iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** V **Month of publication:** May 2022

DOI: https://doi.org/10.22214/ijraset.2022.43526

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue V May 2022- Available at www.ijraset.com

IoT Based Saplings Protection System against Unsuitable Natural Climate

Sourish Mitra[1], Pallabi Das[2], Nilimesh Chakraborty[3], Sounak Majumdar[4], Tiyasa Barman[5], Poulomi Das[6], Riya Pahan[7], Tiyas Ghosh[8]
[1, 2, 3, 4, 5, 6, 7, 8]*Department of Computer Science & Engineering, Guru Nanak Institute of Technology*

Abstract: ***Plants need air, water and sunlight and other weather recourses for healthy and natural growth but over exposure of these natural recourses create harm. Due to excessive sunlight many of the plants and saplings gets scorched thus resulting death in bulk whereas over raining causes excessive water-clogging in root area due to which saplings gets wilted or rotten. For healthy growth of any plant pesticide and fertilizer sprinkling is also required. After focusing all above mentioned problem area we have implemented an automated IoT based baby plant protection system which can be able to stop the death of saplings and sensitive plants from aforesaid natural recourses like high sunlight, huge amount of rain water, excessive dew etc. Our proposed hardware prototype model is already commercialized for protecting outdoor baby saplings from unsuitable natural climate.***
Keywords: IoT, saplings, scorch, water-clogging, prototype etc.

I. INTROUCTION

Saplings are just like new born babies, who cannot stay alive in harsh situations. For saplings the harsh weather conditions are scorching heat of sunlight during summer season, very heavy rain during rainy season. The heat produced by the sunlight of during the summer season is so high that it causes death of a baby plant or sapling. On the other hand, during rainy season, when it rains so heavily, water clogs around the root area of the sapling which rots the roots of the sapling and ultimately causes death of the sapling. Death of saplings is now a very common case in rural areas and it causes financial instability of the farmers. To help the saplings fight against these harsh weather conditions, team Chosen Ones has come up with a device named, IOT Based Saplings Protection System. This device will have a heat sensor which will sense the temperature and when the reading goes beyond the limit, a sunshade will be drawn over the sapling during summer season but in the winter season the sunshade will not be drawn as the temperature will not be so high though there will be sunlight. On the other hand, During rainy season, when it rains heavily the moisture sensor senses the moisture level continuously and when the moisture level goes beyond the limit the shade will be drawn over the sapling and water clogging will be stopped but the shade will not be drawn due to dew, as dew does not cause water clogging around the root area. There will be automated fertilizer and pesticide sprinkling system, which will sprinkle fertilizer and pesticide automatically on scheduled time without any human involvement.

II. PROJECT REQUIREMENTS

A. Hardware Components Required

1) *ArduinoUNO-R3 Microcontroller:* Arduino UNO is an open-source board that uses an ATmega328p microcontroller. This board contains set of analogue and digital pins which are used to connect the board to other components. The Arduino UNO has a USB connection that can be used for power supply to the board. It is often used in electrical projects. Arduino microcontroller is an empty brain in which you can upload memory by coding or programming through Arduino IDE software.

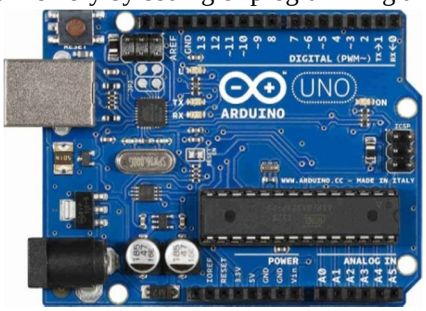


Fig. Arduino UNO-R3 Microcontroller

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2) *NODEMCU ESP8266-12E Wi-Fi Module:* ESP8266 contains 8 pins which some different purpose. These pins are defined as the following normally, ground pin as the name suggest is use to provide ground circuit .TX pin Is used to upload program by connecting it to the Rx pin of the programmer.GPIO-2 pin is use to serve the input/output purpose.GPIO-2 pin serves the same purpose as GPIO-2.CH-EN pin used for high voltage. RX Pin or gpio-3 also serves the same purpose of input/output just as GPIO-O and GPIO-2.+3.3v of voltage is supplied through pin.

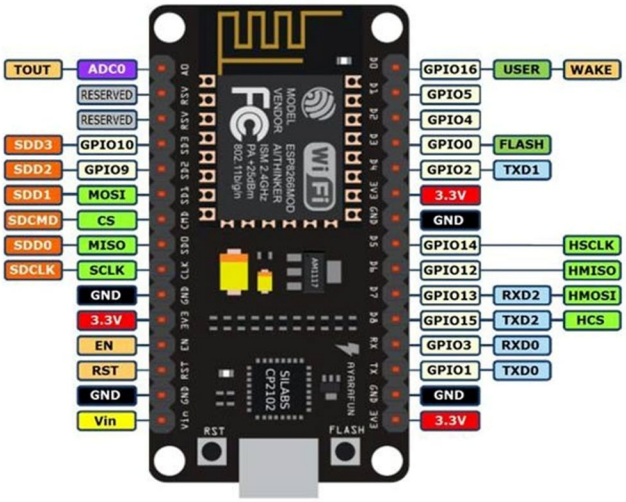


Fig. ESP8266-12E WiFi Module

3) *DHT11 Temperature Sensor:* DHT11 is a Sensor; with the help of that sensor we can get information about the humidity and temperature of the atmosphere. It is a cheap and good sensor and everyone can easily interface to it with any micro-controller such as Arduino, Raspberry Pi etc.

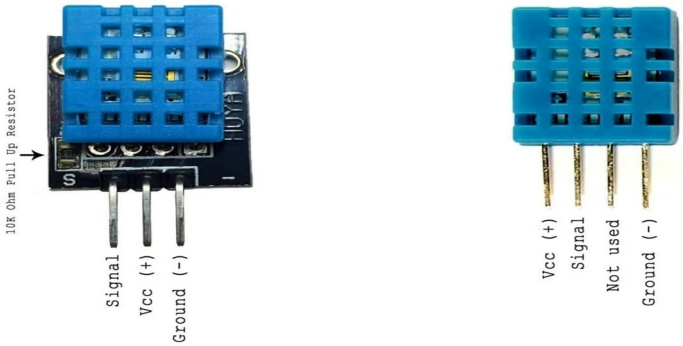


Fig. DHT11 Temperature Sensor

4) *Soil Moisture Sensor:* As we know that soil consist of different layers namely, organic layer, top soil layer, elevation layer subsoil, parent rock and bedrock and these layers contains water in it. So, to estimate the water content present in these layers we use Soil Moisture Sensor.

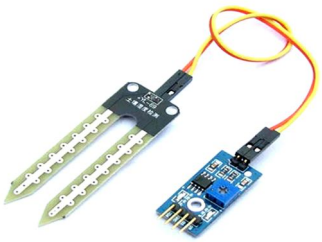


Fig. Soil Moisture Sensor

5) *Servo Motor:* Servo motor is an electrical device which is a modified form of common motor. It will rotate 180 degree not more than that in clockwise and anticlockwise. The motor helps to rotate parts of a machine with high efficiency and with great precision. It coverts Electrical energy into Mechanical energy. By using a controller we control the position of a servo motor. For these properties we often find it in robotics and remote control cars etc. In this project we have implemented shade shaft with the help of servo motor.



Fig. Servo Motor

6) *Connecting Wire:* The movement of electricity from one point to another is facilitated by the movement of free electrons. But this electrons needs a medium for movement so, connecting wires use in a circuit provides the required medium to the free electrons for movement and electrical current flow through the circuit. Here we have used M-M, M-F and F-F jumpier wires.



Fig. M-M, M-F,F-F Jumper wires

7) *Battery:* Here we can use 5V portable battery to give power the whole prototype. Servo motor is not capable to move without 5V.



Fig. 5V Battery

III.OUR PROPOSED WORK

A. *General Idea*

In the introduction we have learned about the challenges faced by the saplings and how our proposed device will help it to fight against them. The device is made up of **Nodemcuesp8266 Wi-Fi module** and **Arduino UNO micro-controller**. A **Servo Motor** will be connected in the circuitry to draw the shade over the sapling when needed. An **analogue Soil Moisture Sensor** is there to measure the moisture level of the soil continuously. Here we are using the analogue moisture sensor so that we can set the threshold moisture level according to the tolerance level of the sapling. On the other hand, a **DHT11 Heat Sensor** will be there to measure the temperature of the surroundings of the sapling.

When the moisture sensor measures that the soil moisture has gone beyond the threshold moisture level it sends request to the microcontroller to activate the servo motor and draw the shade over the sapling and stop rain water to clog around the root area of the sapling, here we are highlighting that the shade will not be drawn to stop the winter dew as the winter dew does not cause water clogging. When the DHT11 sensor measures higher temperature during summer season it sends request to the microcontroller to activate the servo motor to draw the shade over the sapling but during winter season or during night the shade will not be drawn though the temperature is a little bit higher. Through this way the device will help the sapling to stay alive during harsh conditions of weather.

B. Block Diagram

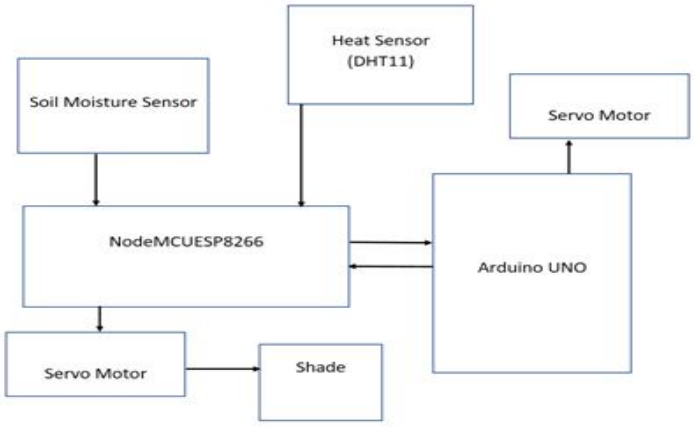


Fig. Block Diagram of proposed work

So, in this project we are using the NodemcuESP8266 as the Wi-Fi module. We have connected the NodemcuESP8266 with 5V power supply. This module will help to trigger the other sensors used in this project. We will use DHT11 sensor to check the temperature. If the temperature is higher than usual temperature for a sapling, the DHT11 sensor sends data to the Wi-Fi module which in turn triggers the Servo-motor that draws the shade over the plant. We also use an analog Soil Moisture Sensor to check the level of water in the soil. If the soil moisture is higher than the specified moisture level then it sends the data to the Wi-Fi module and it will trigger the Servo- motor to draw the shade above the plant. In our upcoming work we are going to integrate many analog sensors for which we need multiple analog ports. Since the Wi-Fi module has only one analog port, we have interfaced it with an ArduinoUNO so that we can connect the multiple analog sensors to our system.

C. Circuit Diagram

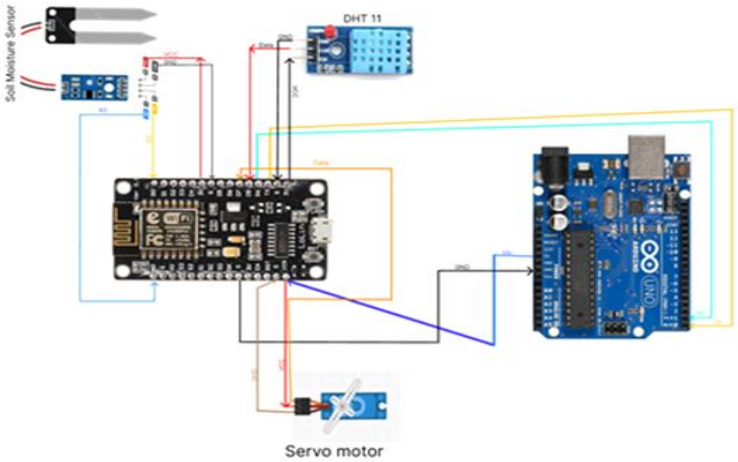


Fig. Circuit Diagram of Proposed Work

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Volume 10 Issue V May 2022- Available at www.ijraset.com

In Soil Moisture Detection section, VCC(4) pin of Soil Moisture Sensor (Analogue) can be connected to NodeMCUESP8266 Wi-Fi Module with 3V pin , GND can be connected with GND of Wi-Fi Module , the A0 pin can be connected with A0 of the Wi-Fi module and the Data pin D0 can be connected to D0 pin of the Wi-Fi Module through which data can be transmitted to the D0 pin of the Wi-Fi module. In Heat and Temperature Detection section , VCC pin of the DHT11 Temperature & Heat Sensor can be connected to the 3V pin , GND pin can be connected to the GND pin and data can be transmitted by connecting the Data pin of the sensor(DHT11) to D8 pin of the Wi-Fi Module. In both the cases mentioned above, the data will be transmitted to the NodeMCUESP8266 Wi-Fi Module which in turn would trigger the servo motor attached with a shed which will get drawn over. The Servo Motor can be connected to the Wi-Fi module by connecting the VCC pin with the 3V pin , GND with GND pin and data can be transmitted by connecting Data pin of the motor with D6 pin of the Wi-Fi Module The NodeMCUESP8266 Wi-Fi Module can be connected to Arduino UNO via TX, RX, V , GND pin to RX, TX, 5V and GND pin of Arduino UNO .

D. Workflow Diagram Of Proposed Work

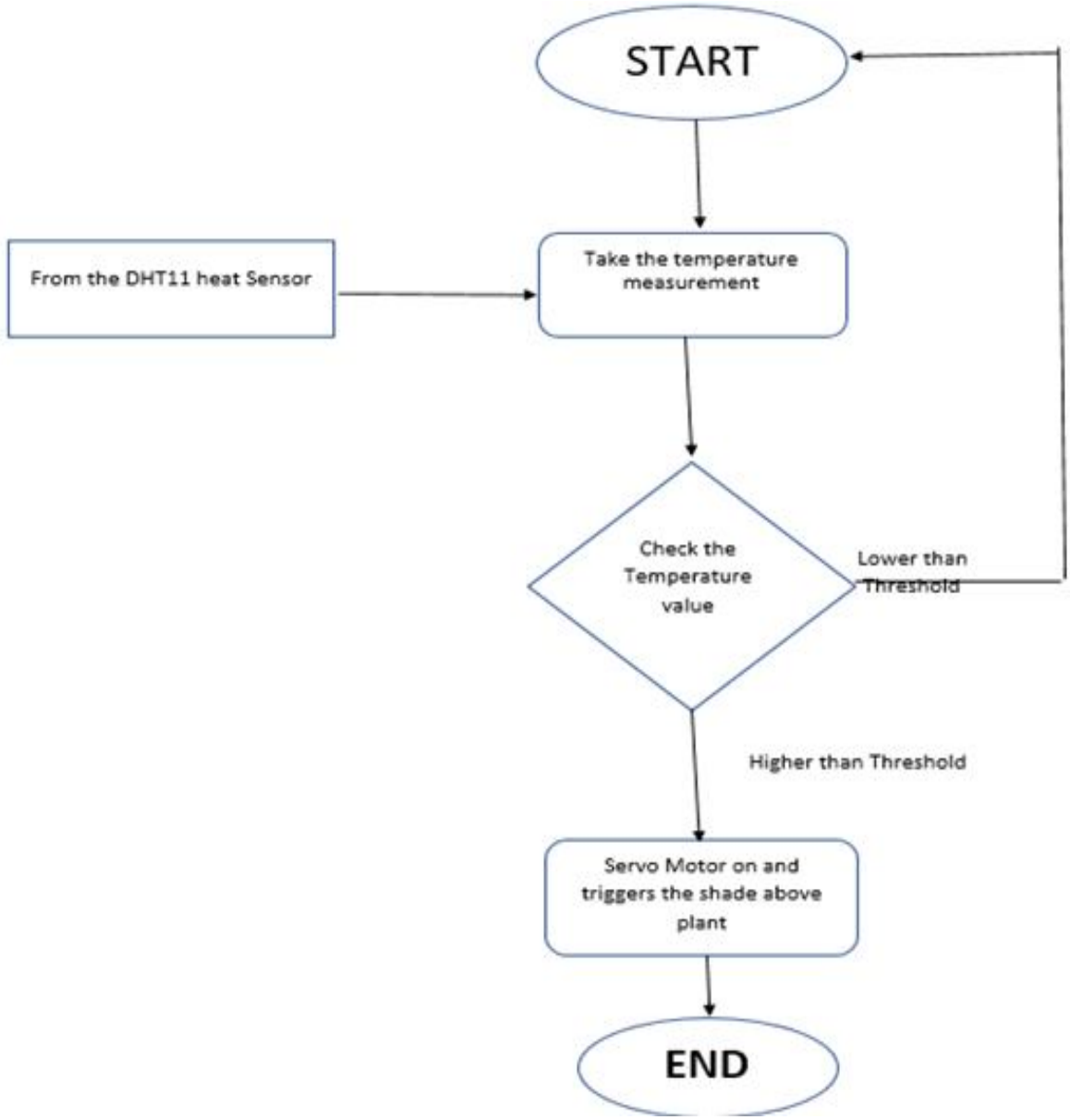


Fig. Flow Diagram of protecting saplings from excessive heat

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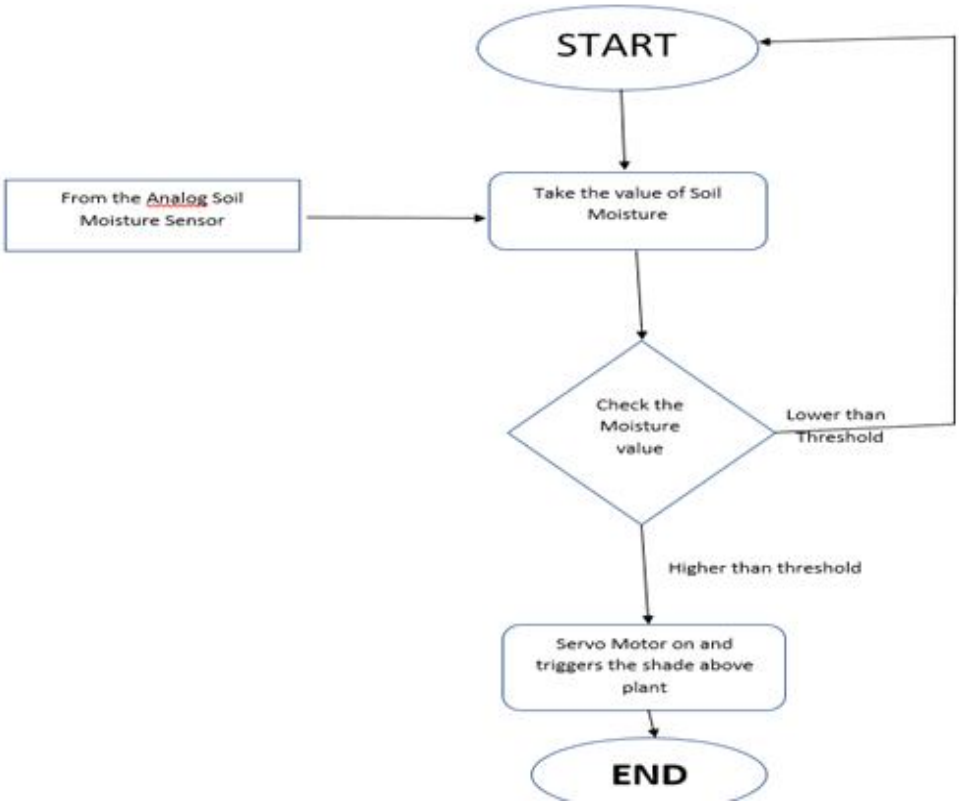


Fig. Flow Diagram of protecting saplings from excessive rain

IV. PROTOTYPE AND RESULTS



Fig. Prototype of Our Proposed Work

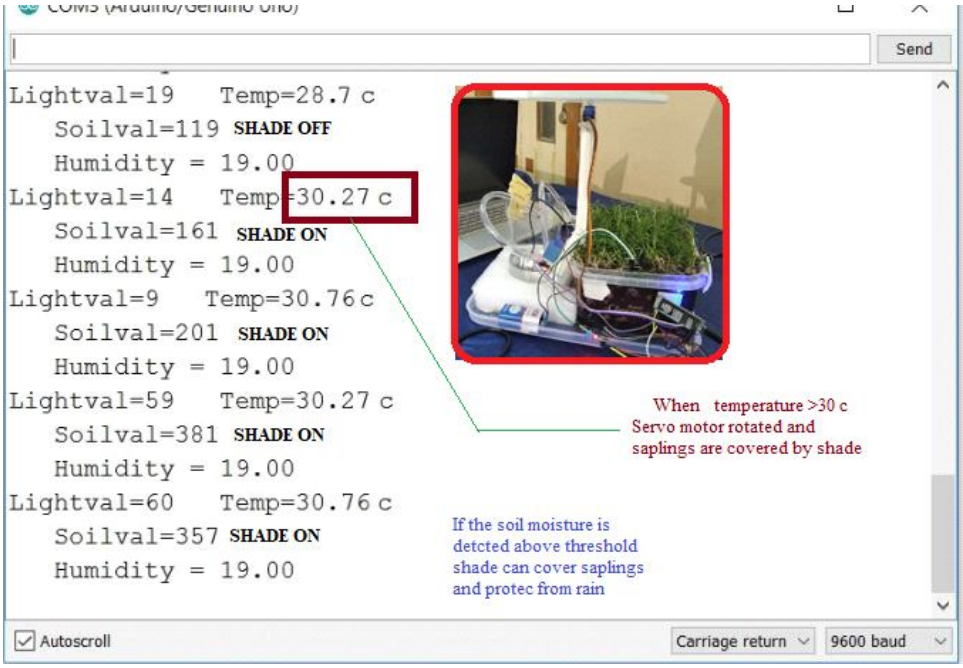


Fig. Output

When the light intensity and temperature is increased and exceed the threshold value 30 degree C then shade automatically rotated and protects the saplings from extreme sunlight. In other hand if the rain intensity is exceeded the threshold 400 unit then it will turn on servo and also protects the saplings from rain.

V. CONCLUSIONS

As a result, the "BABY PLANT PROTECTION USING THE CONCEPT OF IOT" has been successfully planned and constructed. It was created by combining the features of all of the hardware components used. Every module's presence has been carefully considered and positioned, resulting in the best possible operation of the unit. The system was thoroughly tested to ensure that it will run on its own. The moisture sensors monitor the water content (moisture level) of the soil of turmeric plant. The moisture sensor provides a signal to the microcontroller when the moisture level falls below the specified level. The system automatically comes to a halt when the required moisture level is attained, and then the water pump is switched off.Other than that, if the humidity and temperature levels are changed, it is alert the user through the app. Users have the ability to monitor and control the units from anywhere in the world at any time.Also, they have the opportunity to make a watering schedule according to their preference so that can reduce the manual human interactions and water the plant automatically by checking the moisture levels of the soil.Users can also manually water the plant simply by using the mobile app which controls the IOT device.

In the upcoming days we are planning to add some more features(automatic pest repellent, automatic reminder for the owner to put fertilizers, etc.) and scale this project into a full-fledged product which will be much more durable, robust & cost effective than any other available

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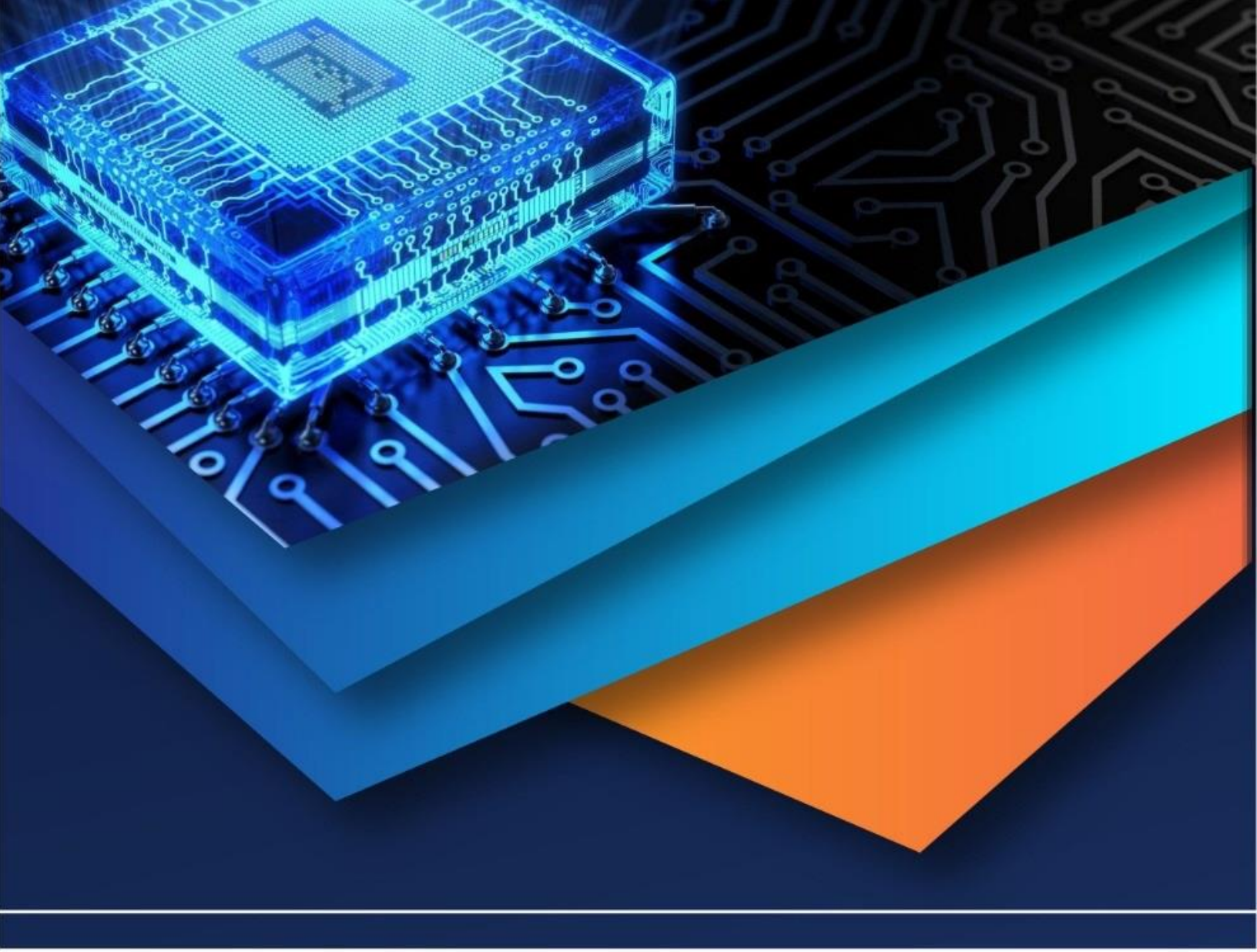
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