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Iot based Home Automation

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Abstract: Home Automation industry is growing rapidly, this is fulfilled by the need to provide supporting systems for the elderly and the disabled, especially those who live alone. Coupled with this, the world population is confirmed to be getting older. Home automation systems must comply with the household standards and convenience of usage.Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled. Typical wireless home automation system allows one to control household appliances from a centralized control unit which is wireless. These appliances usually have to be specially designed to be compatible with each other and with the control unit for most commercially available home automation systems.The developed system can be integrated as a single portable unit and allows one to wirelessly control lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipment's etc. and turn ON or OFF any appliance that is plugged into a wall outlet, get the status of different sensors and take decision accordingly. The system is portable and constructed in a way that is easy to install, configure, run, and maintain. The perfect user interface still does not exist at present and to build a good interface requires knowledge of both sociology and technology fields.

The problem lies with the situation of the elderly or disabled people, who cannot usually help themselves to move around, and might require external assistance. People who live alone might also need a helping hand at home. Therefore An android app controlled home automation system is designed, so that the users can perform certain tasks by just the use of their phones. Having a phone as a remote will make the system more user-friendly and portable.

Keywords: Home Automation, Smart Home, Wireless Home Automation.

I. INTRODUCTION

With the help of new technology, people demand more comfort in their lives. In this new era of automated things such as automatic cars, automatic dishwashers, automatic bots and so on, comes the need of automated homes where people have the luxury of doing things with least possible effort.

The Internet of Things commonly known as IOT (Internet of Things), refers to any device that can be connected to Internet and further controlled using it. Home Automation Systems(HAS) involves the control and automation of lighting, ventilation, security. Home Automation is a modern technology that transforms our home in a way that a different set of tasks are performed automatically.

The main purpose of Home Automation Systems(HAS) is to save electricity and reduce human effort.Also, this system is also built to help the disabled people with walking disabilities or elderly people who struggle to walk and switch off/on the home appliances. The basic motivation for building this product is to make the lives of people more comfortable and easy. It will give people the comfort of staying in place and controlling systems through voice commands. This paper presents controlling the home automation appliances using either voice commands or an android application.

Arduino Uno is a microcontroller board developed by Arduino CC. Arduin UNO is a microcontroller board having a number of input and output pins. It is not only a processing node in Wireless Sensor Networks(WSN) but also acts as a centralized controller in a Wireless Sensor Network(WSN). Further integrating the Home AUtomation System(HAS) to the voice assistant makes it controlled using voice commands. The light in the system will be triggered based on the motion sensor which will indeed trigger the light sensor to check the ambient light and turn the light on if the sensor senses the reading below the threshold value. The fan circuit will be solely controlled either with a single tap on the android app or simple voice commands. Some other Home Automation systems make use of Bluetooth technology for communication. However, Bluetooth has connectivity issues along with the difficulty of wall penetration of the signals. Apart from the connectivity and compatibility issues, most of the Home Automation Systems(HAS) proposed in the literature are too expensive to be afforded by a common man.In this context, the proposed Home Automation System is a low cost, flexible solution, with ease of installation and integration with mobile devices. The experimental setup for this Home Automation System(HAS) is discussed in the next section.

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II. LITERATURE SURVEY

In this research paper [1] raspberry provides security and various ways to control the devices in the house. Because of mobile phones the living is comfortable and at the same time it can be easily accessible through portable devices. It gives users all the rights to decide which makes it reliable as it always asks before taking any decision, it helps when there are any necessary decisions, it helps when there are any necessary decisions to be taken and they can be taken fast in case of an emergency.

In the proposed model of paper [2] the accuracy of Implementations meets the expectation. This home automation system works according to user needs and demands and also the modes of function work as desired during the implementation. Users need to give respective commands through his/her smartphone and the system works according to the assigned algorithm. This project is flexible and user friendly and easy to use. So it can be said that this system has higher accuracy with great efficiency.

In this paper [3], architecture for smart home control and monitoring systems using Arduino is proposed and implemented. It gives a basic idea of how to control different home appliances and provide security by using Arduino Uno controlled from a desktop application. In our project, we tried to implement an embedded system that meets the main functions of home automation for the management of lighting, habitat security, and temperature & humidity control. For these reasons, a desktop application was created to interact with an Arduino via the serial port.

In paper [4],The light sensor was properly configured to detect when the laser was broken, while not accidentally tripping due to different ambient light environments. In addition, the temperature and light control subsystem outputs are confirmed to be working. Specifically, the firmware has been tested and is confirmed to be outputting the appropriate signals to the subsystem BJT switches which control lighting and furnace operations. Overall, the project has been working to design specifications and has maintained a high quality standard which can be integrated into modern homes.

In the main paper no [5],we found out that in this era of computers, smart home technology has become imminent. It's a smart technology that gives us a different level of living standard. We are fully dependent on a system where everything is fully automatic. We are using sun tracking technology so we can get maximum efficiency of solar power.It has two different user functions; one is controlled manually and other automatically. Security is password and/or biometrically protected and sensing ability gives this home strength to protect itself.

In the final research paper,we observed that the raspberry pi based home security system has been successfully developed and verified. Not only has the raspberry pi been helped for live streaming but also for the camera as a movement recognition component. The capturing and causation notification would be done if there was any detection of movement. The inference of the tests performed on the system confirms that the security mechanism provides optimal observations.

Reference	Methodology	Advantages	Future Scope
[1]	In this we have used Raspberry Pi instead of Arduino and PIR sensors which are more effective than normal IR sensors for home security.	The biggest advantage of using Raspberry Pi instead of Arduino is the clock speed of Raspberry Pi. The PIR sensor is directly connected to the led array which will provide a better light environment for the camera to capture a clear photo.	Raspberry pi might be one day used as it has multiple GPIO pins which can be built by or programmed and used to interface various devices in the real world and controlled by python programming language.
[2]	The basic methodology is signal sent from Android Phone to Wi-Fi module. The android application consists of GUI buttons for each appliance. Eventually end users can access appliances over mobile devices.	This home automation works according to the user needs and demands and also the modes of function work as desired during the implementation. These smart switches can be used manually, on mobile phones and computers through the internet.	The project which is to be implemented is a home automation using easy IOT web server and wi-fi and has very good future development

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[3]	The most basic implementation includes the use of an LDR sensor for light intensity and IR sensor to detect human presence .	This system, rather than making people physically go and turn appliances on or off, makes people control from sitting anywhere not only in its circumference but from anywhere in the world.	Project can be scaled by adding more control towards household components.
[4]	In this project the lights and fans are automatically controlled by the external light as well as Human presence and room temperature respectively.	Reduced power consumption. Cost efficient. User Friendly. Easy maintenance.	Use of upgraded sensors increases the precision of the sensor making the system more efficient.
[5]	The intensity of the external lamps(which are used outside the house) are controlled by means of an LDR sensor.	Rather than setting a specific time for the lamps to turn on, the photo-resistor helps control the intensity and thus saving electricity.	Can be implemented on a larger scale(street lights).
[6]	Using Raspberry Pi IR Camera to prevent unauthorized people from entering the house.	The Pi camera helps in streaming the live feed and also captures images at a higher resolution.	Using the biometric sensors present on the mobile of the user, the door can be locked or unlocked.

III.SYSTEM DESIGN

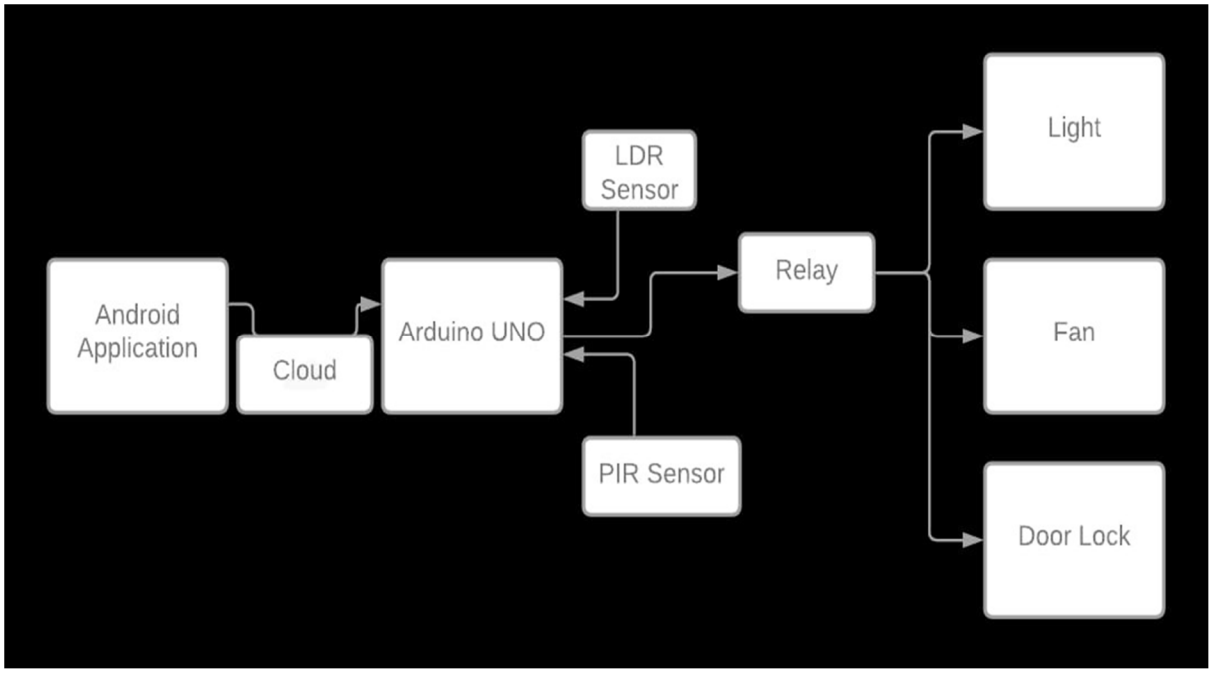


Figure 1 : Block diagram

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1) Smart Home is a very useful project for the people who are not able to do various activities efficiently when they are at home and need one's assistant to perform those tasks. M
2) With the Android Application the complication of wiring in case of wired automation is prevented. With the use of Wi-Fi based Home automation would help a man to switch on/off wherever he is. The Android application system provides secure access to home. In recent years, the Home Automation systems have seen rapid changes due to the introduction of various wireless technologies.
3) The Home Automation industry is growing rapidly, this is fuelled by the need to provide supporting systems that are made to ease our life. Automation systems are supposed to be implemented in existing home environments, without any changes in the infrastructure. The automation is based on android application of and uses Wi-Fi module along with microcontroller. This book presents the overall design of 'IOT based Home Automation', which we are currently developing.
4) The automation recognizes commands given by the app through the user and transfers it to our microcontroller which detects the command and proceeds with the switching accordingly. We are using the Arduino microcontroller module & Wifi module ESP8266 Node MCU to implement our vision. Further we are trying to implement the same on a more user friendly and bigger scale. The home automation system is intended to control all lights and electrical appliances in a home or office using voice commands.

Flowchart

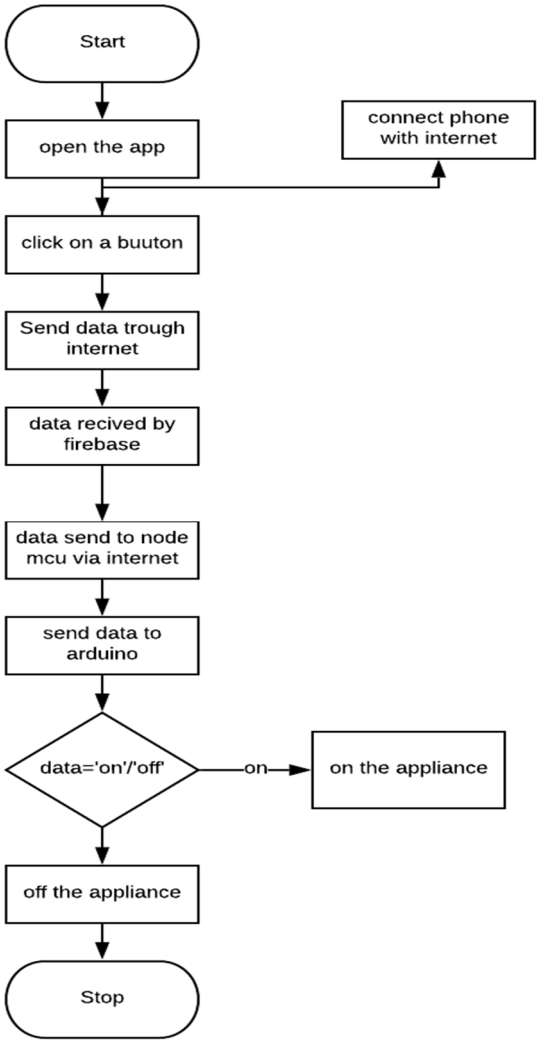


Figure 2 : Flow of our model (Flowchart)

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A. Components Used

1) Arduino : Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.



Figure 3: Arduino Atmega 328p

2) Relay: A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.



Figure 4: Relay

3) LED: Visible LEDs are used in many electronic devices as indicator lamps, in automobiles as rear-window and brake lights, and on billboards and signs as alphanumeric displays or even full-colour posters



Figure 5 : LED

4) Fan: About the power supply: Since your fan uses 100mA at full speed (I assume), it is still possible to power it over the 5V pin of the Arduino. You can source about 500mA over it (including the current for the Arduino itself).



Figure 6: Dynamic Mini Fan

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5) *NodeMCU :* NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

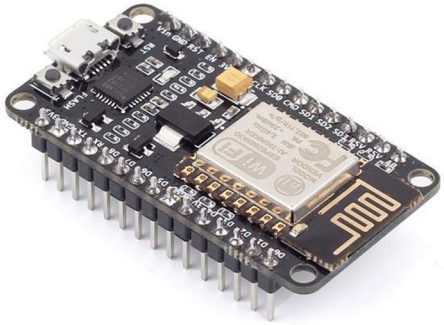


Figure 7: Node MCU

IV. IMPLEMENTATION

1) Home Automation using Internet Of Things(IOT) refers to the automation wherein it allows the users to control their devices using the Internet. It requires the user to connect his/her appliances, which he wishes to be remotely controlled, to the Arduino circuit. It also requires the user to connect the Arduino to the NodeMCU Wi-Fi module in order to allow the devices to be controlled from anywhere in the world using the Internet. The Wi-Fi module is connected to the Firebase real-time database using Database secrets in order to receive the triggering signals.
2) On the front end, we developed an Android app to pass signals to the Arduino circuit. We used a real-time database as a backbone of the project to send signals over the Internet. The Android app is linked to the database using the Firebase API readily available.

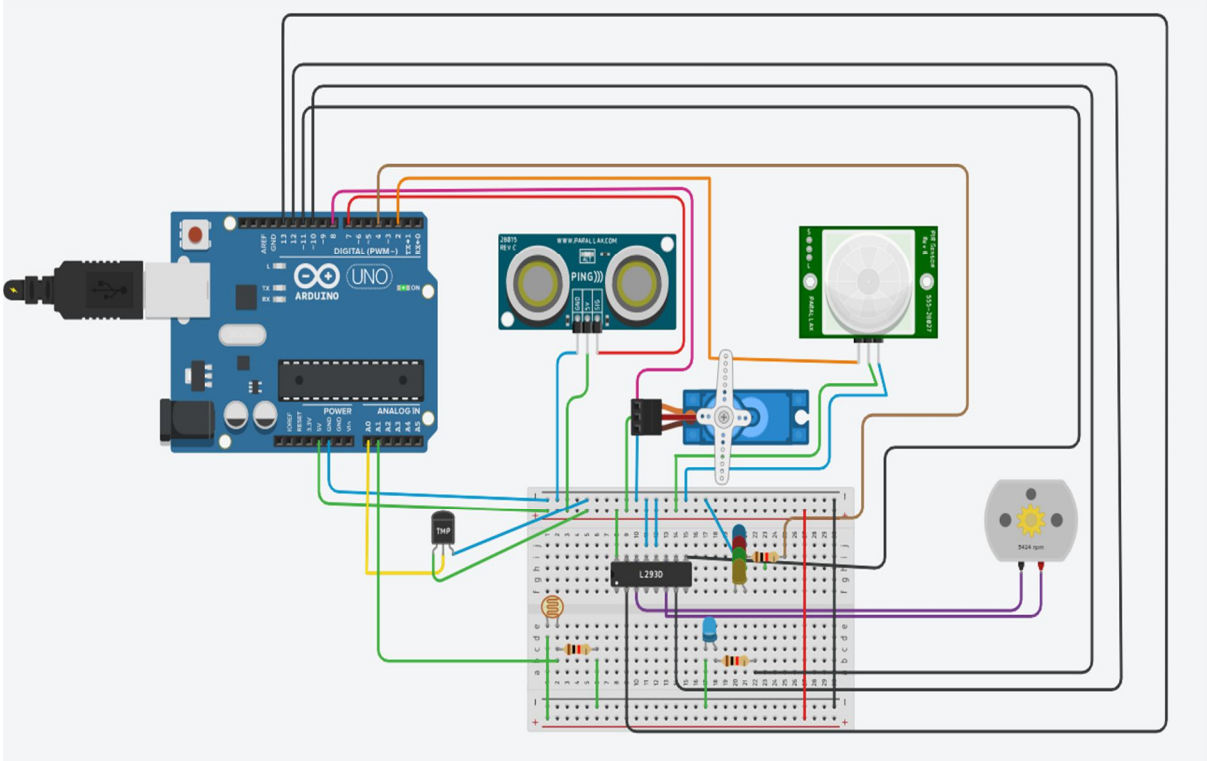


Figure 8: Circuit diagram

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Test Case Table

TEST CASE #	TEST SCENARIO	TEST STEPS	TEST DATA	EXPECTED RESULTS	ACTUAL RESULT	PASS/FAIL
1	Check whether the firebase value changes	1)Open the android app. 2)Click on a	Light Button: ON/OFF Fan button:	The database value changes corresponding to	As expected	PASS
2	Check whether the light bulb or fan starts or stops when	1)Open the google firebase website.	Light:ON/OFF Fan:ON/OFF	The blub lights up or the fan starts rotating	As expected	PASS
3	Check whether the light bulb or fan starts or	1)Open the android app. 2)Click on a	Light:ON/OFF Fan:ON/OFF	the bulb lights up or the fan strats rotating	As expected	PASS
4	Check whether the arduino uno is working correctly	1)Connect the arduino to your computer. 2)Open arduino IDE and select the	Code for blinking an LED	The inbuilt LED 13 starts blinking	As expected	PASS
5	Check whether the NodeMCU is working correctly	1)Connect the NodeMCU to your computer. 2)Open arduino IDE and select the	Code for blinking an LED	The Built-in LED starts blinking	As expected	Pass

Figure 9 : Test case table

V. RESULTS

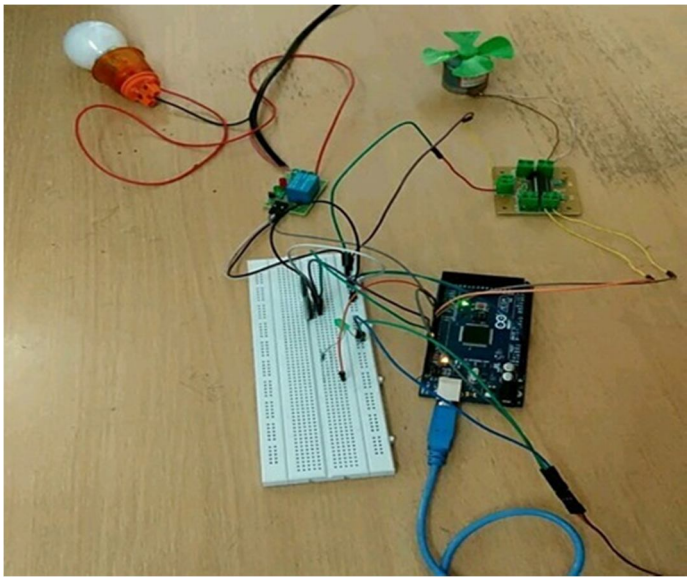


Figure 10 : Home automation system

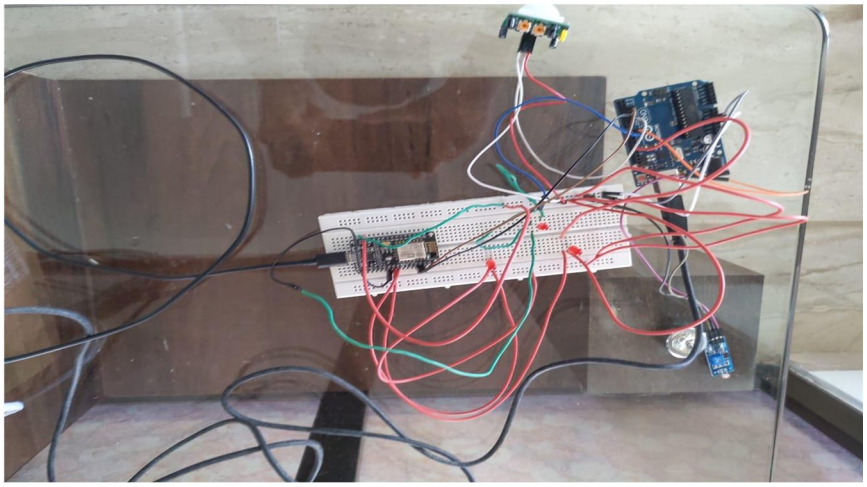


Figure 10.a : Home automation system

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Figure 11 : Home automation system app created through blynk showing that Fan is on



Figure 12 : Home automation system app created through blynk showing the fan is off now

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VI. CONCLUSION

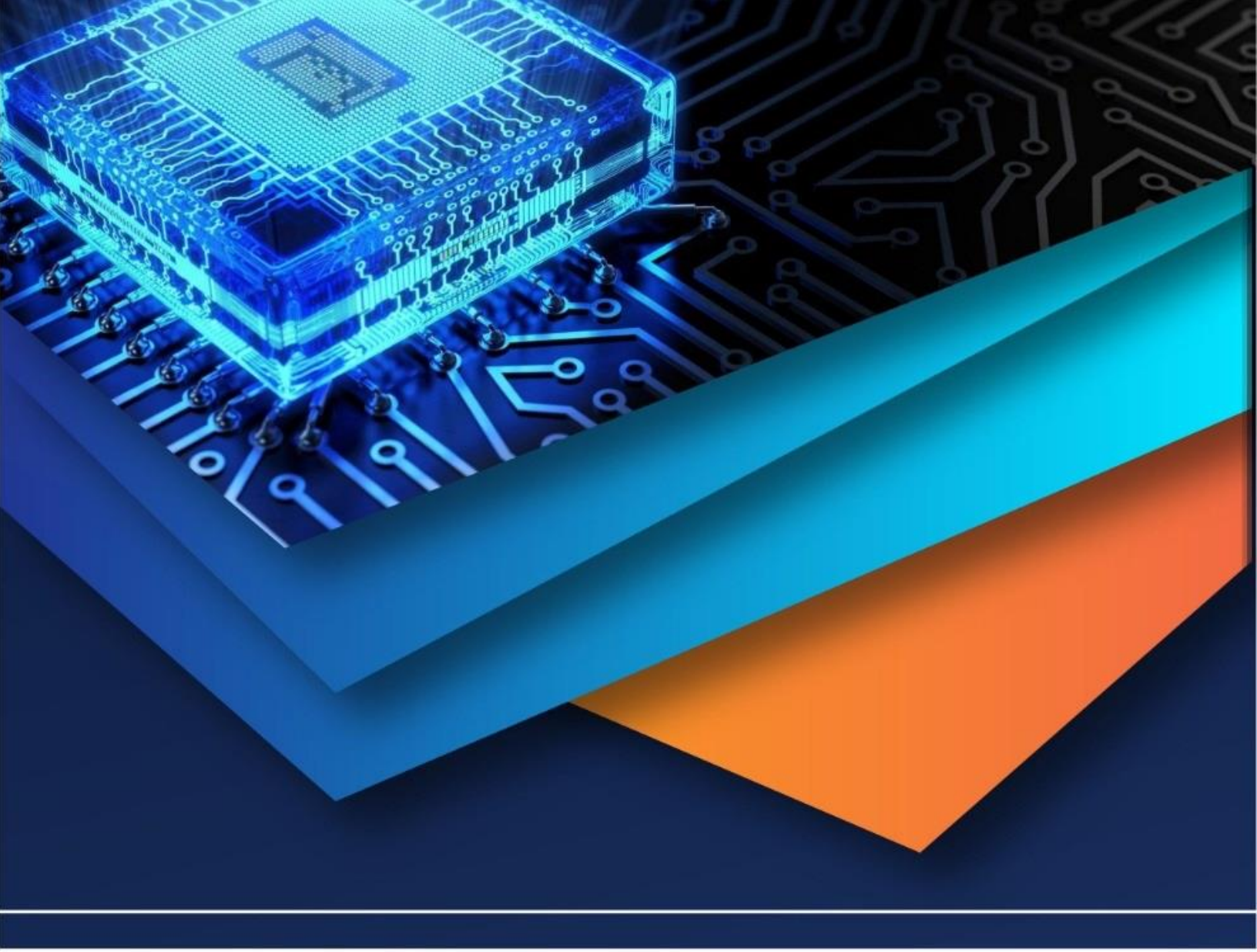
IOT based Home Automation is a very different concept than what is presently available in the market. This would make automation more easy and intuitive. The people will be able to interact with the system anywhere across the world. It also is an important aspect in the present world where people are so busy, this would help them in easing the basic functionality of their life. The world around us is going digital in every aspect we can imagine and it is happening fast, we also need to move forward with it. Our system is a great initiative step in automation, it would also provide security in the near future. As it is based on IOT we can assign access to our electronic devices being anywhere across the world. The following are the features of our system:

A. Easy to use.
B. Saves unnecessary power consumption.
C. Low cost compared to other automation systems.
D. Easy to implement.
E. Has good processing power and can handle multiple functions at the same time.
F. Uses reliable wireless connection

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