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Elucidation of Crop Diseases and Systematic Review of Farming Land

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Abstract: ***Agriculture is the main primary source for improving social welfare. Growth of plants is impacted by various factors, for example diseases which is profoundly affected by the plants, impact of water and other ecological factors. The main objective is to diagnosis the leaf diseases by using image processing techniques for automated vision system used at horticultural field. This acknowledgement framework includes image preprocessing, Hybrid feature extraction and image characterizations. Here color and texture feature are extracted for the input samples and database samples. Color features like mean, standard deviation and texture features like energy, contrast, homogeneity and correlation are extracted. For this approach, programmed classifier Back Propagation with Feed Forward Neural Network (BPN-FF) algorithm is utilized for classification and to identify the type of disease and to provide solution to the disease with the help of OpenCV using Python language. We also identify soil moisture, gas, pH level of water in soil, humidity level and atmospheric temperature by using various sensors. Once the information are being gathered, the data sets are processed by Raspberry Pi microcontroller and automatically the water flow to the field by DC motor. Wi-Fi based long distance network in Internet of Things (IoT) is used to monitor and control the agriculture field and farms in rural areas efficiently. Data sets are stored in real time cloud which can be retrieved whenever required. finally compare the pH level of the plant outcome of diseased plant and healthy plant after implementing the process.***
Keywords: ***Raspberry Pi microcontroller, image processing, BPN FF, water irrigation, IoT, solution for disease***

I. INTRODUCTION

Farming and Agriculture are the foundation of human life which provides food, grains, and other raw materials. Technology holds a tremendous role in increasing production and diminishing additional manpower. IoT has opened up an appropriate solution for smart farming and agriculture but it remains an illusion until the connections to the rural areas is achieved. IoT monitoring and automation from anywhere in the world is replacing human beings. The essential drive factors are the plant disease, impact of water and other eco factor. The first thing is the Plant disease which is a physiological procedure that influences a few or all plant capacities. Diseases may likewise decrease yield and nature of gathered item. Disease is a procedure or a change that happens after some time. It doesn't happen right away like damage. Changes like colour, shape and performance of the plant. Plant diseases their occurrence and severity that result from the impact of three factors: the host plant, the pathogen and the environmental conditions. The missing of any one of the factors causes the triangle to be incomplete there is no chance for the occurrence of disease. The HOST is the plant itself. some can fall to multiple infection, others just endure specific ones. So all the plants are vulnerable to a variety of diseases. The disease is pathogen, plant diseases are often caused by growth. The second one is impact of water and this is the way toward providing water to crop plants in fields which is preserve the moisture of soil for good crop growth. Excess water in the soil contributes to water logging. Some time sit restrains the procedure of germination roots don't develop appropriately in a standing water field and excess water. At last other eco factor like other environmental factors are toxic gas coming from different industries, humidity, soil moisture and temperature. The main objectives are classify the leaf diseases and provide a solution, supply water to plants in the field and test the soil moisture, pH level of the water in soil, humidity, gas level and temperature. And also the overall outcome are measured to compare with existing fruit (i.e.,) measurement of the outcome of the fruit pH level. Compared to the existing IoT based agriculture and farming solutions, the proposed solution reduces time of monitoring and data is stored in real time cloud.

II. SYSTEM SUMUP

The entire system provides solution for disease affected leaf and compare the pH level of the plant outcome of diseased plant and healthy plant. This recognition involves image pre-processing, hybrid extraction, image classification. Also the motor is automated by supplying water according to the electrical output from the soil moisture sensor and humidity sensor. Any toxic gases (carbon monoxide, chlorine, nitrogen dioxide and phosgene) found in the atmosphere of the field are detected by the gas sensor. Data stored in the real time cloud can be verified in future.

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III. DISEASE CLASSIFICATION

The proposed approach explains about the disease classification shown in Fig: 1. Many diseased leaves are trained using deep learning algorithm. The deep learning algorithm is a subset of machine learning which is the artificial neural networks and it allows machine to solve complex problems even when using a data set that is very diverse, unstructured and interconnected. The disease classification is performed by following process.

A. Pre-processing

The process begins first by developing an independent colour space transformation specification for the system. This converts the colour value in the leaf image to colour specified in the colour transformation structure. The colour transformation structure specifies various parameters of transformation. The device independent colour space is one where the resultant colour depends on the equipment used to produce it.

In this method have three steps,

1) *Conversion:* The primary colour of the RGB (Red, Green, Blue) image which converts to HSV (Hue, Saturation, Value) and RGB image to grey scale image for accuracy.
2) *Image resize:* This process involves the conversion of 8 bit Red, 8 bit Green and 8 bit Blue which is totally of 24 bit is resized to 8 bit to reduce the complexity in identifying the disease in the leaves.
3) *Filter:* Pre-processing filtering technique plays an important role in removing noise from the gray scale image. Median filter is used in this process for improving image quality.

B. Feature Extraction

The colour features (RGB) are extracted using HSV, because RGB model is sensitive to non-uniform illumination, colour difference is not linear, irremovable singularities. Hue denotes the dominant colour that an observer identifies. Saturation makes reference to the purification or the level of white light intermingled with hue. Value is the brightness of the colour. After the extraction of colour features, continue over to extract the texture feature. DWT is the most common for image compression, transformation and decomposition. In DWT, the data is expressed in a collection of high pass and low pass coefficient. It is mainly used for conversion of spatial domain image to frequency domain image. The texture features are extracted with use of GLCM (Gray Level Co-occurrence Matrix). The hybrid features include external and internal features. The external features are asymmetry, border, and corner. The internal features are contrast, homogeneity, entropy, correlation and energy. The internal features are alone extracted which is enough to classify the disease.

C. Classifier

The BPN is a feed forward neural network, which is widely used in classification and pattern recognition problems. The input is fed to the neural network. At each node, the primitive function of the nodes and their derivatives are evaluated and these derivatives are stored. It is much faster and accurate than multilayer preceptor networks. BPN networks are relatively insensitive to outliers and generate accurate predicted target probability scores. It approaches bayes optimal classification.

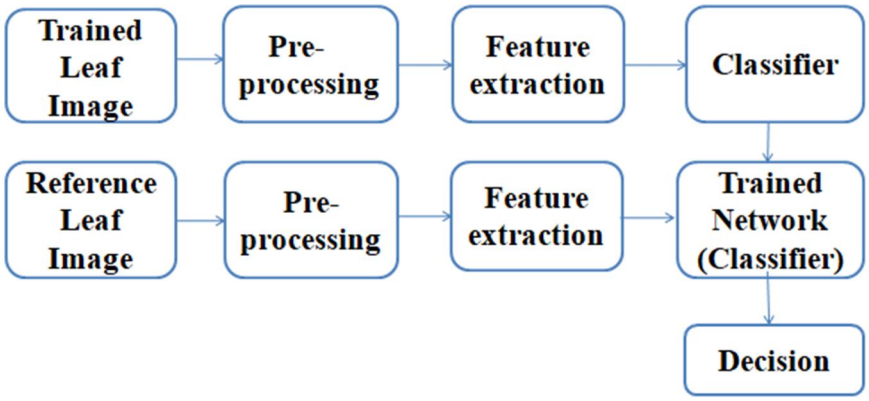


Fig. 1 Block diagram of Disease Classification

IV. TRANSMITTING END

In transmitting end, various sensors are employed for measuring the pH level of the fruit, humidity level in the atmosphere, toxic gases in the atmosphere, temperature level in the environment, water level in the reservoir. This function is divided into four modules: power supply unit, sensing unit, control unit, draining control systems that comprise the automated irrigation control system.

A. pH Sensor

pH sensor measures the quantity of the hydrogen ions in the solutions and determine the pH of the sample. This activity is compared to pure water (neutral solution) using a pH scale of 0 to 14 to determine the acidity alkalinity of the sample solution. It is used to measure the pH level of the outcome comparing the affected plant and unaffected plant.

B. Soil Moisture Sensor

Soil moisture sensor is used to quantify volumetric water content in soil. If the moisture content is low, the module output is high otherwise the output will remain low. The sensor comprises two probes that measure the volumetric substance of water. The two probes send an electrical current into the ground, and the level of moisture is established by examining the resistance encountered by the current. This serves as a key value in operating the motor.

C. Temperature Sensor

LM35 series is used because it is an integrated-circuit temperature device with an output voltage directly relative to the centigrade temperature. The LM35 device does not require any outer calibration or cutting and maintains a precision range of +/- 0.4ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +100 ºC. The low output impedance, linear output, and exact characteristic calibration. The most extreme temperature that can be estimated by the LM35 is 150º centigrade. So we will have a limit of 1.5V at the LM35 output terminal.

D. Humidity Sensor

Humidity is the accumulation of atmospheric water vapour. A humidity sensor (hygrometer) detects, measures and reports both humidity level and air temperature. The ratio of humidity in the air to the maximum amount of humidity at a given air temperature is called relative humidity. Absolute humidity defines the water content in the air in grams per cubic meter.

E. Gas Sensor

A Gas Sensor measures the concentration of gases in the atmosphere. Through changing the resistance of the material inside the sensor, which can be determined as an output voltage. The sensor which creates a corresponding potential difference depending on the gas concentration. The concentration of the gas can be estimated based on this voltage value.

F. Camera

Camera is used to capture the leaf image from the plant and image processing is done which helps in categorizing the leaf diseases. The camera rotates at an angle of 90º, 180º, 270º.

V. RECEIVING END

The receiver section consists of Raspberry Pi microcontroller, relay, amplifier, motor driver unit, DC motor. The electrical output from the soil moisture sensor and humidity sensor which drive the driver unit to operate the DC motor automatically (ON/OFF). All the data sets are processed by the Raspberry Pi microcontroller and stored in the real time cloud. The block of the working module is shown in the Fig. 2

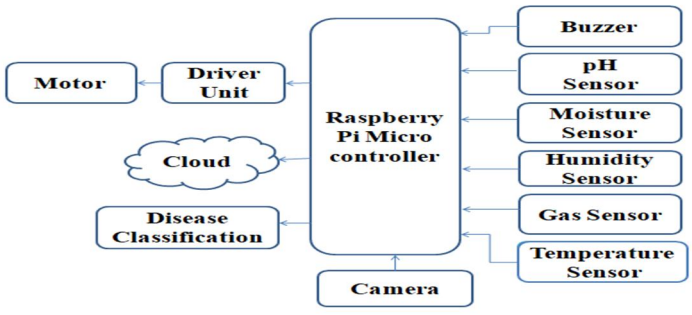


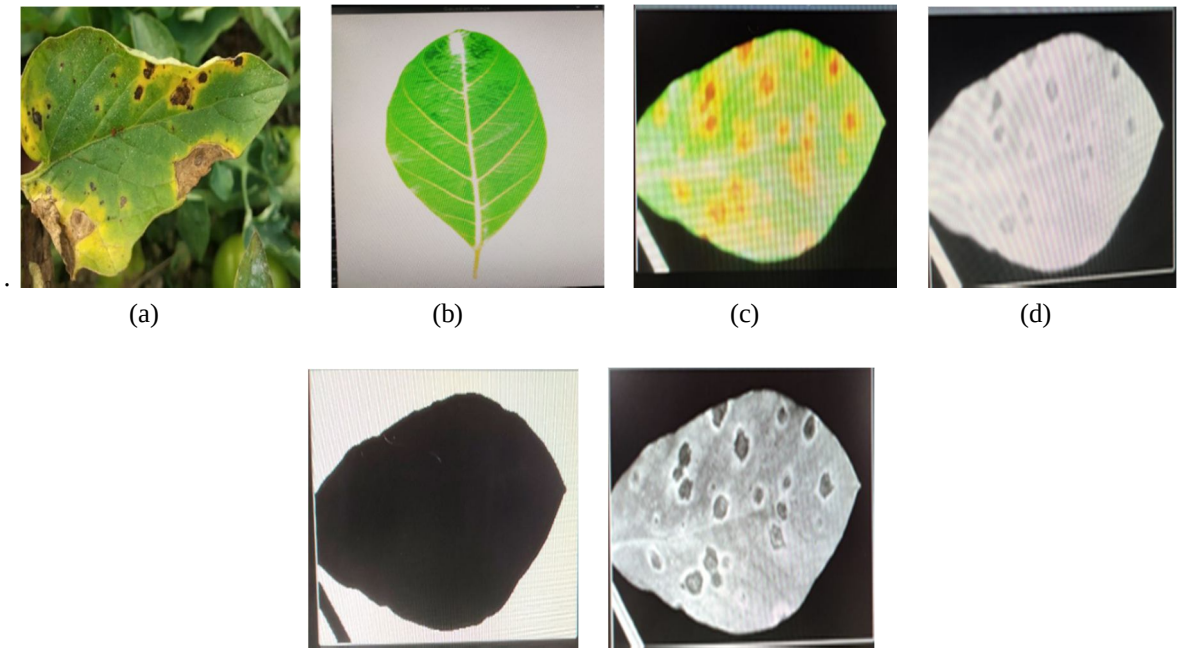
Fig. 2 Block Diagram of Working Module

A. DC Motor

A motor is a machine which helps in converting electrical energy to mechanical energy. The DC motor is connected to the drive shaft. The motor speed is measured in Revolution Per Minute (RPM). The motor automatically starts and stops to supplying the water to the field according to both the electrical value of the Soil Moisture Sensor and Humidity sensor

VI. RESULT

The relevant hybrid features are extracted from captured reference images (input image) as shown in the Fig. 3(a) where the BBN-FF classifier is using to classify the test leaf images into five deviations as well as provide the solution for the disease.



(a) (b) (c) (d)

(e) (f)

Fig. 3 Color coversion of images

(a) Input image (b) Gaussian image (c) Bilateral filtered image (d)Grey image (e) Segemented image (f) Extracted image

The rotating camera recording the images of the leaves which experience a number of processes continues to follow**.** The median filter is a non linear filter which blurs the image and minimizes noise in an image. This filter smoothes the image which is used to detect edges, as shown in the Fig. 3(b) called gaussian image. bilateral filter that reduces the intensity of each pixel from nearby pixels with a determined total intensity level, called bilateral filtered image as shown in the Fig. 3(c). Thus the RGB color image converted to grey scale imge as shown in the Fig. 3(d). The texture features are extracted by use GLCM algorithm from frequency components which result shown in Fig. 3(e) and Fig. 3(f). Using these extracted features, the input image compares with the images in the datasets by BBN-FF classifier to identify the disease and provide the solution as shown in the Fig. 4.

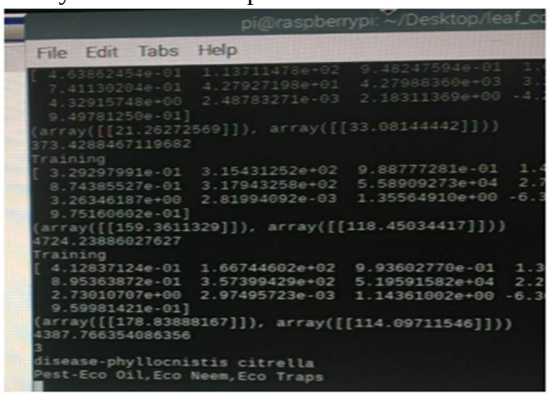


Fig. 4 Final Output of Classifier

The multiple sensor are used for field monitoring. The system is disigned to measure the soil moiture level, humidity level, water level, pH level and environment temperature automatically and display as shown in the Fig. 5. The motor pumps the water into the field according to the sensor values of humidity level and water level. If the soil is dry, the motor starts pumping the water into the field otherwise the soil is wet, the motor stops the pumping.

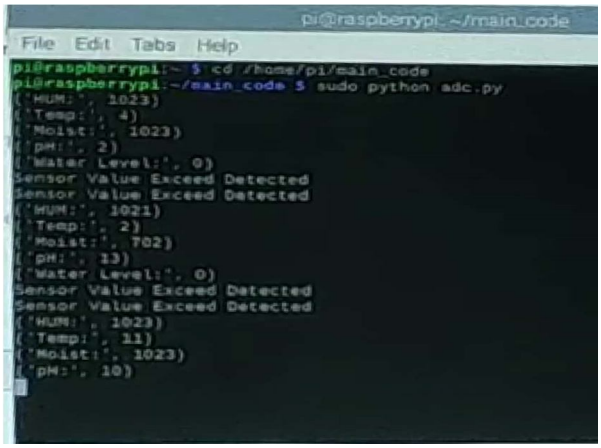


Fig. 5 Field Monitoring Output Results

The information stored as shown in the Fig. 6 in the ThingSpeak cloud can also be retrieved whenever required.

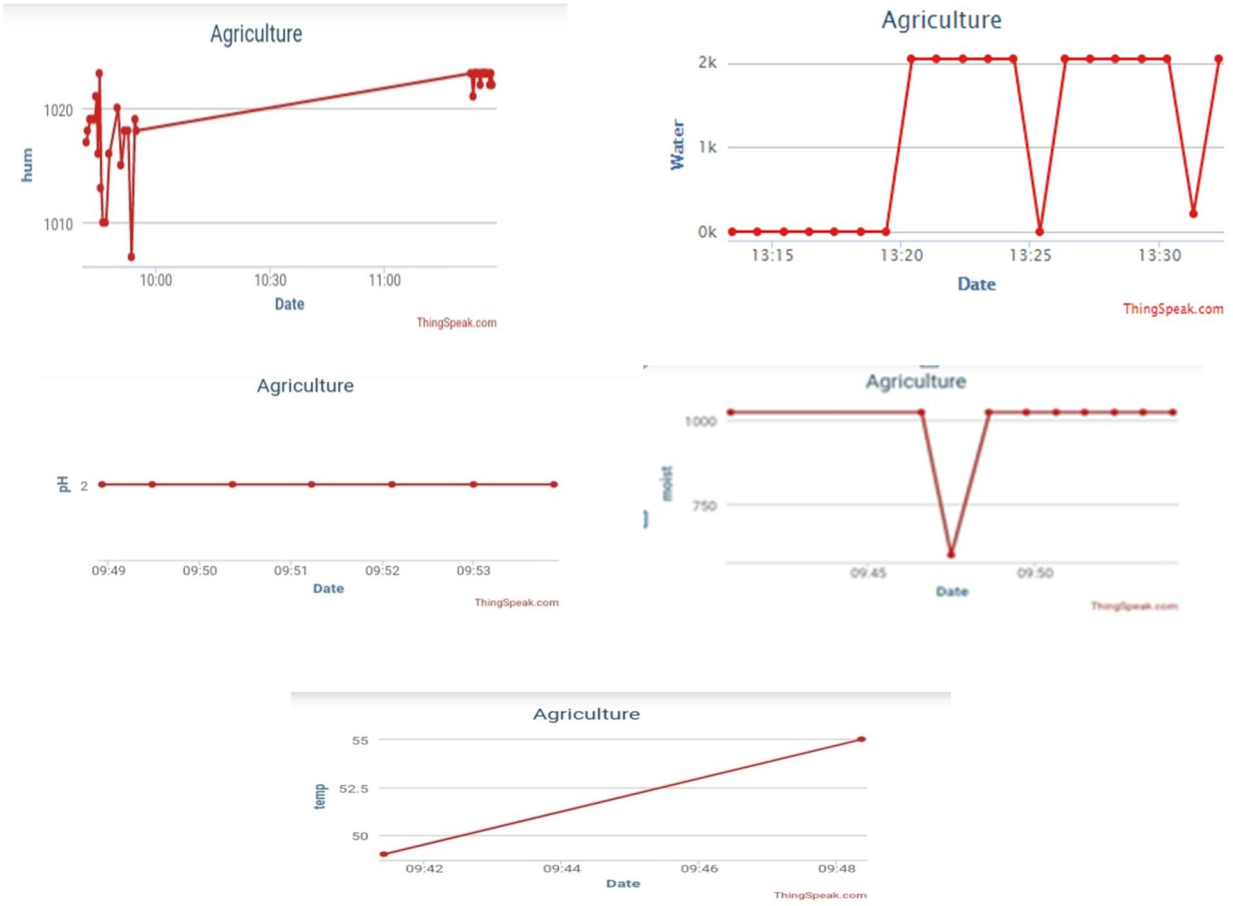


Fig. 6 Thingspeaks IoT Output Results

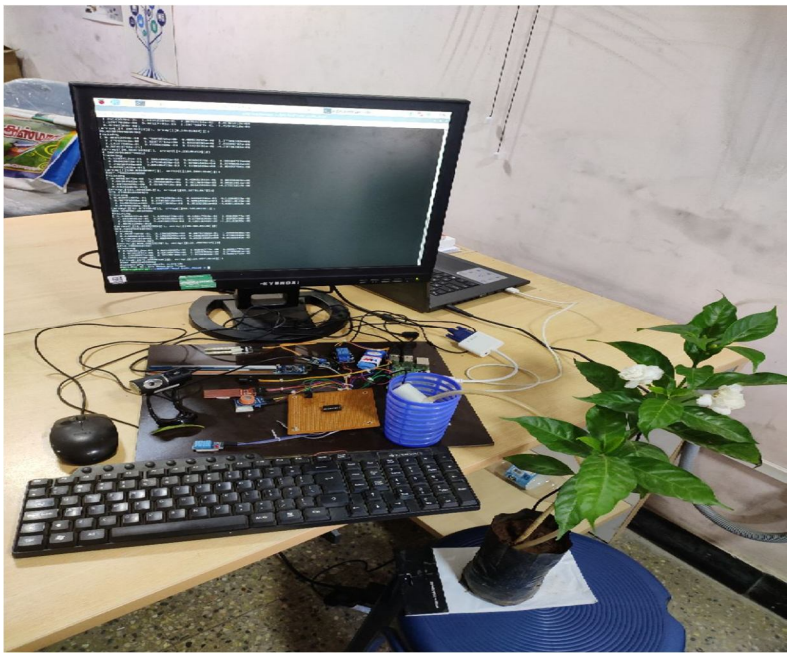


Fig.7 Hardware model

VII. CONCLUSION

We have implemented an image pre-processing method to automatically identify and classify normal or diseased leaves and provide the solution for the disease which benefits beginners in the farming. We also implemented all the hybrid features of a leaf to train by the artificial neural network (BPN-FF). Automatic irrigation control system designed and constructed by using various sensor. The system helps to eradicate the stress of manual irrigation and control of irrigation and at the same time maintaining the available water supply. The toxic gases released from industries are also monitored. Finally the pH level of the outcome in the affected plant and healthy plant is measured.

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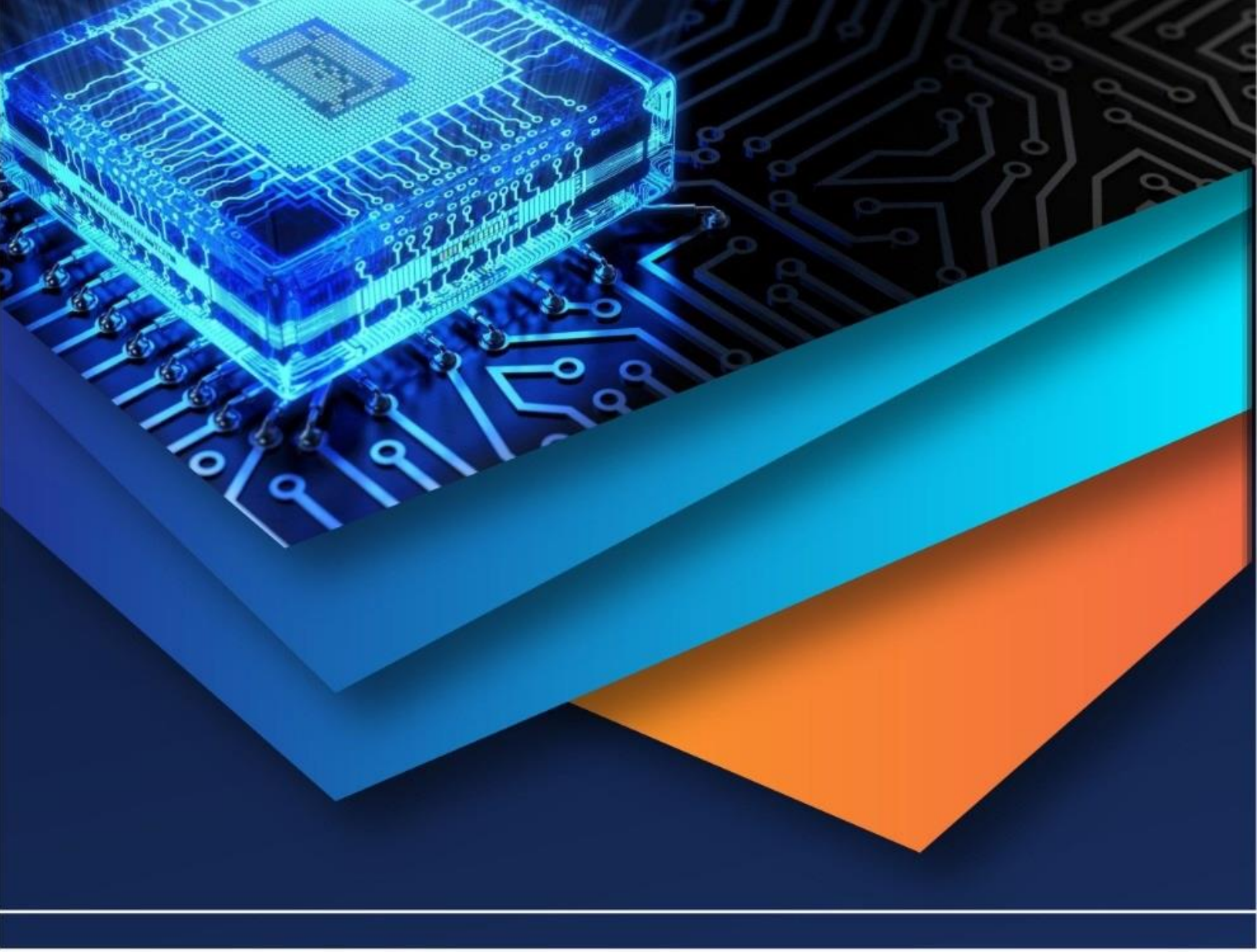

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