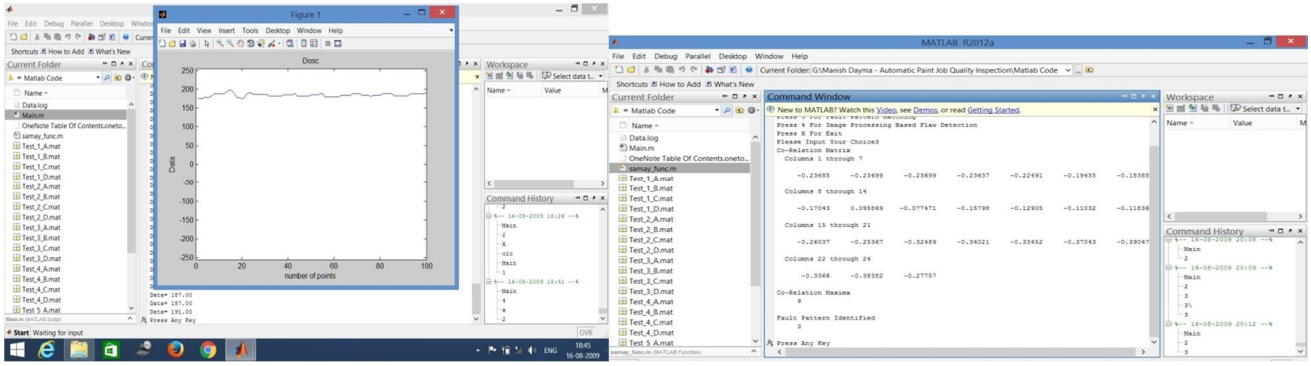

Fig.1 Real time Ultrasonic Profiling analysis and Fault pattern matching

In this process image processing based on flaw detection take place.

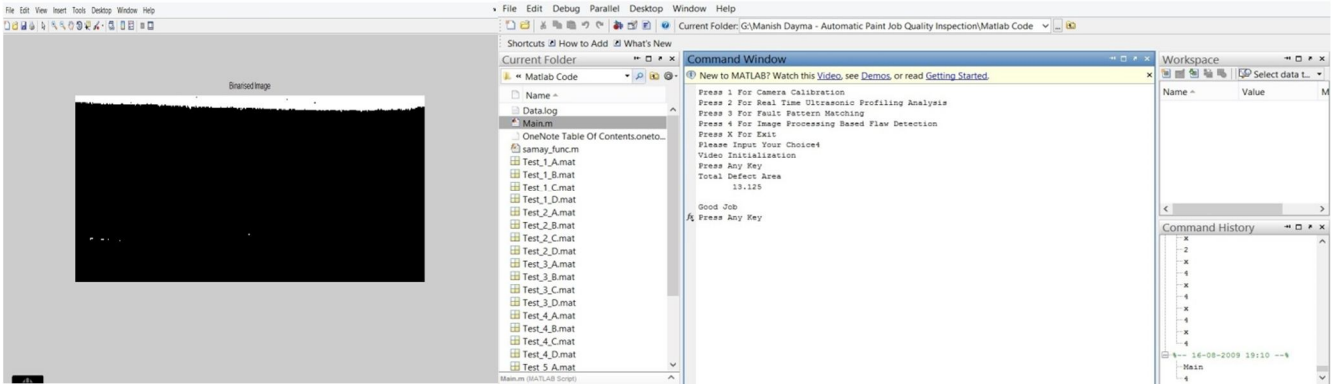

Fig.2 Binary image of product 1 and Total defected area

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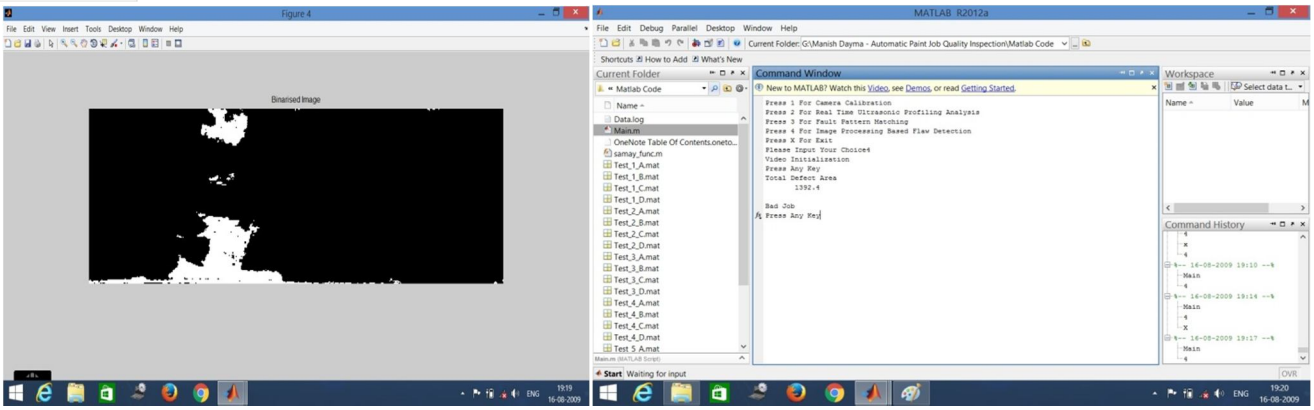

Fig.3 Binary image of product 2 and Total defected area

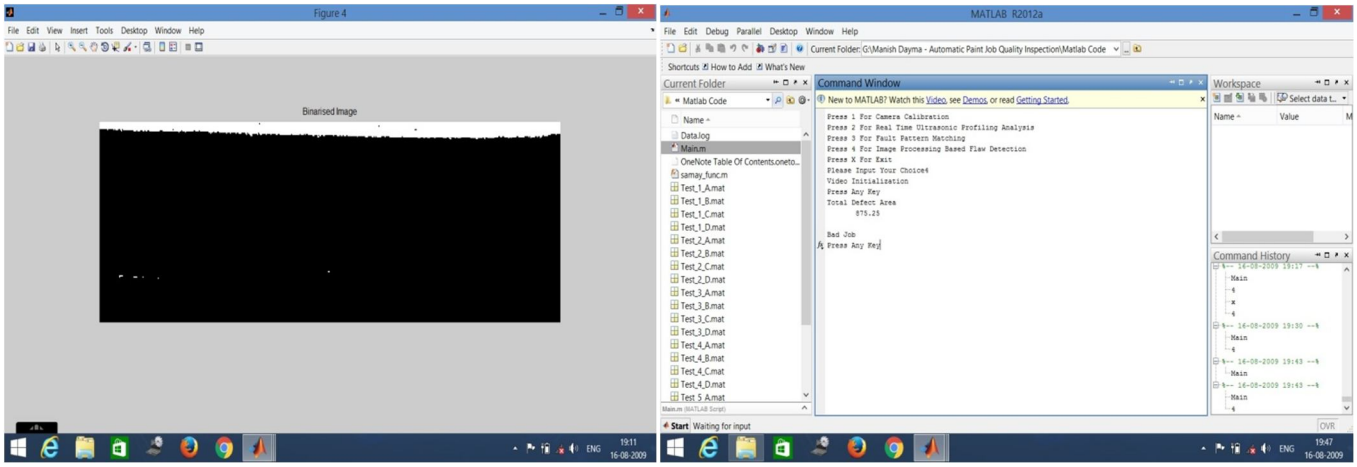

Fig.4 Binary image of product 3 and Total defected area

V. CONCLUSION

The author proposes a unique method of automated paint job quality inspection system which emplays hybridization of image processing with sensor technology. A highly performance ultrasonic distance sensor is emplayed in conjunction of a motorize linear carriage to per-form 1-D ultrasonic per filing of the paint surface. The observed ultrasonic profile is cross cordite with available fault/errors/imperfection database, to compute 2-D matrix correlation the group of fault/errors having maximum symmetry with correlation with observed , is the type of imperfection identified. Image processing quality inspection depends on visual parameters such as paint less space, smudges, scratches, rusting, blistering etc. Image processing technique uses binary image with morphology & absolute image differentiation to identify & segment the detect region. Also the region properties operation is utilized to obtain the specific information above the segmented detects such as area, perimeter, carried etc. Implementation of the proposed system by hybridization of image processing & sensor technology is achieved using MATLAB image processing toolbox with a low cast web camera & for sensor technology a 8-bit microcontroller controlled timer, motorized carriage along with HC-SR04 ultrasonic sensor is used. The embedded system oboes on embedded ‘C’ code & acts as a slave to MATLAB & communicates via serial communication to MATLAB. As observed by the result above the proposed system has been successfully implemented & demonstrated

VI. FUTURE SCOPE

Automation of inspection system is a rapidly emerging technological niche. The author has proposed & demonstrated an advanced hybridized automatic paint job inspection system, which combines best of image procession & sensor. Data acquisition technologist to achieve a accurate judgment about paint job quality despite the successful implementation of the proposed system, there are a lot of improvements sought in this field of automatic paint job inspection. One of the most desired improvements is introduction of 2-D ultrasonic profiling in live of 1- D profiling. Another important improvement would be to introduce automated lighting control to compute for having scan illumination. Also another dimension can be color sensitivity so that light differences in color can be detected.

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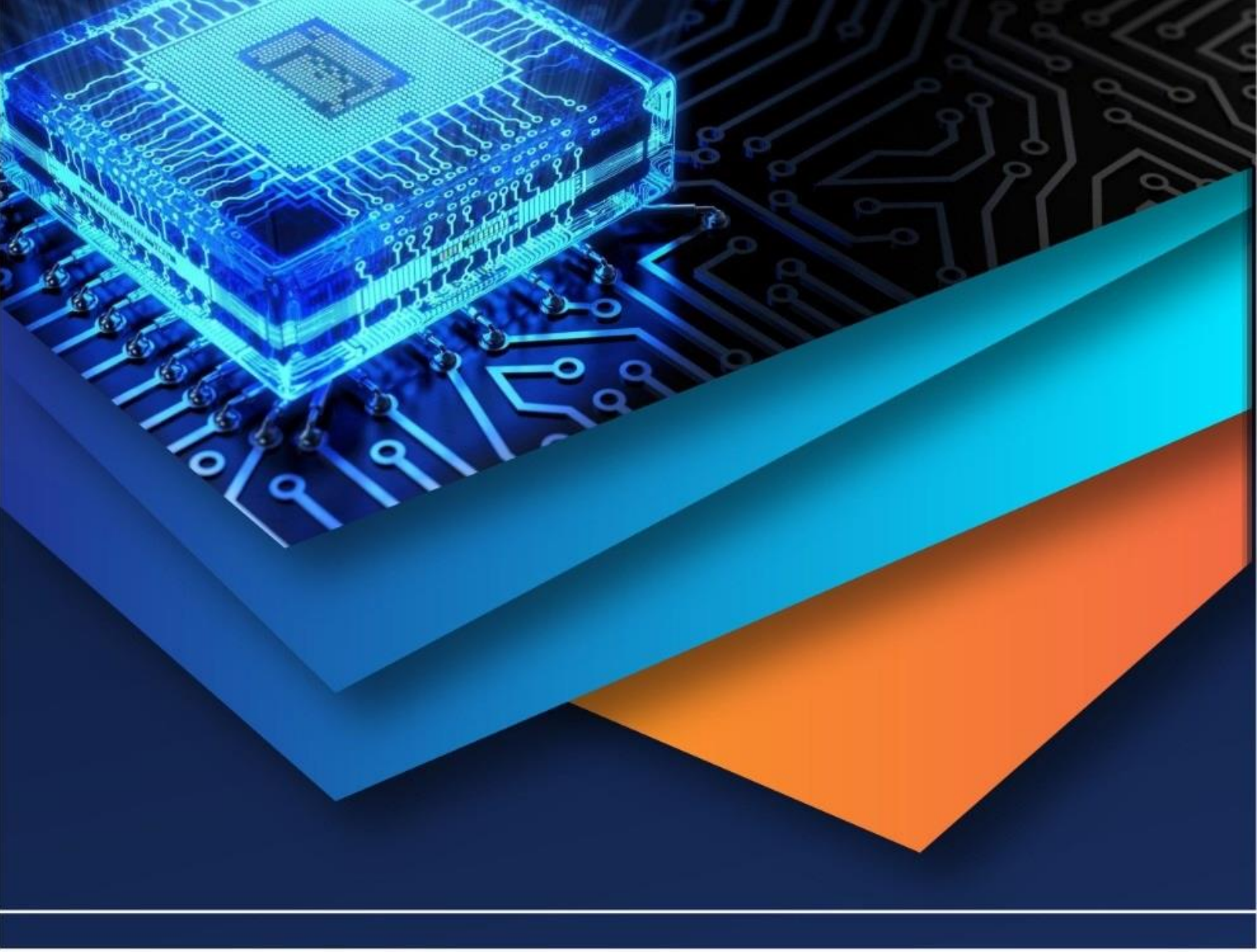

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