BCSE308L - COMPUTER NETWORKS

DIGITAL ASSIGNMENT – 2

- *22BCE1250*

ELEVATING SMART LIVING WITH
ADVANCED SAFETY & SUSTAINABILITY

I.   ABSTRACT :

Cisco Packet Tracer is a network simulation tool developed by Cisco Systems, where the users can create network topologies and simulate the behaviour of network devices, such as routers, switches, and IoT devices, in a virtual environment. A smart home ecosystem is implemented using Cisco Packet Tracer, highlighting the seamless integration of various IoT devices with a home gateway and their connectivity to both cloud-based services and a dedicated server. The smart home system can be controlled wirelessly using a control device (tablet in our case) for efficient and convenient remote management. Through this project, we demonstrate the potential of IoT technology to enhance home automation and control, providing insights into the future of smart homes and their practical applications.

The system which was built previously are upgraded with many features to improve the safety and privacy of the house. This new system is implemented by adding some more IoT devices to the existing network which must be programmed with instructions and conditions, and the IoT devices can be controlled and managed by the control device. The design of this new system prioritises security and usability. Several Motion-Detector sensors and CCTV surveillance are included to make the house more safer for the residents. In order to increase the safety of the inmates of the house, the home gateway of the system is linked to fire, smoke, carbon dioxide, and carbon monoxide detectors where all the conditions are set in control device. An RFID-based door-locking system is added for the safety of the ornaments and locker in order to improve the security of the home's safe room. In order to use renewable solar energy to power some devices and reduce our electric costs, we also installed a solar panel and a battery. An Elderly-friendly room automation is done and it prioritizes the well-being and quality of life for elderly occupants by minimizing physical strain and ensuring a seamless living experience.

II.   INTRODUCTION :

This smart home project's development tackles a variety of practical needs, many of which centre on security, safety, and energy efficiency. To address the critical security concern, it integrates motion detector sensors and CCTV surveillance first and foremost. This feature ensures continuous monitoring by keeping an eye out for any suspicious or unauthorized activity within or around the house, protecting residents from potential threats. This level of protection is priceless for homeowners who wish to safeguard their possessions and loved ones.

All the iot device such as carbon dioxide, smoke, fire, and carbon monoxide detectors is made with the occupants' safety and well-being in mind. By alerting residents to the presence of hazardous conditions like fires or harmful gases, these detectors serve as early warning systems that have the potential to save lives and create a safer and healthier living environment.

An additional degree of security is provided by the installation of an RFID-based door locking system, especially for priceless objects like decorations and the contents of lockers in the home's safe room. This project's feature serves homeowners who want to feel secure in the knowledge that their valuables are protected, and if someone tries to bypass the system, the siren which is integrated with this system turns on, and intimates the inmates of the house. In addition, the project is focused on energy efficiency and sustainability. Installing solar panels and batteries enables the use of renewable solar energy to power specific devices. This makes sense for homeowners who want to cut back on their energy expenses and their impact on the environment because it not only fits with an eco-friendly lifestyle but also results in lower electric bills. An intelligent and useful addition to any house, the Elderly-Friendly Room Automation offers customised features made to meet the specific requirements of senior citizens. The purpose of this automation system is added in this system to improve accessibility, safety, and comfort of an elderly person's living environment. All these improvements are done in this project and will be discussed in further sections.

III.   METHOD USED IN DA - 1 :

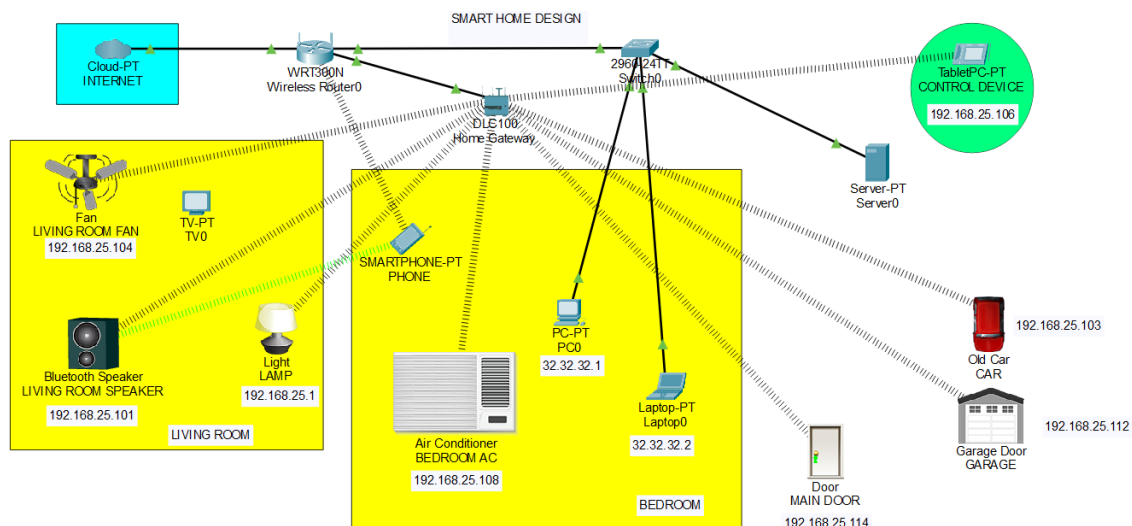1. IMPLEMENTATION OF SMART HOUSE IN DA – 1 :

Fig. 1. Network Implemented in DA - 1

The Implementation which was done in Digital Assignment 1 was a simple structure in which every IoT device is linked to the Home Gateway, which was previously connected to a WRT300N wireless router. The switch in this architecture is connected to the router, and the router is connected to the server. Computers are linked to the network by router, switch, and

internet access. The whole system is connected to the Cloud which provides the Internet for all the devices. To connect computers to the network a router, switch, and internet connection (cloud) is utilized. The router manages the connectivity of devices and serves as a gateway to the internet. The switch ensures that data flows efficiently between the server, IoT devices, and other connected computers. The internet connection is vital as it provides access to external resources and enables communication beyond the local network. In the network the personal computer and a laptop is connected to a switch using a guided medium for data transfer and effective communication inside the network.

2. DEVICES CONNECTED TO THE NETWORK :

SL. NO	DEVICE	IP ADDRESS
1	Living Room Fan	192.168.25.104
2	Lamp	192.168.25.1
3	Bedroom AC	192.168.25.108
4	Living Room Speaker	192.168.25.101
5	Main Door	192.168.25.114
6	Garage Door	192.168.25.112
7	Car	192.168.25.103
8	PC	32.32.32.1
9	Laptop	32.32.32.2

TABLE 1 : List of Devices with IP Address

The Figure given below shows the ability of the control device over the IoT devices and it can manage and control all the devices remotely. So this has added a user-friendliness to the system.

Fig. 2. List of IoT Devices Connected to the Network

The image given below shows that all the packets which are transferred in this network are successful. So, this proves the communication between different IoT devices and conditions can be set between the IoT devices to make a smart home.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
●	Successful	Server0	PC0	ICMP	■	0.000	N	0	(edit)
●	Successful	Server0	Laptop0	ICMP	■	0.000	N	1	(edit)
●	Successful	CONTROL DEVICE	LIVING ROOM FAN	ICMP	■	0.000	N	2	(edit)
●	Successful	CONTROL DEVICE	LIVING ROOM SPEAKER	ICMP	■	0.000	N	3	(edit)
●	Successful	CONTROL DEVICE	LIVING ROOM SPEAKER	ICMP	■	0.000	N	3	(edit)
●	Successful	CONTROL DEVICE	LAMP	ICMP	■	0.000	N	4	(edit)
●	Successful	CONTROL DEVICE	BEDROOM AC	ICMP	■	0.000	N	5	(edit)
●	Successful	CONTROL DEVICE	MAIN DOOR	ICMP	■	0.000	N	6	(edit)
●	Successful	CONTROL DEVICE	GARAGE	ICMP	■	0.000	N	7	(edit)
●	Successful	CONTROL DEVICE	CAR	ICMP	■	0.000	N	8	(edit)
●	Successful	LIVING ROOM FAN	BEDROOM AC	ICMP	■	0.000	N	9	(edit)
●	Successful	CAR	MAIN DOOR	ICMP	■	0.000	N	10	(edit)
●	Successful	LIVING ROOM FAN	LIVING ROOM SPEAKER	ICMP	■	0.000	N	0	(edit)
●	Successful	CAR	GARAGE	ICMP	■	0.000	N	1	(edit)
●	Successful	MAIN DOOR	PHONE	ICMP	■	0.000	N	2	(edit)
●	Successful	LIVING ROOM SPEAKER	PHONE	ICMP	■	0.000	N	3	(edit)

Fig. 3. Packet Transfer - Success

IV.   UPGRADATION DONE IN DA - 2 :

Nowadays, Technology is becoming increasingly integrated in our daily lives, and the idea of a "SMART HOME" has evolved from a convenience to a solution that provides increased sustainability, safety, and security. This design of upgraded smart home presents an innovative smart home system created within Cisco Packet Tracer that goes above and beyond the standard, addressing a wide range of modern issues. It strives to improve the residents' quality of life by offering a safe, effective, and environmentally responsible living environment through a variety of features.

In this "SMART HOME", there are different rooms and areas which requires automation of its own. In this design of the home, we have added few extra areas such as Lawn, a Room for Elderly people, a kitchen and terrace area and added the required components and upgraded the Home. As previously discussed, all the devices are connected to the Home Gateway and the devices are controlled and managed by the Tablet which is named as "Control Device" in Fig. 4. which describes the upgraded home. Each upgrade which we have done concentrates on specific problem which can lead to unthinkable situations, and we have resolved them with the growing technology of IoT and Networking. Each upgradation for each area will be covered in the document's subsequent sections.

The list of IoT devices which are used in this network are given in the image attached below.

Fig. 4. List of IoT Devices which are used in upgraded Network

Fig. 5. UPGRADED NETWORK

1. MOTION-DETECTOR SENSORS AND CCTV SURVEILLANCE FOR SECURITY :

The inclusion of multiple motion-detector sensors and CCTV surveillance ensures comprehensive security. Residents can rest easy knowing that potential intrusions and security breaches are closely monitored and that their loved ones and property are well-protected. This layer of security is indispensable in today's world. There are two motion-detecting sensors installed for Security purpose. The first is located outside the house near the main door and serves as the primary security measure at night. The second is installed in the garage to prevent unauthorized activity there.

1.1. Motion-Detector Sensor at the Main Door :

An essential security measure is the installation of a motion-detector sensor outside the home, close to the main entrance, especially at night. This sensor is essential in improving the overall safety of the property and discouraging possible intruders. The motion-detector sensor instantly sounds an alert or activates a siren to alert people to any unauthorised movement in its area and potentially expose a breach. Concurrently, the linked CCTV (closed-circuit television) security system turns on, starting to record live footage of the surrounding area. In the event of any suspicious activity, residents and security personnel will have easy access to vital visual information thanks to this live feed, which can be conveniently viewed and monitored from a control device. Having access to the CCTV feed through a control device gives homeowners the ability to act quickly or call for help, improving overall security and peace of mind, particularly at night when visibility is usually lower and security risks are higher. These conditions can be set in the "Control Device" and can be managed by it. When the motion is not detected, the siren inside the house is turned off and the CCTV stops recording. The figure given below explains the situation.

	Actions	Enabled	Name	Condition	Actions
Edit	Remove	Yes	MOVEMENT IN DOORSTEP	MOTION DETECTOR MAIN DOOR On is true	Set IoT - Siren On to true Set MAIN DOOR CCTV On to true
Edit	Remove	Yes	NO MOVEMENT IN DOORSTEP	MOTION DETECTOR MAIN DOOR On is false	Set IoT - Siren On to false Set MAIN DOOR CCTV On to false

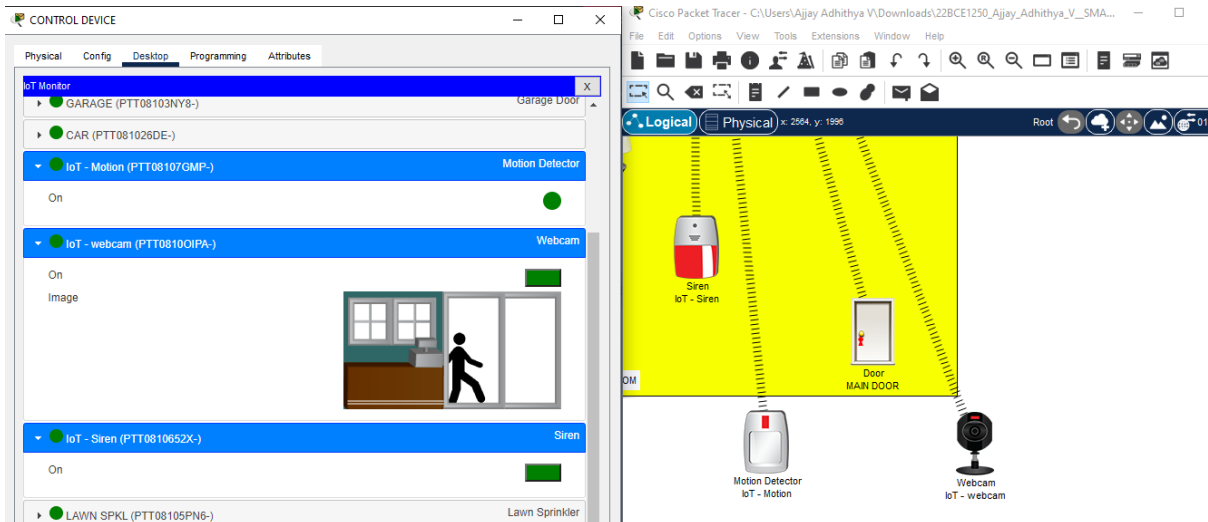Fig. 6. Condition for Motion Detected near Main Door

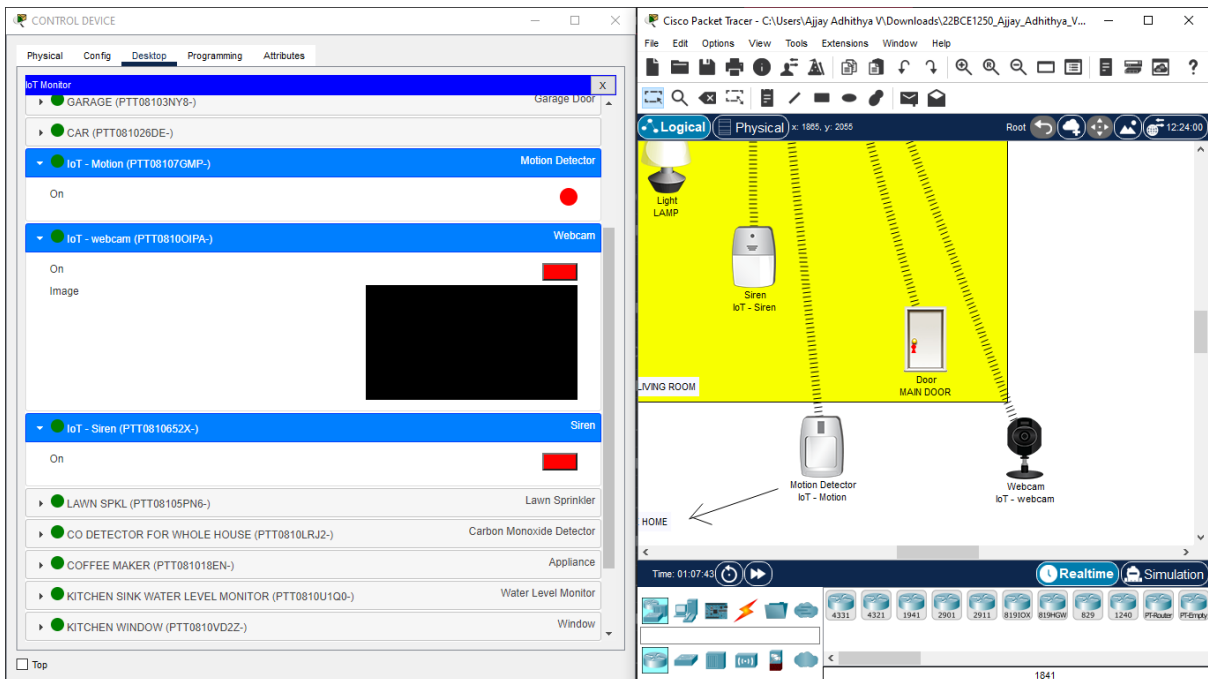Fig. 7. Motion Detected near Main Door

Fig. 8. Motion NOT Detected near Main Door

1.2. Motion-Detection Sensor at the Garage :

The installation of a motion-detector sensor in the garage is a crucial addition to the smart home's security system. Much like the sensor placed near the main door, this garage-based sensor serves as a robust security measure, particularly in the context of potential intrusions into a traditionally vulnerable area. When the sensor detects any motion within the garage, it promptly triggers a siren, sounding an immediate alert to any unauthorized presence. Simultaneously, the connected CCTV surveillance system comes to life, initiating live video recording of the garage. This recorded feed can be conveniently accessed and monitored from a control device, providing a comprehensive security solution that ensures the safety and protection of valuable belongings, vehicles, and the home itself. Since the garage may hold valuables like tools, cars, and other possessions, it is frequently the target of theft or unauthorised entry. An extra degree of security is provided by the garage's motion-detector sensor, which deters possible break-ins and thefts.

Edit	Remove	Yes	GARAGE MOTION DETECTED	GARAGE MOTION DETECTOR On is true	Set GARAGE SIREN On to true Set GARAGE CCTV On to true
Edit	Remove	Yes	GARAGE MOTION NOT DETECTED	GARAGE MOTION DETECTOR On is false	Set GARAGE SIREN On to false Set GARAGE CCTV On to false

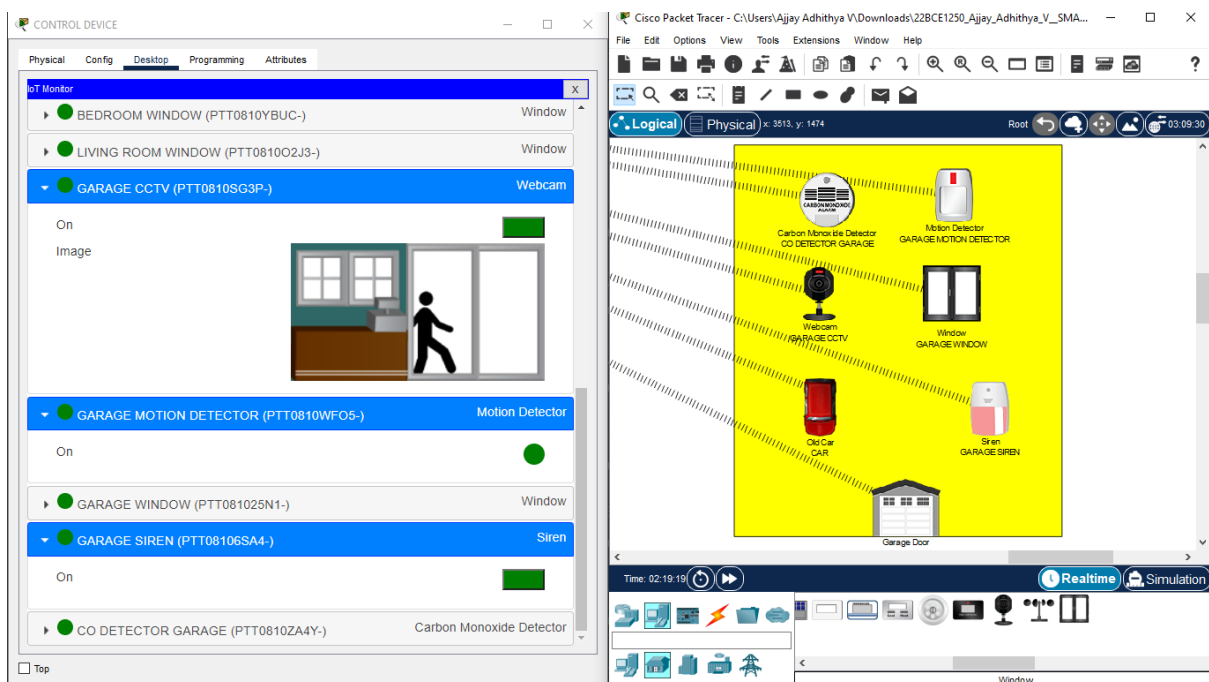Fig. 9. Condition for Motion Detected in Garage

Fig. 10. Motion Detected near Garage

2. SAFETY AND ENVIRONMENTAL SENSORS & DEVICES :

2.1. Garage Carbon Monoxide Detector :

A carbon monoxide detector is installed in the garage and it is an important feature as it can detect and respond to potentially harmful gases such as carbon monoxide (CO) emissions, often released from car exhaust fumes. When the CO level in the garage reach or exceed 25 ppm which is set as a condition in the control device and the image is attached below, the detector triggers an automatic mechanism that opens the garage doors and windows. This immediate action allows for the efficient ventilation of the space, reducing the concentration of harmful CO gas. Once the CO levels drop below the 25 ppm threshold, the system then automatically closes the garage doors and windows. This feature is of utmost importance as it addresses a silent but lethal threat – CO poisoning.

This is an important feature as it can protect the health of the people inside the house and can potentially save lives. In a garage, where vehicles are often running, CO emissions can accumulate rapidly, posing a threat to anyone exposed to them. By automatically opening the garage doors and windows when CO levels rise, the system effectively prevents CO poisoning and its associated health risks. Furthermore, the automation ensures that residents are shielded from harm even if they are not immediately aware of the danger, offering peace of mind and a proactive response to a potentially life-threatening situation. The image given below are the conditions set in the Control device to manage and synchronise the timing of these IoT devices.

Edit Remove	Yes	CO LEVEL IN GARAGE MORE THAN 25	CO DETECTOR GARAGE Level > 25	Set GARAGE WINDOW On to true Set GARAGE DOOR On to true
Edit Remove	Yes	CO LEVEL IN GARAGE LESS THAN 25	CO DETECTOR GARAGE Level < 25	Set GARAGE WINDOW On to false Set GARAGE DOOR On to false

Fig. 11. Condition for CO level in Garage

2.2. Fire & Smoke Detector :

When the whole-house fire detector detects a fire and the smoke level detector indicates a reading of more than 30%, a series of critical safety measures are initiated within the smart home. In the case of a fire emergency, these steps have been painstakingly planned to guarantee the safety and prompt evacuation of the residents. First, the house's three fire sprinklers are turned on immediately to help contain and suppress the fire and lessen its intensity and spread.

Second, an important safety feature that facilitates residents' quick and simple escape is the main door's automatic switch from lock to unlock. Every second counts in a fire, so making sure everyone can easily escape is essential to everyone's safety. Similarly, the automatic opening of all windows throughout the house, as well as the activation of the garage door and window, further facilitates ventilation and escape routes. These actions help in dissipating smoke and providing clear pathways for residents to exit the premises safely.

The importance of these coordinated actions cannot be overstated. In a fire emergency, the quick response of the system ensures that safety measures are initiated without delay. The activation of fire sprinklers helps to contain and control the fire while the unlocking of doors, opening of windows, and garage access allow for rapid evacuation, reducing the risk of injury or harm to residents. This integrated approach to fire safety minimizes the potential dangers associated with fire emergencies and enhances the overall safety and survivability of the occupants in the smart home. The image given below explains the whole situations and all the necessary actions taken place among IoT devices.

Edit	Remove	Yes	FIRE DETECTED IN HOUSE	Match all: • FIRE DETECTOR FOR WHOLE HOUSE Fire Detected is true • SMOKE DETECTOR Level > 30	Set SPRINKLER 1 Status to true Set SPRINKLER 2 Status to true Set SPRINKLER 3 Status to true Set MAIN DOOR Lock to Unlock Set LIVING ROOM WINDOW On to true Set KITCHEN WINDOW On to true Set BEDROOM WINDOW On to true Set GARAGE DOOR On to true Set GARAGE WINDOW On to true
Edit	Remove	Yes	FIRE NOT DETECTED IN HOUSE	Match all: • FIRE DETECTOR FOR WHOLE HOUSE Fire Detected is false • SMOKE DETECTOR Level < 30	Set SPRINKLER 1 Status to false Set SPRINKLER 2 Status to false Set SPRINKLER 3 Status to false Set MAIN DOOR Lock to Lock Set LIVING ROOM WINDOW On to false Set KITCHEN WINDOW On to false Set BEDROOM WINDOW On to false Set GARAGE DOOR On to false Set GARAGE WINDOW On to false

Fig. 12. Condition for FIRE DETECTED IN HOUSE

2.3. Lawn Sprinkler Automation :

The installation of a lawn sprinkler automation system with two water sprinklers, a water level monitor, and a drain is the smart and efficient approach to garden irrigation. The automation system plays a crucial role in maintaining the ideal soil moisture levels for the plants while preventing overwatering. When the water level rises beyond 7 cm, a common trigger for potential waterlogging and overhydration, the system promptly deactivates both sprinklers. These conditions are important as high level of water in the soil can affect the health of the plants and it decreases availability of oxygen. On the other hand, when the water level falls to 0 cm, the sprinklers are automatically triggered again by the system, ensuring that the garden is reliably and adequately hydrated without the risk of drowning.

The system protects the plants from potential damage brought on by soggy conditions in addition to conserving water by avoiding needless irrigation. Ultimately, this automation system's value rests in its capacity to balance effective water management with the health of your garden by encouraging strong plant development and cutting down on water waste. It's a conscientious and environmentally beneficial method of watering gardens that promotes plant life and sustainability.

Edit	Remove	Yes	LAWN WATER LEVEL MORE	LAWN WATER LEVEL MONITOR Water Level > 7.0 cm	Set LAWN SPKL 1 Status to false Set LAWN SPKL 2 Status to false
Edit	Remove	Yes	LAWN WATER LEVEL LESS	LAWN WATER LEVEL MONITOR Water Level = 0.0 cm	Set LAWN SPKL 1 Status to true Set LAWN SPKL 2 Status to true

Fig. 13. Condition for LAWN SPRINKLER AUTOMATION

The main problem which we are facing today is water scarcity, and manual irrigation is the inefficient use of a precious resource in a world where water resources are becoming

increasingly limited. Manual irrigation methods often lack precision and cannot adapt to changing conditions, leading to water wastage and potential overwatering. In regions plagued by water scarcity, this mismanagement exacerbates the already acute issue of insufficient water availability. The lawn sprinkler automation system described earlier addresses this problem by automating irrigation and ensuring that water is used efficiently, promoting sustainability and responsible water use while safeguarding plant health.
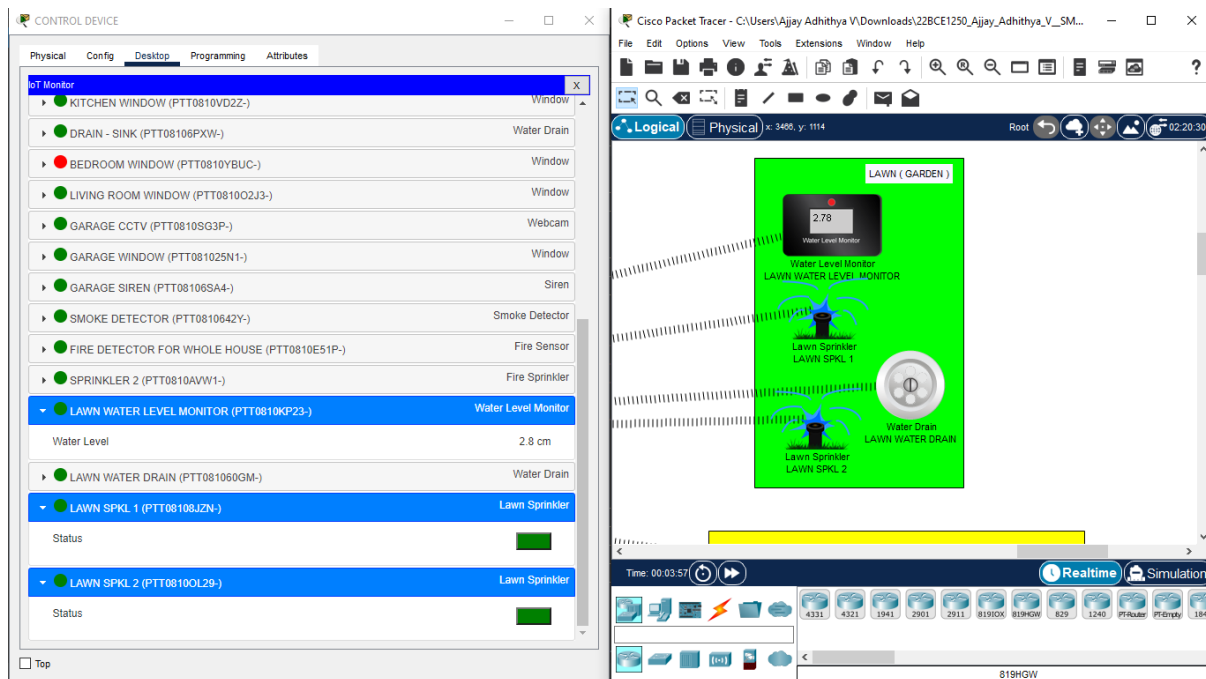

Fig. 14. LAWN SPRINKLER AUTOMATION

2.4. Kitchen Sink Water Overflow Prevention :

The implementation of an automated system that activates the drain of the kitchen when the water level in the kitchen sink exceeds 5 cm plays a pivotal role in preventing water overflow and potential property damage. When the water level reaches this threshold, the system triggers the drain to expel the excess water, effectively averting any possible flooding or spillage. This feature's significance is complex. Its primary function is to protect your house and possessions from water damage, which can be expensive to fix and result in structural problems. The system helps maintain a dry and safe environment by taking proactive measures to stop overflowing. This stops water from seeping into cabinets, flooring, and walls, which could lead to the growth of mould or structural deterioration. Additionally, it encourages water conservation by making sure that only the necessary quantity is used—a crucial practise in areas where water scarcity is a concern. In conclusion, this automation feature contributes to sustainability and safety by safeguarding your property and encouraging wise water use, which lowers the likelihood of water-related problems.

Edit Remove	Yes	WATER LEVEL IN KITCHEN SINK	KITCHEN SINK WATER LEVEL MONITOR Water Level > 5.0 cm	Set DRAIN - SINK Status to true
Edit Remove	Yes	WATER LEVEL IN KITCHEN - LOW	KITCHEN SINK WATER LEVEL MONITOR Water Level < 5.0 cm	Set DRAIN - SINK Status to false

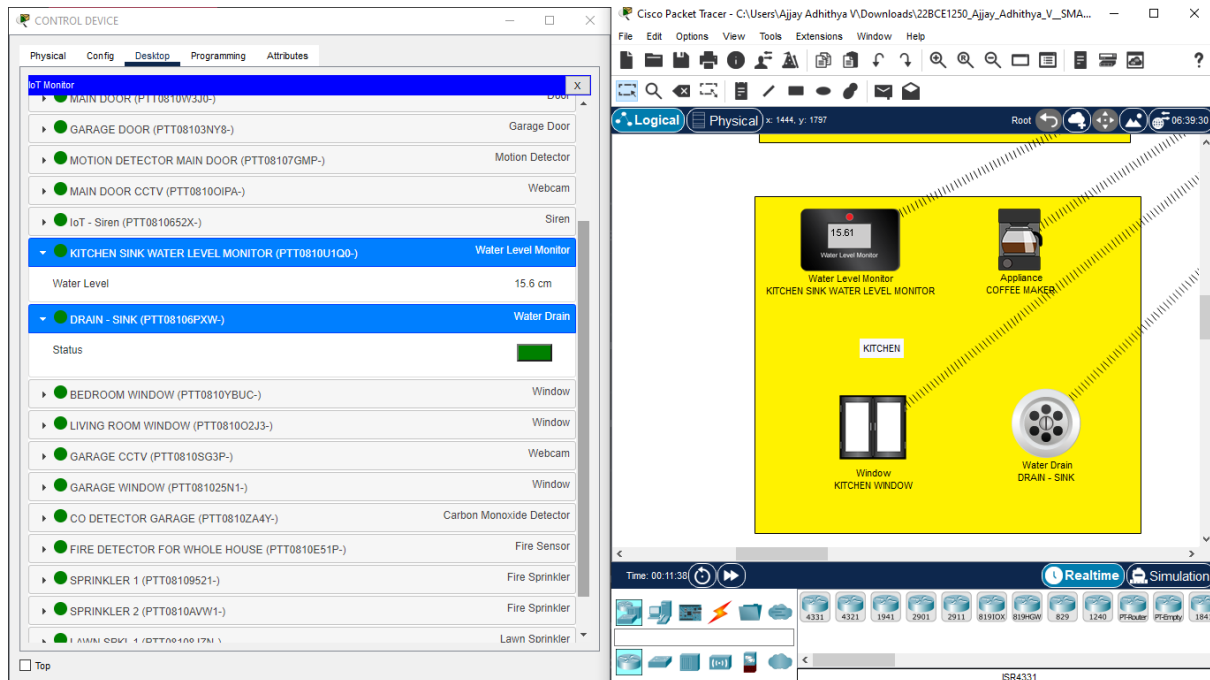Fig. 15. CONDITION FOR KITCHEN SINK WATER OVERFLOW PREVENTION

Fig. 16. KITCHEN SINK WATER OVERFLOW PREVENTION

2.5. Energy Conservation – Solar Powered Appliances :

The installation of solar panels on the house's terrace which is connected to a power meter and a battery, represents a forward-thinking approach to energy management and sustainability. This integrated system allows the smart utilization of renewable solar energy to offset high electricity costs and provides a backup power solution during frequent power cuts. The power meter displays the power drawn from the solar panel.

There are several reasons why this solar panel and battery system is important. It first significantly reduces the household's dependency on grid-based electricity, which eventually brings down electricity bills. Solar panels contribute to a decrease in carbon emissions and dependency on fossil fuels by generating electricity from the radiation of the sun, a clean and renewable energy source. This energy resource guarantees a consistent power supply even in the case of a power outage, the battery storage system increases energy resilience. Ensuring the comfort and safety of residents during power outages is especially dependent on maintaining basic services like lighting, refrigeration, and communication devices which are important during emergency services.
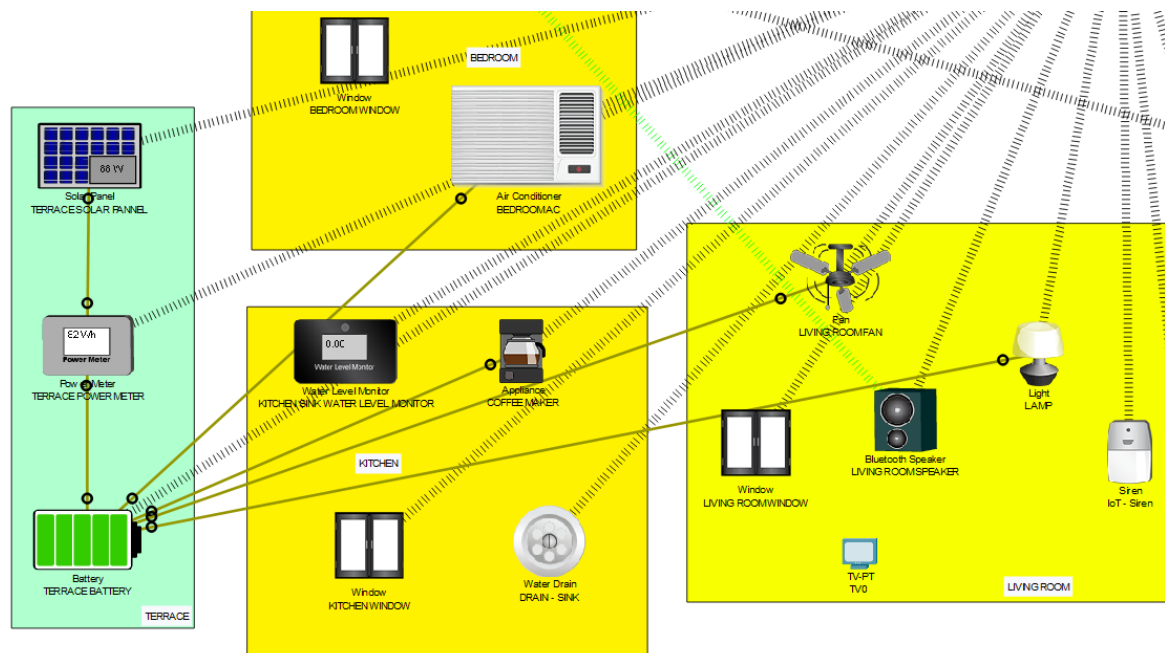
Fig. 17. SOLAR POWERED COMPONENTS

Moreover, the ability to connect the battery to various components such as Air Conditioner, Kitchen appliances, Fan and Lights that consume significant power allows for efficient energy allocation. It empowers homeowners to prioritize which appliances or devices receive backup power, optimizing energy management. In summary, this solar panel and battery system not only offers economic benefits but also contributes to environmental sustainability and ensures uninterrupted power supply during outages, enhancing the overall quality of life for residents.

3. RFID INTEGRATED SAFE ROOM FOR ENHANCED SECURITY :

Homeowners often keep valuable possessions and important documents in safes or lockers. An RFID-based door-locking system adds an extra layer of security by allowing access control to these areas. It prevents unauthorized individuals from tampering with or accessing sensitive belongings, enhancing overall home security. To access the entry into the room, the user require a RFID enabled card in which the key of the card should match with key which is set in RFID Detector (1011 in our case).

The implementation of an RFID-based door-locking system in a home's safe or locker room represents a significant enhancement in security and access control. To access the locker room, user should have an RFID-enabled card, this system adds an extra layer of protection for valuable possessions and important documents. The RFID-enabled card serves as a digital key, and the key stored within the card must match the key set in the RFID Detector (e.g., "1011" in your case) for the door to unlock. This means that unauthorized individuals are effectively barred from accessing the safe room, providing homeowners with peace of mind knowing their valuable items are secure.

This feature is important because it can prevent unauthorised access to important documents and sensitive belongings. Valuable items like jewellery, legal documents, passports, and more are frequently secured with safes and lockers. Only those who are authorised can enter thanks to the system's requirement that an RFID card match the predetermined key. The possibility of theft or tampering, which could have adverse impacts on homeowners, is reduced by this access control feature. By successfully preventing unwanted access to a secure area, it also improves general home security by providing homeowners with more control and comfort.

This technology not only protects valuables but also provides convenience. Homeowners can use RFID-enabled cards instead of conventional physical keys, which are frequently more secure and less likely to be misplaced or duplicated. The system's ease of use guarantees that access to valuables is regulated and expedited for those who possess the requisite RFID card, making it a crucial component for individuals looking to safeguard their most prized assets.

The inclusion of a trip sensor near the locker, activates a series of security measures upon detecting unauthorized access, further reinforces the integrity of the safe room's security system. When an individual passes through the trip sensor without authorization, it sends a signal to the siren within the safe room. The siren immediately blares a loud and attention-grabbing alarm, alerting others in the house to the security breach. This auditory alarm is an invaluable tool for quickly notifying occupants about a potential threat and ensuring a swift response.

Edit	Remove	Yes	RFID VALID	SAFE ROOM RFID READER Card ID = 1011	Set SAFE ROOM RFID READER Status to Valid
Edit	Remove	Yes	RFID NOT VALID	SAFE ROOM RFID READER Card ID != 1011	Set SAFE ROOM RFID READER Status to Invalid
Edit	Remove	Yes	SAFE ROOM DOOR UNLOCK	SAFE ROOM RFID READER Status is Valid	Set SAFE ROOM DOOR Lock to Unlock
Edit	Remove	Yes	SAFE ROOM DOOR LOCK	SAFE ROOM RFID READER Status is Invalid	Set SAFE ROOM DOOR Lock to Lock
Edit	Remove	Yes	SAFE ROOM SIREN ENABLE	SAFE ROOM TRIP SENSOR On is true	Set SAFE ROOM SIREN On to true Set CCTV FOR SAFE ROOM On to true
Edit	Remove	Yes	SAFE ROOM SIREN DISABLE	SAFE ROOM TRIP SENSOR On is false	Set SAFE ROOM SIREN On to false Set CCTV FOR SAFE ROOM On to false

Fig. 18. CONDITIONS FOR RFID INTEGRATED SAFE ROOM

Simultaneously, the activation of the nearby CCTV camera, which begins recording and streaming live footage to the control device, plays a crucial role in documenting and potentially deterring unauthorized access. The live video feed enables residents to assess the situation and take necessary action in real time. In the event of a security breach, this feature can provide critical evidence for authorities, should legal action be required. The importance of this integrated system is evident in its ability to prevent and respond to unauthorized access effectively, thereby bolstering the security of the safe room and its contents.
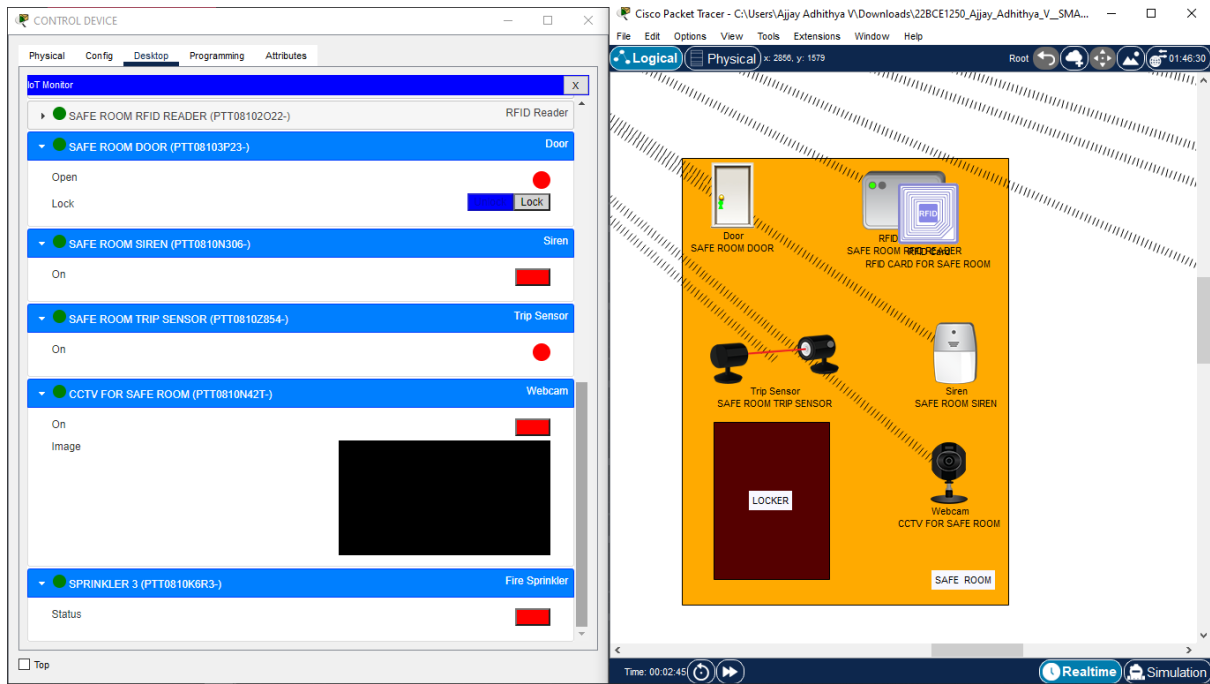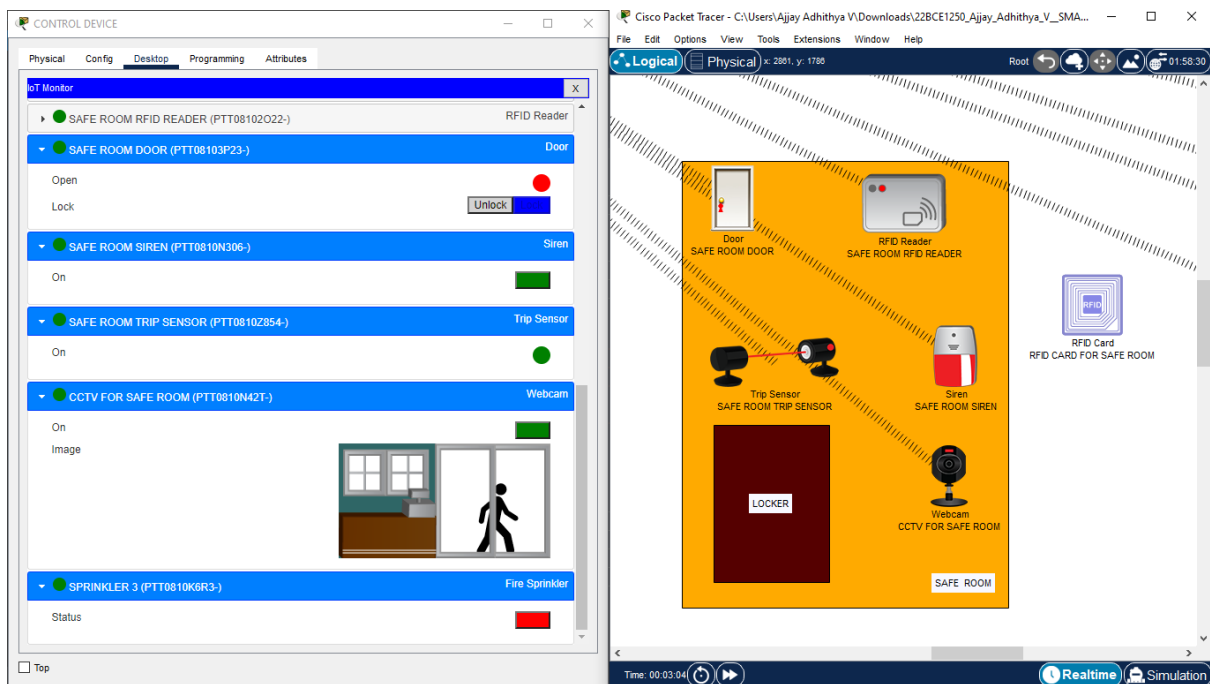
Fig. 19. RFID ENABLED SAFE ROOM

Fig. 20. RFID ENABLED SAFE ROOM – UNAUTHORIZED ENTRY

In conclusion, this security feature's ability to prevent, identify, and record unauthorised access to the safe room makes it crucial. A live CCTV feed and a siren alarm work together to effectively discourage would-be burglars. In addition, it gives homeowners peace of mind by guaranteeing that any security breach will be quickly detected and documented, enabling prompt action and an increased degree of security and protection for priceless possessions and private documents kept in the safe room.

4. ELDERLY - FRIENDLY ROOM AUTOMATION :

An intelligent and useful addition to any house, the Elderly-Friendly Room Automation offers customised features made to meet the specific requirements of senior citizens. The purpose of this automation system is to improve the accessibility, safety, and comfort of an elderly person's living environment. It includes motion sensors, lighting controls, and fan activation mechanisms. The door to the room automatically opens when the motion sensor picks up movement. The system maximises the person's comfort and convenience by turning on the ceiling fan and room light as soon as they arrive.

The significance of this automation system is twofold. Firstly, it prioritizes the well-being and quality of life for elderly occupants by minimizing physical strain and ensuring a seamless living experience. The automatic door opening, lighting, and fan activation reduce the need for manual actions, which can be challenging for seniors with limited mobility. This not only enhances daily comfort but also promotes independence, allowing elderly residents to move around freely in their own space. Secondly, the automation system contributes to safety by providing well-lit and well-ventilated living conditions, reducing the risk of accidents. While fan activation ensures a comfortable and climate-controlled environment, especially in areas with hot or humid climates, adequate lighting enhances visibility and helps prevent falls. This feature is crucial because it helps senior citizens live safer, more convenient, and more enjoyable lives. It also supports the seniors' physical well-being and provides peace of mind for both the seniors and their careers.

The integration of an air conditioning (AC) system and a temperature monitor within the Elderly-Friendly Room Automation is a strategic move to ensure the optimal comfort of elderly residents. This feature operates in a straightforward manner: when the temperature in the room exceeds 32 degrees Celsius, the AC system is automatically activated, cooling the space to a more comfortable level. Conversely, when the temperature falls below this threshold, the AC system is turned off, promoting energy efficiency. This automated temperature control is important for two reasons. Its main objective is to protect the health of senior citizens especially in areas with high temperatures. Elderly people are more vulnerable to heat-related illnesses, dehydration, and discomfort when there is excessive heat. This automation system makes sure that the living area is comfortable for them, keeping the temperature below 32 degrees Celsius, which improves the quality of life for senior citizens.

Edit Remove	Yes	MOTION DETECTED ELDERLY ROOM	MOTION DETECTOR - OLD AGE On is true	Set DOOR - OLD AGE Lock to Unlock Set WINDOW OLD AGE On to true Set FAN - OLD AGE Status to Low Set OLD AGE - CCTV On to true Set LIGHT OLD AG Status to On
Edit Remove	Yes	MOTION NOT DETECTED OLD AGE	MOTION DETECTOR - OLD AGE On is false	Set DOOR - OLD AGE Lock to Lock Set WINDOW OLD AGE On to false Set FAN - OLD AGE Status to Off Set OLD AGE - CCTV On to false Set LIGHT OLD AG Status to Off
Edit Remove	Yes	AC ON OLD AGE	Match all: • OLD AGE TEMPERATURE MONITOR Temperature >= 32.0 ºC • MOTION DETECTOR - OLD AGE On is true	Set OLD AGE AC On to true Set WINDOW OLD AGE On to false Set FAN - OLD AGE Status to Off
Edit Remove	Yes	AC OFF OLD AGE	Match all: • OLD AGE TEMPERATURE MONITOR Temperature < 32.0 ºC • MOTION DETECTOR - OLD AGE On is false	Set OLD AGE AC On to false Set WINDOW OLD AGE On to true Set FAN - OLD AGE Status to Low

Fig. 21. CONDITIONS FOR ELDERLY-FRIENDLY ROOM

The system's energy-efficient operation is environmentally responsible and cost-effective. It not only provides comfort but does so efficiently, helping to reduce energy consumption and associated costs. This is particularly significant in the context of rising energy expenses and environmental concerns. By regulating the AC system based on the room's temperature, the automation feature promotes a sustainable and economical approach to indoor climate control, ultimately benefiting both residents and the environment. The integration of motion detection technology with the automated door and CCTV recording system in the Elderly-Friendly Room Automation is a highly impactful safety and security feature. When the motion sensor detects movement within the room and triggers the door to open automatically, it concurrently activates the room's CCTV camera, initiating a live video recording of the space. This recorded feed is instantly made accessible to the homeowner through a control device, allowing for real-time monitoring and assessment of the situation.

The significance of this feature cannot be understated. It enhances the security and safety of elderly residents in multiple ways. Firstly, it ensures that any movement within the room is immediately documented, providing a level of surveillance and peace of mind, particularly if the elderly individual is alone or in need of assistance. This not only deters potential intruders but also allows for the timely response to emergencies or accidents.
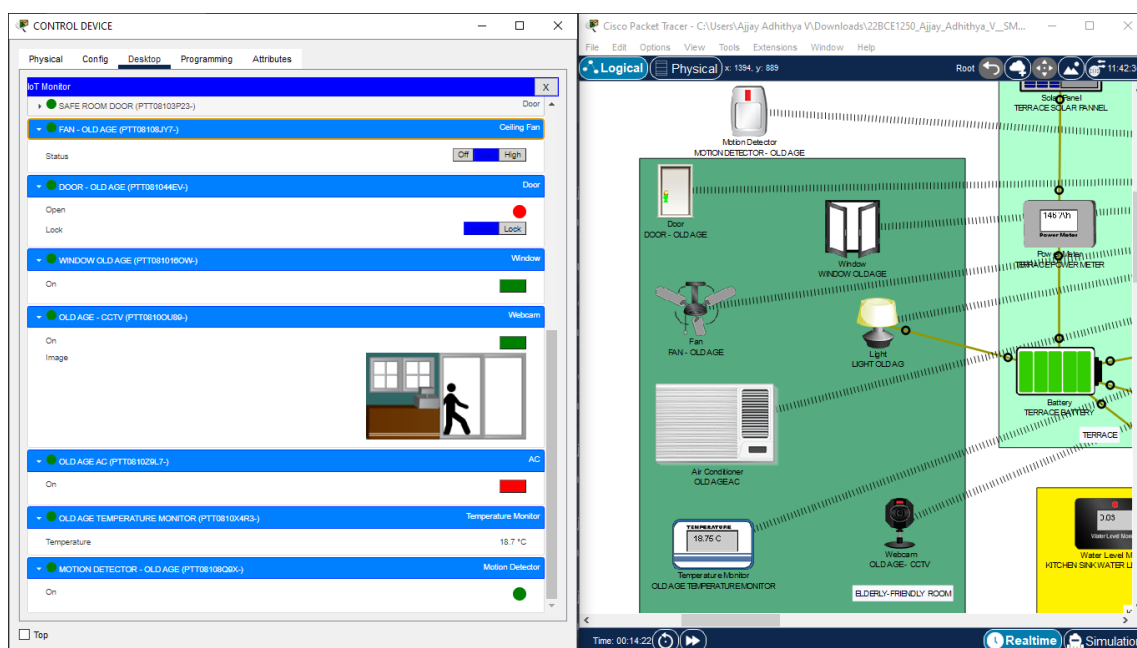

Fig. 22. ELDERLY FRIENDLY ROOM AUTOMATION

Furthermore, the live feed on the control device allows homeowners to remotely monitor the well-being of the elderly occupant, which is especially important when caregiving or medical assistance is required. This real-time access provides a means for family members or caregivers to maintain a continuous connection with the elderly resident and respond swiftly to any needs or concerns. Overall, this integration of motion detection, door automation, and CCTV recording ensures the safety and security of elderly individuals while promoting their independence and overall well-being.

A Panic BUTTON is installed within the Elderly-Friendly Room Automation is a vital safety feature designed to provide immediate assistance to elderly residents in case of emergencies. The button is strategically placed near the bed of the elderly person, ensuring easy access. When the individual encounters an emergency situation like sudden health issue, they can press the panic button which is installed near to the patient's bed. This action sends an input signal to a Microcontroller Unit (MCU) integrated into the system, where a JavaScript code has been programmed to recognize the signal. In response, the MCU activates a loud alarm connected to the system, which immediately starts to sound, alerting others in the vicinity. Here, in the MCU, the port 0 of the MCU is the input port from the button and the port 1 of the MCU is the output to the Alarm and the following code will explain the working of signals sent and received.

CODE FOR ALARM (PROGRAMMED IN MCU) :

```javascript
function setup() {
      pinMode(0, INPUT);
      pinMode(1, OUTPUT);
}
function loop() {
      var h = digitalRead(0);
      Serial.println(h);
      if(h == 1023){
            digitalWrite(1,HIGH);
      }
      else{
            digitalWrite(1,LOW);
      }
}
```
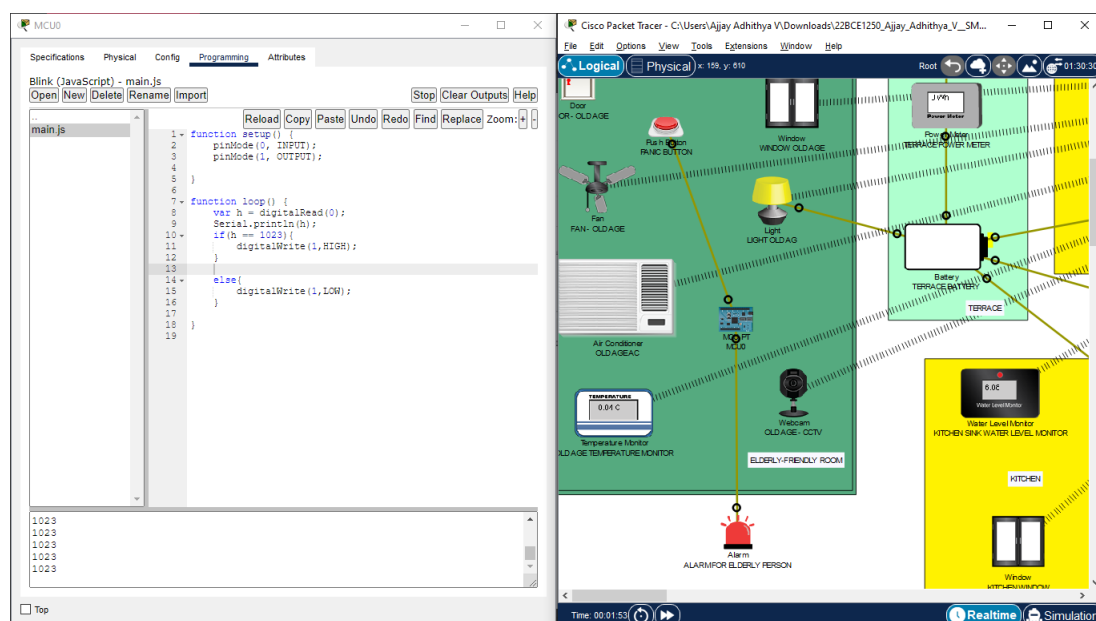

Fig. 23. ELDERLY FRIENDLY ROOM – AFTER INSTALLING PANIC BUTTON WITH CODE SNIPPET

The significance of this feature is profound in ensuring the safety and well-being of elderly occupants. It provides a direct and accessible means of calling for help when it's most needed. Elderly individuals can often face health challenges, and in certain situations, time is of the essence. The panic button offers a quick response mechanism that can summon aid, whether from family members, caregivers, or emergency services. This level of immediate assistance can be life-saving and ensures that elderly residents can live independently with the reassurance that help is just a button press away. Furthermore, this feature offers peace of mind to both the elderly residents and their caregivers or family members. Knowing that there is an effective emergency response system in place reduces anxiety and allows for a greater degree of independence for the elderly person. It also enables caregivers to provide timely assistance, which is especially important for those who may be living alone. Overall, the panic button is a crucial component of the Elderly-Friendly Room Automation, prioritizing safety and the well-being of elderly residents while providing support and security during emergency situations.

V.   CONCLUSION :

This new upgraded smart home project is a sophisticated and all-inclusive solution made to meet a variety of requirements and useful applications. It enhances residents' sense of security and safety while safeguarding priceless possessions and encouraging the use of sustainable energy sources. It stands for an all-encompassing way of living in the modern world, where environmental responsibility, security, and safety coexist peacefully. In this comprehensive smart house project developed in Cisco Packet Tracer, a host of features have been integrated to ensure the safety, security, and sustainability of the residents' living environment. The deployment of Motion-Detector sensors and CCTV surveillance forms a formidable defence against potential intruders, providing better surveillance. Moreover, the incorporation of fire, smoke, carbon dioxide, and carbon monoxide detectors further fortifies the safety net by swiftly alerting residents to potential threats. This amalgamation of security measures is vital in modern living, ensuring peace of mind and a safeguarded living space.

Several features concentrates on improving security. The RFID-based door-locking system adds an extra layer of security, focusing on the protection of valuable belongings and sensitive documents in the home's safe room. This integrated system allows the smart utilization of renewable solar energy to reduce high electricity costs and provides a backup power solution during frequent power cuts by integrating solar panels and a battery, the project fosters sustainability and cost-efficiency while reducing the household's reliance on conventional power sources. This eco-conscious approach not only helps the environment but also curtails electricity expenses. Lastly, the creation of a dedicated room for elderly residents, complete with user-friendly automation, ensures their comfort and convenience, enhancing their quality of life. So, this smart house project demonstrates the potential of modern technology to create homes that are not just intelligent but also safer, more sustainable, and accommodating for diverse needs.