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Smart City using IOT simulation design in Cisco Packet Tracer

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Abstract: ***IoT is a system of interconnected devices which can collect and transfer data without human interference. Now-days IoT is used in various sectors including industries, agriculture, medical, smart city etc. This article review about smart city including – smart home which measures temperature according environment, smart garden which is sprinkling water according to water lever, smart grid which taking energy from solar panel and transfers it to power meter which charge the battery and helps in glowing the bulb. Smart city are the modern urban concepts that are essential for people to have quality of life. In view of the fact that high-tech, reasonable and control obstacle, the smart city opinion is still not extensive through the world. As a consequence, the major purpose of this paper is to carry the personification of smart city. We explain many challenges and opportunities in smart city. The enormity and diversity of devices and their and configuration provide inventive services and frameworks that need a new stimulating sight in integration, reliability and management of data. In this paper the simulation of related work is done by CISCO PACKET TRACER (7.3.1).***

Keywords: IOT, Smart City, Smart home, Smart grid, Smart garden. RFID, CISCO PACKET TRACER

I. INTRODUCTION

The idea of smart city combines communications technology and internet of things (IOT) for the improvement of services of city and allows to interact with the citizens. It is desire to provide good infrastructure and services to the citizens of the city. Smart city provides a good relation between citizens and government using available technologies. The relation between them is maintained by a good feedback system of facilities to create mechanism to gather the information, improve service delivery. By using IOT, especially the supremacy and interactive of city services is supposed to be upgraded. At the same time the demand for IOT enabled devices have been raised the interest of the device is that they do not need human interaction at all this makes them appropriate to bring into action for smart cities. IOT contains many frameworks such as sensors, hardware and software, wireless devices, architecture and its protocols, etc. The main objective of the IOT is to delegate things to be connected with each other at anytime, with anything and anyone preferably using distinct network technologies. Much appreciated to the latest expansion of digital technologies because of which smarts cities have become smarter. A smart city is provision with distinct electronic elements working by numerous applications [1]. In the circumstances of IOT, by employing and examining system devices can be desegregated form on the geographic location. Collection of specific data for the sensor services which is used with numerous materialize projects regarding the observing of parking slots, cyclists, vehicles etc. There are various service domains applications which is use an IOT architecture conducive to enable operations in air and noise pollution, the portability of vehicles and superintendence systems. Perhaps IOT will influence the numerous features of the smart city citizen's life like health and security. Further, it can enact an vital role at the national level. On this footing, the IOT will help out to furnish well organized, profitable and safe operation of the system which is based on distinct features, such as energy saving policies, profitable deliberations, dependability levels, etc. Eventually, a "Smart City" can be described as that desegregated city accommodate network of digital sensors which authorize the operation towns or cities architecture communicating through wireless networks and reinforced by allocated processing center for real time counselling cautions and informing for the flawless operations of cities, as a consequence contribution gratifying living skill for its people [2].

A. Smart Home

Smart homes are the crucial development which involves the combination of electrical appliances with networks of communication. Smart homes includes productive power management, associated all smart devices and managing data. Most important thing about a smart home is security. Basically, the meaning of smart home is that if a man forget to turn off the lights, fans or any electrical appliances then he/she can turn off the appliances with the help of mobile app which we can access remotely through our mobile phones from everywhere. Another application of IOT in smart home is smart anti-theft system which means that only the landlord have access to lock/unlock the door by using mobile app . It contains Arduino microcontroller which maintains the record of information about the visitor.

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If a thief entered into the home then the alarm will rang and it will notify the landlord about the theft [3]. We can also used cameras to recognize the man with the help of face recognition algorithm. Smart homes expect and acknowledge to the requirement of the householder, working to encourage their security, ease and comfort zone through the supervision of technology within the home.

B. Smart Grid

Smart grid system is preferred to solve the affairs of electricity grid [4]. In this paper, design protocol of the smart grid system has been discussed for a smart city built on IoT [5]. Smart grid has various advantages in affordable power generation. IOT technology executed to the power network enable for sensing and transmitting the data for the smart grid. Especially provide energy, it deploy intelligent controllers, strong software programming tools, and dynamic communication between devices attached to the network and the hardware. Here, hardware has the capability to sense and respond to the users demand. The main advantages of smart grid are- it provides smarter and cleaner energy usage process, cost efficient, and reliable [6]. Sensors plays a significant role for smart grid applications as it process data in real-time so to provide upgraded knowledge on the energy flow. This sensors should be affordable, self-operating and flexible as they can be utilized in huge numbers. These sensors gives wide range of data like voltage, current, frequency, power quality and so on. That data allows the grid to have the complete information of the operating conditions [7]. Smart meters, sensors and other smart devices that measure and accumulate facts and figures in a smart grid, generate big data that can use a lot of energy and other services and create a blockage. We should make the blueprint of smart grid in such a way that can easily store this huge amount of gathered data [8].

C. Smart Garden

Smart garden is an environmental monitoring system. Now, more than ever before, farmers have to more productively utilize and preserve their resources. And here the need of data comes in, and machine-to-machine communication has made the constant gathering of that info easy. In this smart garden system, water is provided to the plant by using lawn sprinklers. With the help of temperature sensor and water level monitor, checks the temperature of soil and provide it with water through the sprinkler [9]. In this system all devices are connected wirelessly to the home gateway, which provides the IP address to the devices. It works on the mobile application and on the web server by uploading the data on arduino application available on PC. In web server for this particular IP address provided by the home gateway data is uploaded on the server and through the sensors data is uploaded on the web server.Set the water level conditions and the sprinkler will work according to those conditions.

D. Smart Parking System

Now a days the major problem in metropolitian cities is detecting parking space for vehicles. The vast accretion in number of vehicles on the road including disorderly parking space has produced parking related problems. Therefore, it is necessary to grow a smart parking system. The car parking information system notify the drivers about the accessibility of parking slots on distinct parking locations. The accessibility of parking slots is a really time-varying issue. The consecutive nature of the facts concerning parking slots tenancy and period of tenancy needed to be examine using time sequence analysis techniques. On this point, we implemented RNN to utilize the consecutive nature of car parking data. The CPIS highly rely on the accomplishment of the decision support system to prepare precise facts about the accessibility of parking slots to the drivers indicates that data is accumulation through distinct sensors from numerous parking slots then this data is transfer through the communication layer to the processing layer where data is reserved for processing motive [10]. From the processing layer the reserved data of numerous parking slots is brought by the decision support system in rejoinder to a inquiry petition by a car driver who desire to know the accessibility of free parking slots at distinct parking locations on a specific time interval. The yield of the decision support system to notify the driver about the accessibility of parking slots on a same time, location and a day. This system can also determine vehicle's inappropriate parking and guess the time-period of the parking slot's tenancy by vehicle by accepting an fused component which is called parking meter.

II. SIMULATION WORK

A. Experimental Analysis

In this project we explain the replication environment of the recommended IoT network and the study of the network representation instance like data packets in a network. Packet tracer used for the experiment authorize us to recognize the packets proceed in the pattern IoT network and inspect what occurs to the packet. Cisco packet tracer permit us to sight the network instances of data packet transmit and received from one gadget to another in the IoT network and study what occurs when a packet is diminish. The estimation of the network production is to perspective the data packets transmit and received by the IoT gadgets.

B. Network Implementation Using Cisco Packet Tracer

We started the designing phase of the recommended IoT network by using cisco packet tracer which contains the numerous IoT devices for study. In the experimental setup, many smart IoT devices are placed unpredictably in the IoT environment with different sensors that are arranged with IP addresses to concatenate via a wireless home gateway. The home gateway arranged with a IPv4 address and attached to the mediator IoT server through the switch using copper straight wires. A smart phone is configured to associated to the home gateway.

C. Smart Home

Smart home introduce a convenient home set up. In smart home we considering appliances and devices can be automatically controlled remotely from anywhere with an internet connecting using mobile or other network device.

Components Required
Home gateway(DLC100) and Switch(2960-24TT)
Temperature Sensor and Temperature Monitor
Single Board Computer (SBC-PT)
Door and Window
Fan and Heater
Portable music player and Bluetooth Speaker
LCD
Smart Phone

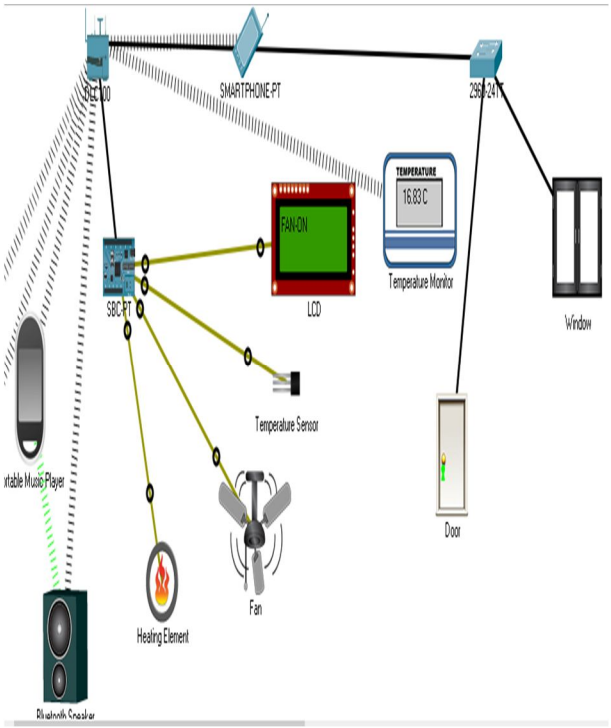


Fig. 1 Smart Home when Temperature > 15°C (Fan On)

- *Working:* First of all, let us take home gateway, home gateway is Wireless connected to multiple devices like mobile, temperature monitor, portable music player and Bluetooth speaker. Next we take a switch and SBC-PT board which is connected through straight copper wire. Now the switch is connected to the door and window through a copper wire. After that, the SBC-PT board is connected to the temperature sensor, cooler, heating element and LCD via the IoT cable. The temperature sensor senses the temperature. If the temperature drops below 15°C, the heating element will turn on, and it will display on the LCD that the heater is on. If the temperature is equal to 15°C then the LCD shows the normal temperature and the temperature is greater than 15°C then the fan is on and it will display on the LCD that the fan on.

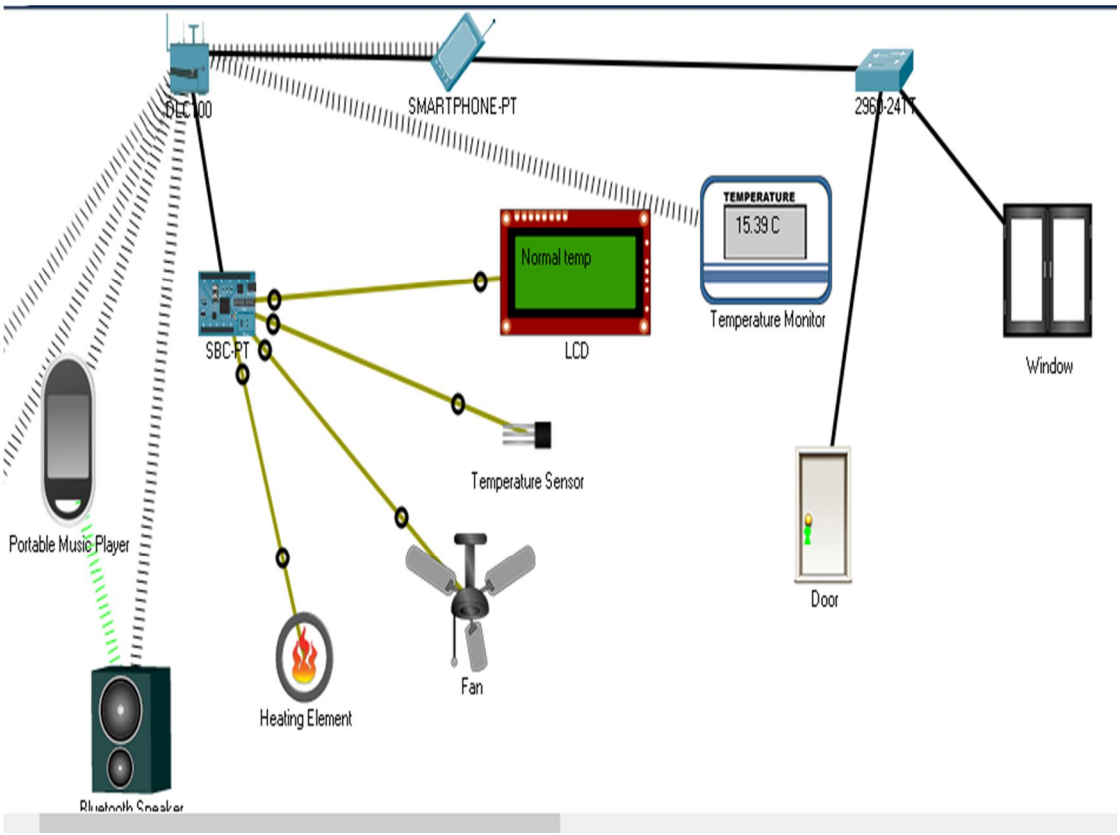


Fig. 2 Smart Home when Temperature = 15°C

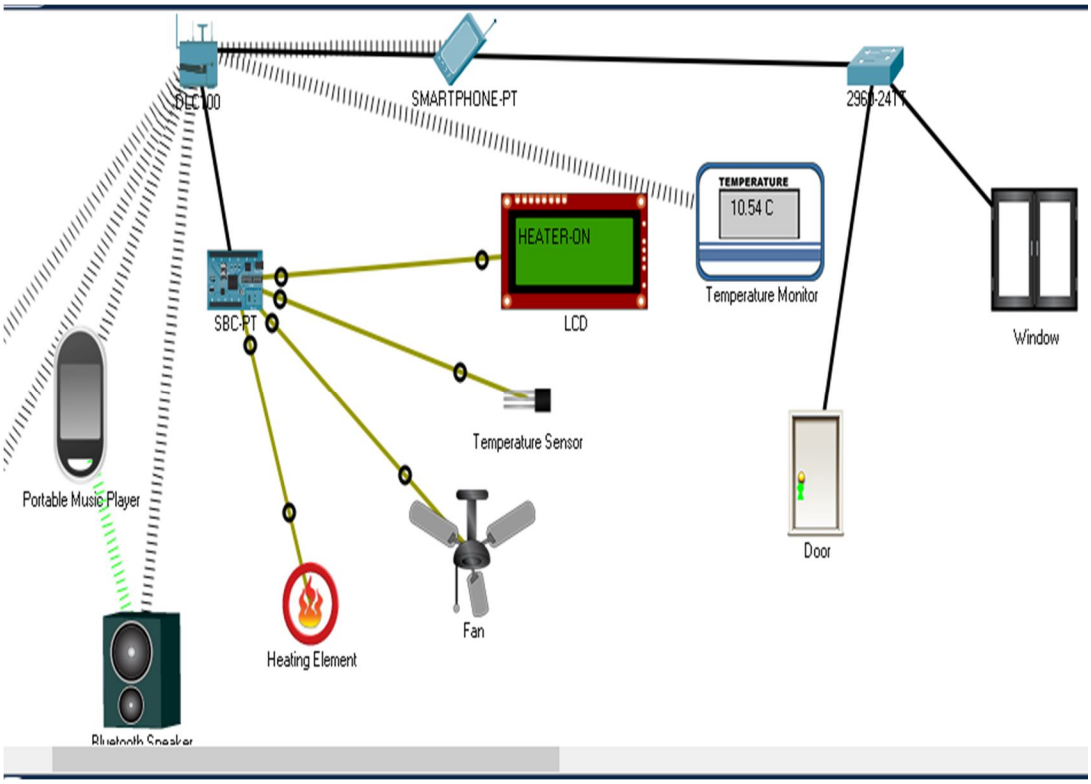


Fig.3 Smart Home when Temperature < 15°C

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D. Smart Garden

A smart garden is an environmental monitoring system that automatically waters the plant-based data received by the water-level monitor.

Components Required
Water lever monitor
Lawn sprinkler
Smart phone

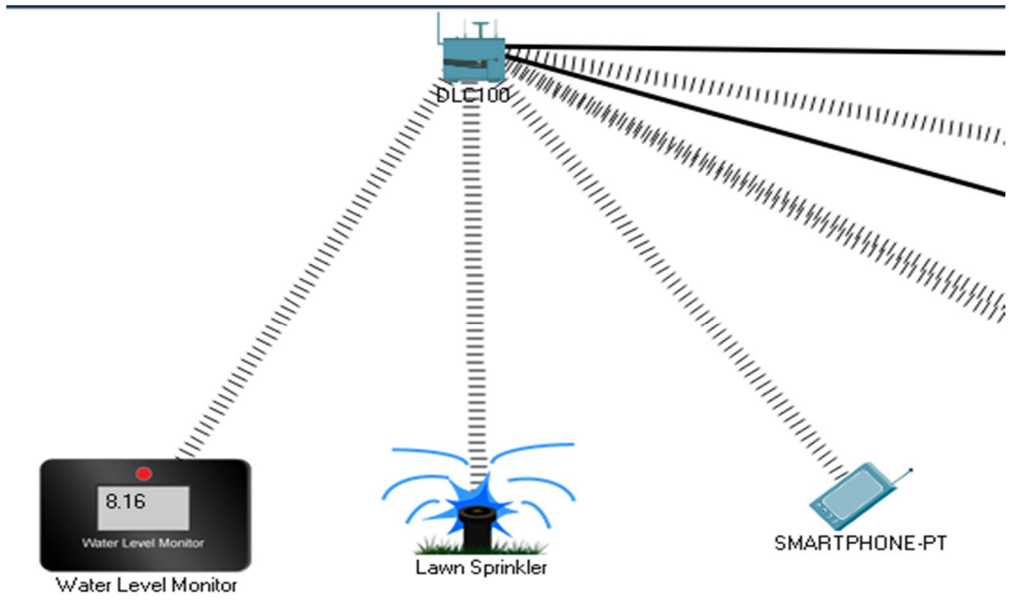


Fig. 4 Smart garden

- *Working:* In this smart garden, we carry a water level monitoring device, mobile phone and lawn sprinkler all devices are wireless connected to the home gateway The home gateway provides the IP address which is 192.168.25.1. Now set lawn sprinkler to DHCP and Home Gateway This will show the same IP address that the Home Gateway provides, similarly set water level monitor on DHCP and Home Gateway This will show the same IP address that the Home Gateway provides. Now go inside the desktop in the mobile phone and open the web browser now enter IP address (192.168.25.1) and set admin username, password it will show connected devices. Now set the water level position if the water level goes below 10cm the lawn sprinkler will draw out the water and if the water level is above 10cm the lawn sprinkler will not drain the water.

E. Smart Grid

Smart grid systems have the possibilities to mark today's grid challenges, including rising electrically demand. A smart grid is an electrical grid with automation communication system that can monitor the flow of electricity from the points of generation to the points of consumption and control the flow of electricity in real time to reduce the load to the next generation.

Components Required
Server
Laptop
Switch
Solar panel
Power meter
LED
Battery

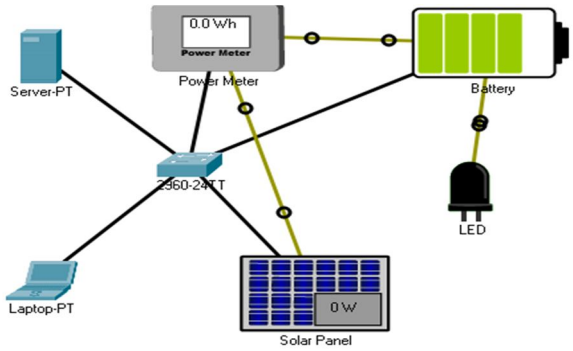


Fig.5 Smart grid

- *Working:* In smart grid system we take some electronic devices. The switch is connected to 5 devices via a straight copper wire. These 5 devices are Battery, Solar Panel, Power Meter, Laptop, Server. The electricity meter is also connected to the solar panel and battery through an IoT cable. And the battery is connected to the LED via IoT cable.First, we take the server. Now, click on the service icon to open Registration Server and VM Management.As a result, go to the configuration icon and turn on Gateway/IP4 DHCP which provides an IP address(192.168.25.1). Now Solar Panel, Battery and Power Meter are set to Gateway/IPv4 over DHCP and Server Address (192.168.25.1), Username (Admin) Password (Admin) is set in Remote Server to connect to Server. Connected devices will appear on the server desktop on the web browser.

E. Smart Parking System

Smart parking system play a very significant role in the smart city. Smart parking systems are starting to offer solutions for urban cities. This is a system allows real - time data to be obtained about parking availability both outside and inside and regarding traffic and road condition .Through the smart parking various vehicles arrival and departure could track for different parking lots spread in the city.

Component Required
SMART GATE
RFID CARD READER
RFID CARD
SERVER and Switch
MCU-PT BOARD
METAL SENSOR

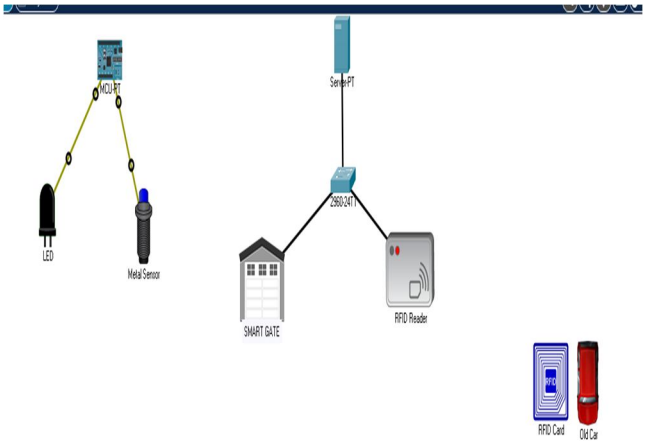


Fig.6 Smart Parking System (When there is no vehicle at gate)

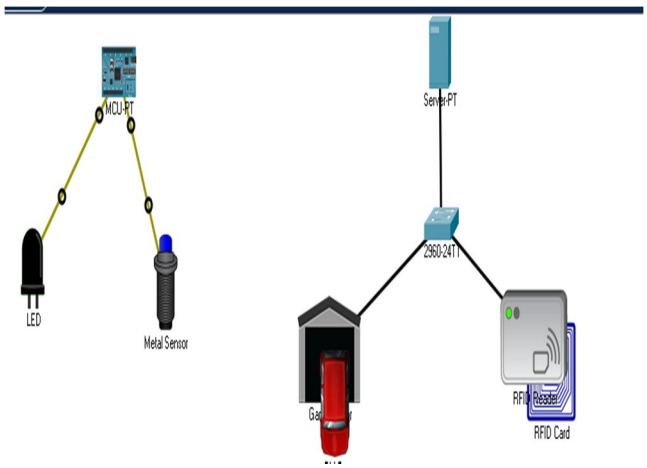


Fig.6 Smart Parking System (When there is vehicle at gate) Gate open

- *Working:* First, we take the server. Now, click on the service icon to open Registration Server and VM Management. Consequently, go to the configuration icon and turn on gateway/ip4 DHCP. The server is connected to the switch(2960-24TT) via copper wire. The switch is also connected via copper wire to the main door and the RFID card reader. Now, the main gate and The RFID card reader sets up the Gateway/IPv4 over DHCP and sets up the server address (169.254.217.48), username (admin) Password (admin) in the remote server to connect to the server. RFID card is a unique id card it is used to identify the car, when the car has a valid RFID card it will enter it in the smart parking area. After checking the validity user ID, the gate will open When the valid ID was punched by the user, was about invalid ID users. If any invalid id was scan in the RFID reader, the reader would detect the invalidity of the ID and the gate would not open. The Microcontroller (MCU-PT) is then connected to the metal sensor and LED bulb by the IoT custom cable. The programming code will be written in the MCU-PT the code will execute and the metal sensor will detect the car's metal body and the LED will glow.

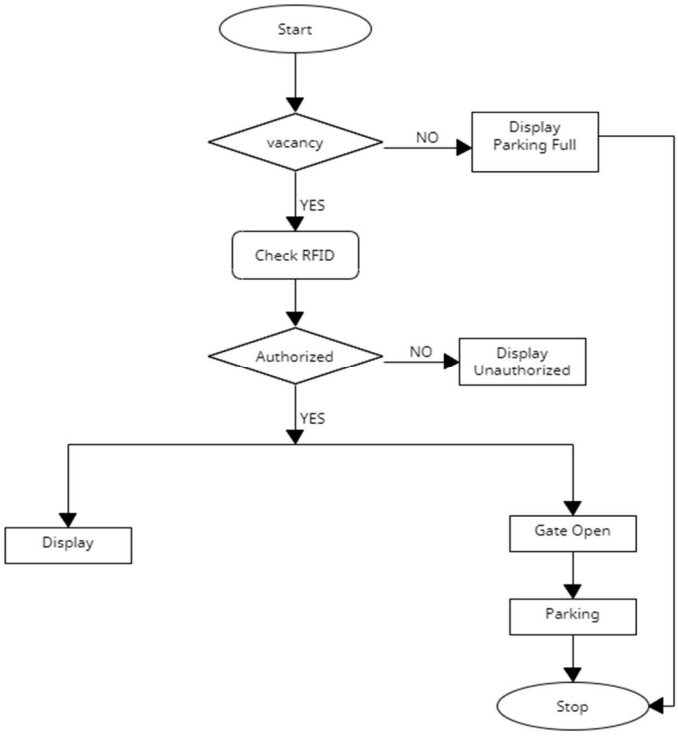


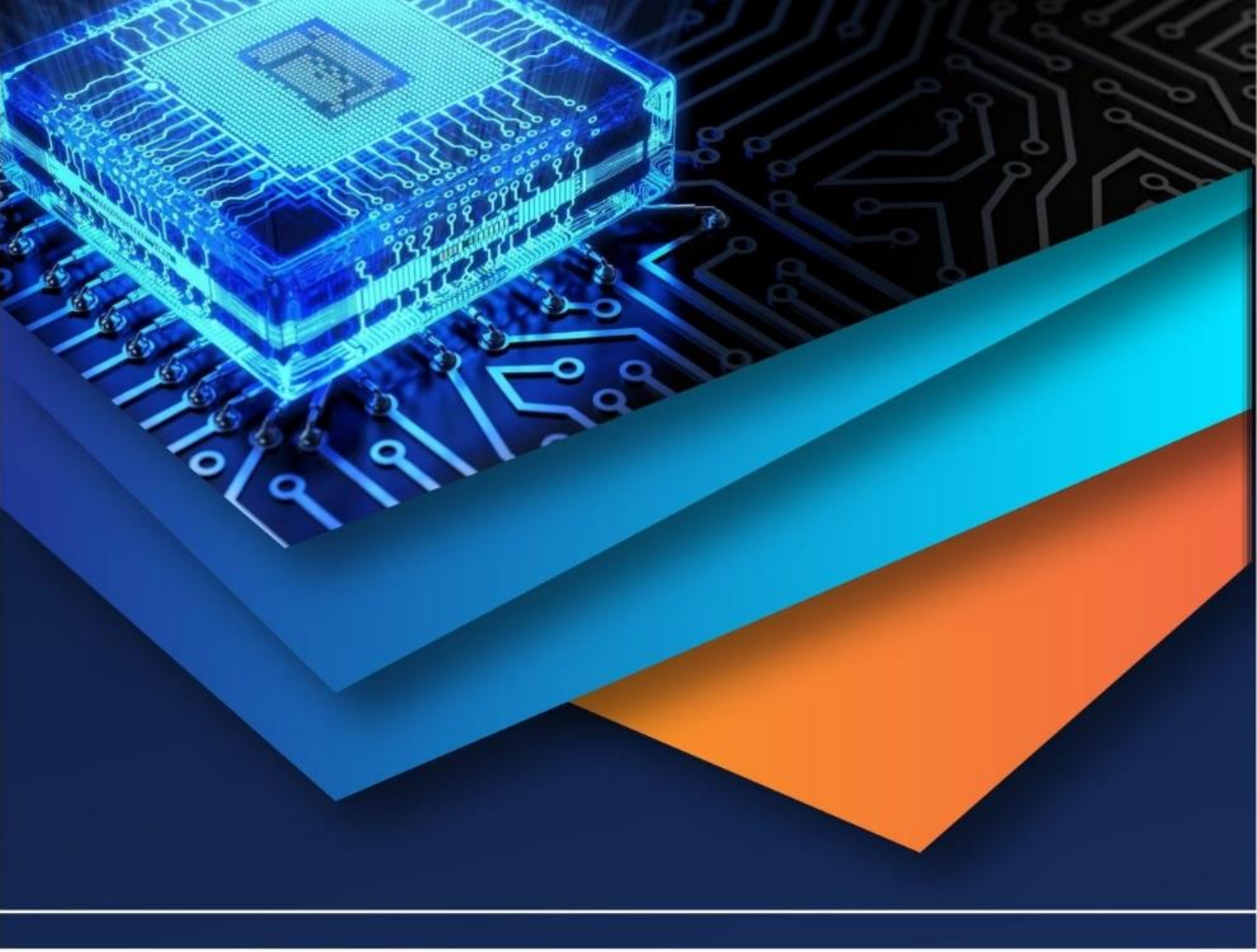
Fig.7 Flow Chart of Smart Parking System

III.CONCLUSIONS

IOT is not only connected with the vast technology but it is more interconnected to the widespread community framework. The agenda of the smart city will be the temperature, it will automatically measure the temperature according to the environment in the smart home. In the smart garden according to the water level monitor, water will be come out by the lawn sprinkler. The aim of this research paper is to develop a modern city through which the life of the people becomes easy. This paper focused on smart home, smart parking system, smart grid and smart garden. To recognize the principle of organization, some of the constituents of smart city are express in detail. In the future, some of the provocation and possibilities supply direction for the research work.

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