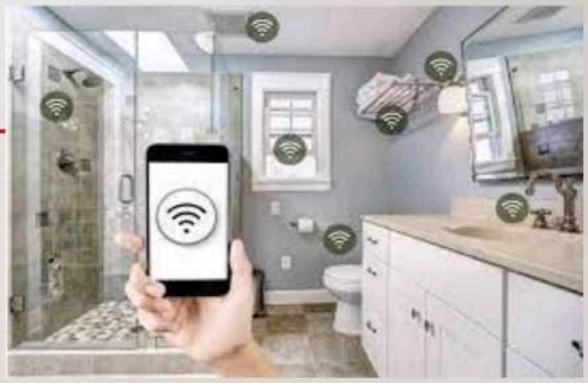
SMART PUBLIC RESTROOM

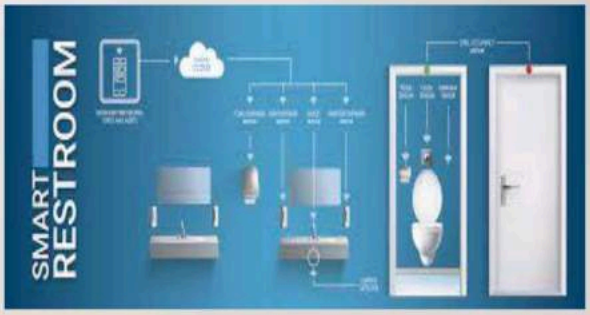


PROJECT DEFINITION:

- The project aims to enhance public restroom management by installing IoT sensors to monitor occupancy and maintenance needs. The goal is to provide real-time data on restroom availability and cleanliness to the public through a platform or mobile app. This project includes defining objectives, designing the IoT senor system, developing the restroom information platform, and integrating them using IoT technology and python.

PROJECT OBJECTIVE:

- Real-Time restroom availability information.
- Cleanliness monitoring.
- Improved user experience.
- Efficient restroom.



REAL-TIME RESTROOM AVAILABILITY INFORMATION.

- Real-time restroom availability information in smart public restrooms can significantly improve user satisfaction, reduce wait times, and enhance restroom management efficiency. It can also be a valuable feature in smart cities and public spaces where providing a high level of convenience to residents and visitors is a priority.

CLEANLINESS MONITORING.

- Cleanliness monitoring in smart public restrooms not only helps maintain a clean and hygienic environment but also contributes to cost efficiency by optimizing cleaning schedules and resource allocation. It enhances the overall user experience and public health, making it an essential feature in modern public facilities

IMPROVED USER EXPERIENCE.

Real-time availability information, cleanliness monitoring, touchless features , hand hygiene stations, accessibility features, baby changing station, multilingual signage , amenities and comfort, privacy considerations, emergency feature , maintenance alerts, queue management feedback mechanism , energy efficiency, security , smart notifications, hygiene supplies, green feature , regular maintenance, user education By focusing on these aspects, public restrooms can become more user-friendly and contribute to a positive overall experience, which is especially important in busy public spaces, transportation hubs, shopping centers, and smart city initiatives.

EFFICIENT RESTROOM

- Efficiency in smart public restrooms not only benefits users but also helps organizations save resources and reduce environmental impact. By integrating smart technologies, data analytics, and sustainable practices, smart public restrooms can provide a more streamlined and eco-friendly experience for the public.

IOT SENSOR DESIGN.

- Select the appropriate sensors for the parameters you want to monitor. Common sensor types for smart restrooms include:Occupancy sensors (infrared, ultrasonic, or weight sensors) to detect user presence.
- Environmental sensors (temperature, humidity, air quality) for monitoring comfort and cleanliness.
- Fluid level sensors for soap, water, and sanitizer dispensers.
- Image sensors or cameras for cleanliness assessment and occupancy tracking.
- Acoustic sensors for measuring noise levels and detecting issues.
- RFID or NFC sensors for tracking restroom supplies and equipment.

REAL-TIME TRANSIT INFORMATION PLATFORM

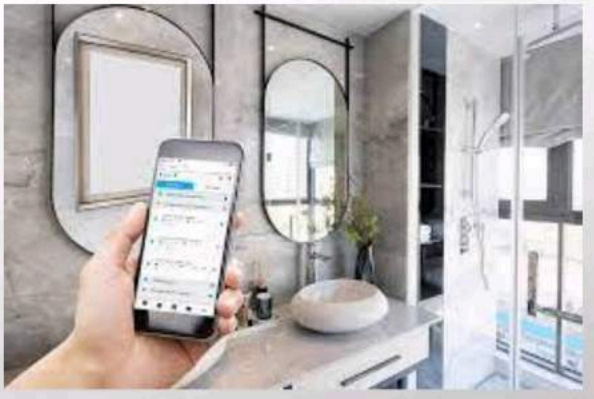
- Creating a real-time transit information platform in a smart public restroom can be a valuable service for users, especially in busy transportation hubs. This platform can provide up-to-date information about public transportation options, schedules, delays, and nearby services.

INTEGRATION APPROACH.

- Integration is a key component of a smart public restroom, as it allows various systems and technologies to work together seamlessly to provide a comprehensive and efficient user experience.

INTRODUCTION

- THE USE OF PREDICTIVE ALGORITHMS IN SMART PUBLIC RESTROOMS CAN OPTIMIZE MAINTENANCE EFFICIENCY AND ENHANCE USER SATISFACTION. THIS PRESENTATION WILL EXPLORE THE BENEFITS OF IMPLEMENTING PREDICTIVE ALGORITHMS IN SMART PUBLIC RESTROOMS AND EXPLAIN HOW THEY WORK.



WHAT ARE PREDICTIVE ALGORITHMS?

- PREDICTIVE ALGORITHMS ARE COMPUTER PROGRAMS THAT USE STATISTICAL MODELS AND MACHINE LEARNING TECHNIQUES TO ANALYZE DATA AND MAKE PREDICTIONS ABOUT FUTURE EVENTS. IN THE CASE OF SMART PUBLIC RESTROOMS, PREDICTIVE ALGORITHMS CAN BE USED TO ANTICIPATE MAINTENANCE NEEDS AND IMPROVE USER EXPERIENCE.

CHALLENGES IN PUBLIC RESTROOM MAINTENANCE

- PUBLIC RESTROOMS ARE HIGH-TRAFFIC AREAS THAT REQUIRE FREQUENT MAINTENANCE TO ENSURE CLEANLINESS AND FUNCTIONALITY. HOWEVER, TRADITIONAL MAINTENANCE METHODS ARE OFTEN REACTIVE AND INEFFICIENT, LEADING TO COMPLAINTS FROM USERS AND INCREASED COSTS FOR FACILITY MANAGERS.

BENEFITS OF PREDICTIVE MAINTENANCE

- BY USING PREDICTIVE ALGORITHMS, FACILITY MANAGERS CAN ANTICIPATE MAINTENANCE NEEDS BEFORE THEY BECOME URGENT, REDUCING DOWNTIME AND IMPROVING USER SATISFACTION. PREDICTIVE MAINTENANCE CAN ALSO HELP MANAGERS PRIORITIZE TASKS AND ALLOCATE RESOURCES MORE EFFICIENTLY, SAVING TIME AND MONEY.

DATA COLLECTION AND ANALYSIS

- TO IMPLEMENT PREDICTIVE ALGORITHMS, DATA MUST BE COLLECTED FROM VARIOUS SOURCES, SUCH AS SENSORS, CAMERAS, AND USER FEEDBACK. THIS DATA IS THEN ANALYZED USING MACHINE LEARNING ALGORITHMS TO IDENTIFY PATTERNS AND PREDICT FUTURE EVENTS. THE ACCURACY OF THE PREDICTIONS IMPROVES OVER TIME AS MORE DATA IS COLLECTED AND ANALYZED

PRIVACY AND SECURITY CONCERNS

- IMPLEMENTING PREDICTIVE ALGORITHMS IN PUBLIC RESTROOMS RAISES PRIVACY AND SECURITY CONCERNS. IT IS IMPORTANT TO ENSURE THAT DATA IS COLLECTED AND STORED SECURELY AND THAT USER PRIVACY IS PROTECTED. FACILITIES MUST ALSO BE TRANSPARENT ABOUT THEIR DATA COLLECTION PRACTICES AND OBTAIN CONSENT FROM USERS WHERE NECESSARY

COSTS AND IMPLEMENTATION

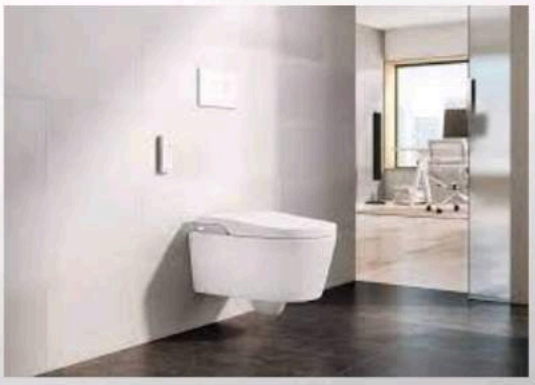
- IMPLEMENTING PREDICTIVE ALGORITHMS IN SMART PUBLIC RESTROOMS REQUIRES AN INITIAL INVESTMENT IN SENSORS, CAMERAS, AND OTHER EQUIPMENT, AS WELL AS THE DEVELOPMENT OF SOFTWARE AND ALGORITHMS. HOWEVER, THE LONG-TERM BENEFITS IN TERMS OF MAINTENANCE EFFICIENCY AND USER SATISFACTION CAN OUTWEIGH THE COSTS. FACILITIES SHOULD ALSO CONSIDER PARTNERING WITH TECHNOLOGY COMPANIES OR SEEKING GOVERNMENT GRANTS TO OFFSET THE COSTS OF IMPLEMENTATION.

ENERGY EFFICIENCY

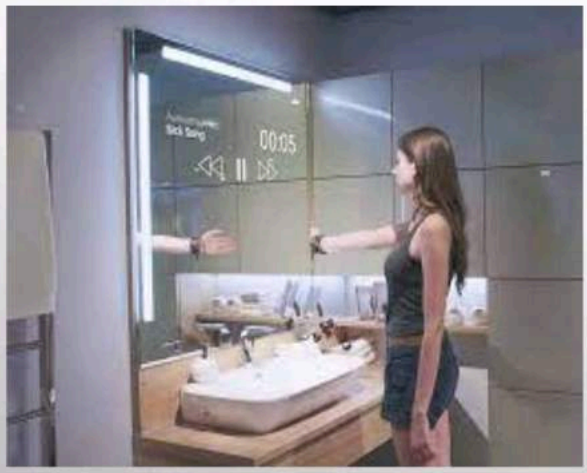
- SMART BATHROOMS CAN ALSO HELP REDUCE ENERGY CONSUMPTION BY USING LED LIGHTING AND MOTION SENSORS. LED LIGHTING IS MORE ENERGY-EFFICIENT THAN TRADITIONAL LIGHTING AND CAN BE CONTROLLED REMOTELY. MOTION SENSORS CAN DETECT WHEN A ROOM IS UNOCCUPIED AND TURN OFF LIGHTS AND APPLIANCES TO SAVE ENERGY.

SMART TOILETS

- SMART TOILETS USE SENSORS TO DETECT WHEN THE USER IS FINISHED AND AUTOMATICALLY FLUSH. THEY CAN ALSO DETECT ANY ISSUES WITH THE PLUMBING AND ALERT THE HOMEOWNER TO PREVENT POTENTIAL DAMAGE. ADDITIONALLY, SMART TOILETS CAN ANALYZE WASTE TO DETECT ANY HEALTH ISSUES AND PROVIDE FEEDBACK TO THE USER



SMART MIRRORS



- SMART MIRRORS CAN PROVIDE PERSONALIZED LIGHTING AND VOICE-ACTIVATED CONTROLS. THEY CAN ALSO ANALYZE THE USER'S SKIN AND PROVIDE PERSONALIZED SKINCARE RECOMMENDATIONS. ADDITIONALLY, SMART MIRRORS CAN DISPLAY THE USER'S CALENDAR AND WEATHER FORECAST TO HELP THEM PLAN THEIR DAY.

WATER CONSERVATION

- SMART BATHROOMS CAN HELP CONSERVE WATER BY USING LOW-FLOW FIXTURES AND LEAK DETECTION SENSORS. THESE SENSORS CAN DETECT LEAKS AND AUTOMATICALLY SHUT OFF THE WATER SUPPLY TO PREVENT WASTE. ADDITIONALLY, SMART SHOWERS CAN MONITOR WATER USAGE AND ADJUST FLOW RATES TO ENSURE OPTIMAL WATER CONSERVATION.

PRIVACY AND SECURITY

- SMART BATHROOMS COLLECT A LOT OF DATA, WHICH RAISES CONCERNS ABOUT PRIVACY AND SECURITY. IT'S IMPORTANT TO ENSURE THAT ALL DATA IS ENCRYPTED AND STORED SECURELY. ADDITIONALLY, USERS SHOULD BE NOTIFIED OF ANY DATA COLLECTION AND HAVE THE OPTION TO OPT-OUT

USER FEEDBACK AND SATISFACTION

- IN ADDITION TO PREDICTING MAINTENANCE NEEDS, SMART PUBLIC RESTROOMS CAN ALSO COLLECT USER FEEDBACK TO IMPROVE SATISFACTION. FOR EXAMPLE, SENSORS CAN DETECT WHEN SOAP OR TOILET PAPER IS RUNNING LOW AND ALERT STAFF TO REFILL SUPPLIES. USER FEEDBACK CAN ALSO BE USED TO IDENTIFY AREAS FOR IMPROVEMENT, SUCH AS ADDING MORE HAND DRYERS OR IMPROVING VENTILATION.

REAL TIME EXAMPLE

- SEVERAL FACILITIES HAVE ALREADY IMPLEMENTED PREDICTIVE ALGORITHMS IN THEIR PUBLIC RESTROOMS WITH GREAT SUCCESS. FOR EXAMPLE, THE SAN FRANCISCO INTERNATIONAL AIRPORT INSTALLED SENSORS TO MONITOR RESTROOM TRAFFIC AND PREDICT MAINTENANCE NEEDS, RESULTING IN A 30% REDUCTION IN COMPLAINTS AND A 20% REDUCTION IN LABOR COSTS. OTHER FACILITIES, SUCH AS UNIVERSITIES AND SHOPPING MALLS, HAVE ALSO REPORTED IMPROVED MAINTENANCE EFFICIENCY AND USER SATISFACTION.

THE FUTURE IS HERE

- SMART BATHROOMS ARE THE FUTURE OF HOME TECHNOLOGY. WITH PREDICTIVE MAINTENANCE, WATER CONSERVATION, ENERGY EFFICIENCY, AND PERSONALIZED FEATURES, THEY OFFER A UNIQUE AND EFFICIENT BATHROOM EXPERIENCE. HOMEOWNERS CAN SAVE MONEY AND REDUCE THEIR ENVIRONMENTAL IMPACT WITH THIS INNOVATIVE TECHNOLOGY.

CONCLUSION

- PREDICTIVE ALGORITHMS HAVE THE POTENTIAL TO REVOLUTIONIZE PUBLIC RESTROOM MAINTENANCE AND IMPROVE USER SATISFACTION. BY ANTICIPATING MAINTENANCE NEEDS AND COLLECTING USER FEEDBACK, SMART PUBLIC RESTROOMS CAN PROVIDE A BETTER EXPERIENCE FOR USERS WHILE REDUCING COSTS FOR FACILITY MANAGERS. WHILE THERE ARE PRIVACY AND SECURITY CONCERNS TO CONSIDER, THE BENEFITS OF IMPLEMENTING PREDICTIVE ALGORITHMS MAKE IT A WORTHWHILE INVESTMENT FOR FACILITIES

INTRODUCTION

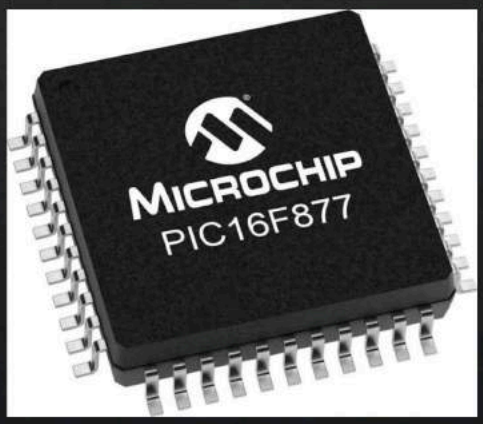
- Developing a smart public restroom using IOT involves integrating various technologies to enhance user experiences, improve maintenance, and promote sustainability.

- Developing a smart public restroom using IOT involves careful planning, integration, and ongoing maintenance to provide a convenient and hygienic experiences and users while optimizing resources and improving overall efficiency.

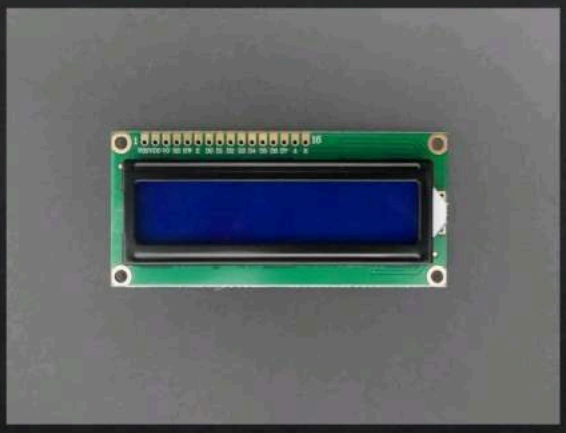
- Introduce to use and maintain the toilets in the clean and hygienic way. The project is based on IOT concepts using different sensors like smell sensor, dirt sensor, sonic sensor, RFID reader, Database. Using these materials we are trying to provide the clean toilets

HARDWARE REQUIREMENTS TO BUILT IOT SENORS

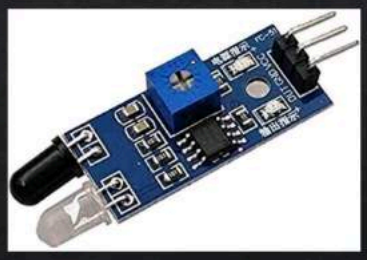
- **MICROCONTROLLER** : A microcontroller is a small computer on a single combined circuit holding a processor core, memory and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications. PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is commonly used for experimental and modern applications because of its low price, wide range of requests, high quality, and ease of obtainability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on. The PIC 16F877 features all the mechanisms which present microcontrollers usually have.



- **LCD** : LCD stands for Liquid Crystal Display. By using the LCD, all the outputs are displayed. LCD doesn't know about the content (data or commands) supplied to its data bus. It is the user who has to specify whether the content at its data pins are data or commands. Display For this, if a command is inputted then a certain arrangement of 0s and 1s has to be applied to the Control lines so as to specify it is a command on the other hand if a data is inputted at the data lines then an another combination of 0s and 1s has to be applied to the control lines to require it is Data.



- **BUZZER**: Buzzer is also called as Beeper. It is a sound signaling mechanical device.
- **INFRARED SENSOR :** The IR sensor is used to detect the dirt present in the toilet. Here we nourish the image models into the sensor. It can perceive the dirt by comparing the images we feed into it, after using the toilet. If it can detect the dirt, it raises the alarm, and the users may get embraced and they clean it. This system can create the responsiveness among the people.

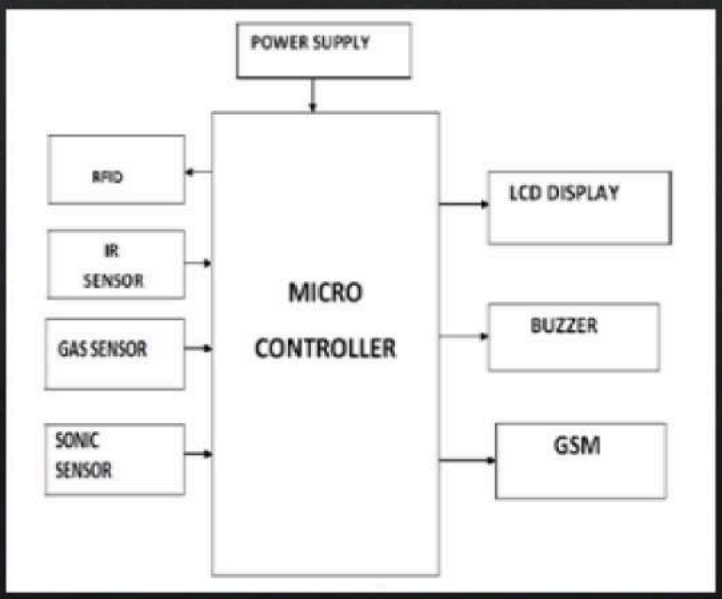


- **SMELL SENSOR :** The Smell Sensor is used to detect the unwanted smell and gases in the toilet. For this purpose, we are going to use the sensor called Figaro sensor. It cans intellect the dry gases present in the toilets such as NH3, CO2, CH4, H2S, etc. By taking those gases leads to Nausea, Drowsiness, instant loss of awareness, etc. After sensing the unwanted gases, it can blink the red light. Then the sweeper can clean it by using particular Cleaning Agents.

- **RFID READER:** The RFID stands for Radio Frequency Identification. It can be used for monitoring the Sweeper. The Organization wishes to provide the identity tag for the Sweeper. The Sweeper desires to show the tag before the cleaning process is going to start and after it is finished. Then the CR4 sensor can spot the presence of dirt. If it is present, it can blink the red light. If it is clean, it can blink the blue light. It assistances to understand the responsibilities of sweeper by his/her own. If Sweeper is not clean the toilets for period of time, his/her absence in cleaning the toilet also reported to the dependable organization. These all the details are stored in the database.

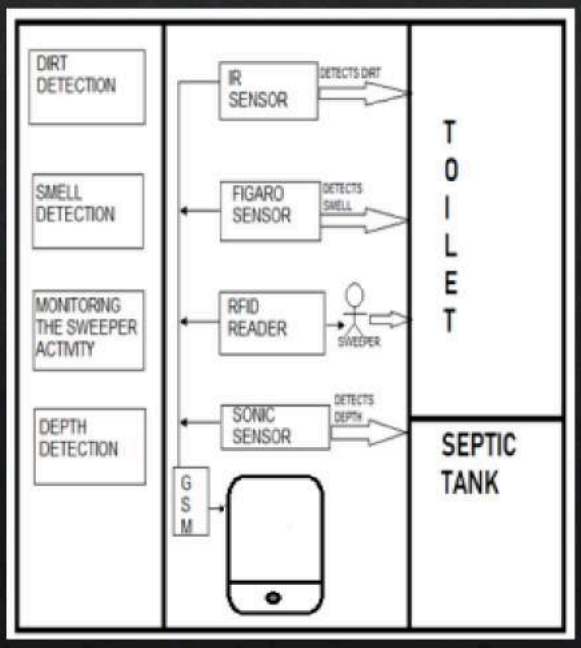
- **SONIC SENSOR:** The Sonic Sensor is used for computing the depth. Here it is used to measure the depth of the septic tank. The Sonic Sensor is fixed into the Septic tank. Then the Septic tank get filled means, it can sends the communications to particular organization. Then they will allot persons to clean the septic tank. This ultrasonic sensor can be used for measuring distance, object sensor, motion sensors etc. High sensitive module can be used with microcontroller to integrate with motion circuits to measure the distance, position & motion sensitive products. In a nutshell, water depth sensing is using a sensor to measure the depth of water in a tank or container. Although various sensors can be used for this application, we will talk about ultrasonic sensor application. With ultrasonic sensors, we can find the water depth calculation by finding the distance between the transceiver and the surface of the water. The sensor will transmit a short ultrasonic pulse, and we can measure the travel time of that pulse to the liquid and back. We can then subtract that distance from the total depth of the tank to determine the water depth.

Block diagram of the proposed system



- **GSM:** GSM stands for Global System for Mobile communication. It establishes the mobile communication from It transfers the information from main circuit to operator. It uses Time Division Multiple Access (TDMA). GSM is mainly used for communicating and transferring message from one person to concerned organization. GSM module is used to establish communication between a computer and a GSM and GPRS system. om one place to another place. Here we are using GSM LT-2 communication module makes it possible to use GSM paths to provide monitoring and messaging functions in alarm systems. It facilitates cooperation with SATEL and third party control panel diallers or correctly configured outputs. Here GSM LT-2 module makes it possible to implement monitoring as well as text and voice messaging functions. The caller ID retransmission function creates it likely to present the incoming callers number on telecommunication station sarmed with this functionality. GSM alarm system built-in GSM communication module inside, work as a mobile handset. After purchased the GSM alarm system, people need to acquisition the SIM card, and select the mobile service package. GSM alarm system can program several phone numbers for alarm receiving. When any abnormal event happens, the system will response, then inform the owner via voice call and short message (SMS). GSM will check the messaging activities for sweepers and also need to check with their cleanliness duty for their work. The sweepers need to check with particular activity of its work by their sensors.

ARCHITECTURE OF THE PROPOSED SYSTEM



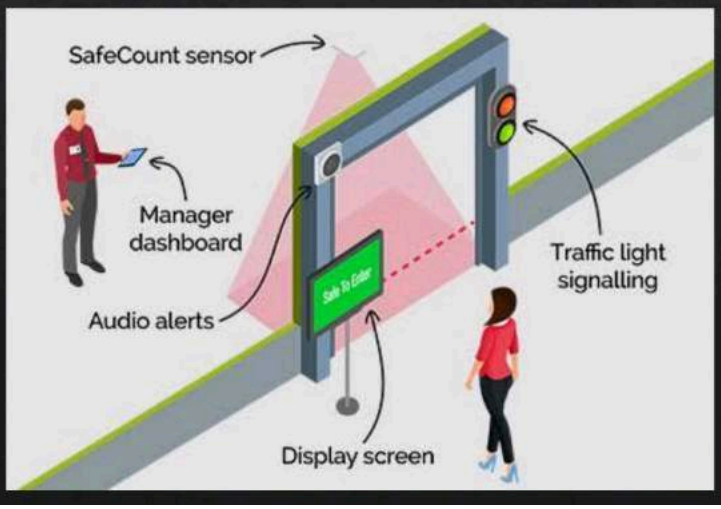
DEPLOY IOT SENORS IN PUBLIC RESTROOM TO COLLECT DATA

- **WHAT IS AN OCCUPANCY MONITORING SYSTEM?**

The occupancy monitoring system is a system that uses occupancy monitoring sensors deployed at different parts of an area being monitored to detect people count, people movement, duration, and other statistical information. The sensors send real-time data to a central management dashboard. The dashboard is cloud-based and can be accessed at any time, from any connected device. It can also be configured to send instant alerts to the building manager if a specific activity takes place or if a planned activity does not take place.

- **The need for washroom occupancy monitoring:**

A well-functioning washroom occupancy monitoring system is needed to ensure the maintenance of proper hygiene in the washroom through regular cleaning.



BENEFITS OF IOT-ENABLED WASHROOM OCCUPANCY MONITORING

WASHROOM CLEANING ON DEMAND

It is possible to use anonymous footfall data to establish a consistent level of hygiene and cleanliness. When washroom cleaning is demand-based, it becomes easier to optimize the use of existing resources to ensure that the janitorial team cleans when needed. As an example, an alert system can be created to inform washroom cleaning staff to initiate washroom cleaning after ten people have used the facility.

WORKING OF IOT ENABLED WASHROOM OCCUPANCY MONITORING SYSTEM

- An loT-based washroom occupancy monitoring system uses a variety of sensors, scanners, and other sophisticated devices to implement occupancy monitoring. Here's a list of the key components of an loT-based washroom occupancy system

DOOR SENSORS

- In washroom occupancy monitoring applications, a door sensor counts the number of times the door is opened/ closed. In conjunction with the data from the rest of our sensors in the restroom, the algorithm calculates overall traffic
- flow.

- The sensor is a magnetic contact switch, with one half mounted on the door, and the other half mounted on the door frame. The sensor connects to a device that communicates with a gateway.

ROOM OCCUPANCY SENSORS

◈Different Washroom occupancy sensors use different methods to count the number of people walking in/out of a washroom. One of these methods is Time of Flight (TOF) technology. This technology detects the number of people walking in/ out through the door very accurately. The IR sensing direction device will count the people walking in and walking out.

◈ The sensor is typically installed in the
◈ceiling and it can detect objects up to a 3meter distance. The sensor continuously monitors the traffic and communicates with a gateway using LoRaWAN or other LPWAN technology.

Programming the sensor

write a python script that interfaces with the sensor and collect data. We will need to include libraries or modulus specific to our sensor type.

Implement code to read data from the occupancy and cleanliness sensors.

Ensure that the script collects and process data at regular intervals.

Python program

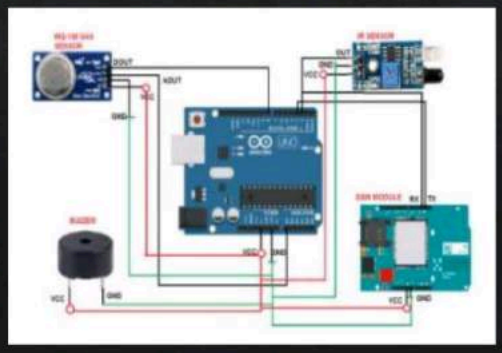
- **Algorithm**
  - Import the libraries or modulus for the occupancy and cleanliness sensors.
  - Initialize and configure the sensors using the appropriate setup functions.
  - Create functions to read data from each sensor.
  - Implement a function to send data to your restroom information platform.
  - In the main() function, read data from both sensors at specified intervals and send it to the platform.
  - Add error handling to manage exceptions that may occur during sensor reading or data transmission.

Program

```
import time
import occupancy_sensor_module                    # Replace with your occupancy sensor library
import cleanliness_sensor_module                  # Replace with your cleanliness sensor library
# Initialize and configure the occupancy sensor
occupancy_sensor = occupancy_sensor_module.setup()        # Replace with sensor setup code
# Initialize and configure the cleanliness sensor
cleanliness_sensor = cleanliness_sensor_module.setup()        # Replace with sensor setup code
def read_occupancy():
    occupancy_data = occupancy_sensor_module.read_data()  # Replace with sensor-specific read function
    return occupancy_data
```

```
def read_cleanliness():
    cleanliness_data = cleanliness_sensor_module.read_data()    # Replace with sensor-specific read function
    return cleanliness_data
def send_data_to_platform(occupancy_data, cleanliness_data):
# Implement code to send data to your restroom information platform
# This may involve formatting data as required by the platform and using HTTP, MQTT, or other protocols
def main():
    while True:
    try:
        occupancy_data = read_occupancy()
        cleanliness_data = read_cleanliness().
```

```
            send_data_to_platform(occupancy_data, cleanliness_data)
# Wait for a specified interval before reading data again
            time.sleep(10)  # Adjust as needed
        except Exception as e:
            print("Error:", str(e))
            # Implement error handling, such as logging or retries
if __name__ == "__main__":
    main()
```

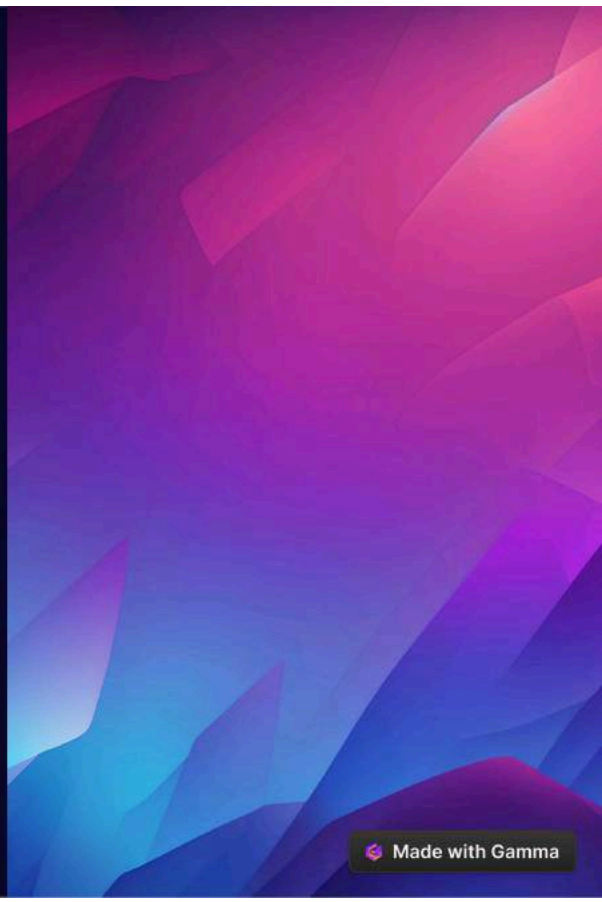


- Data formatting: Format the data in a way that is suitable for transmission. This might include converting data to JSON or another structured format.
- IoT connectivity: Depending on the server, configure it to connect to the internet using Wi-Fi, cellular, or other connectivity options. We need to include authentication and security measures for data transmission.
- Data transmission: Use libraries or modules to send the data to the restroom information platform. Common protocols for IoT communication include MQTT,HTTP, or CoAP. Ensure the platforms API or endpoint is correctly set up to receive the data.
- Error handling: Implement error handling and retry mechanisms to account for intermittent connectivity issues.
- Logging and debugging: Add logging and debugging capabilities to the python script to help troublehsoot issues remotely.

- Testing: Thoroughly test the script and sensor in a controlled environment to ensure that data is being sent reliably and accurately.
- Deployment: Install the python script on the IoT sensor device. This may involve transferring the script and configuring the sensor to run it on boot.
- Security: Ensure that the IoT sensor and the python script have appriate security measures in place to protect against unauthorized access and data breaches.
- Monitoring and maintenance: Regularly monitor the IoT sensor and the data it transmits to the platform to ensure its continued operation. Schedule maintenance tasks such as software updates, sensor calibration, and battery replacement if applicable.
  - Scaling: If you plan to deploy multiple IoT sensor, consider how they will be managed and scaled in the future.
  - Documentation: Document the deployment process, including configurations, sensor specifications, and any relevant information for future reference.

What is a Smart Public Restroom?

Explore the concept of smart public restrooms and how they leverage technology to enhance user comfort, improve cleanliness, and optimize maintenance operations.



Importance of Smart Public Restrooms

1 Hygiene & Safety 🧼

Efficient cleaning systems and touchless fixtures minimize the spread of germs and ensure a safe restroom environment.

2 User Satisfaction 😄

Smart restrooms provide pleasant experiences through automated features, such as occupancy sensors and intuitive interfaces.

3 Sustainability ♻️

Innovative technologies reduce water consumption, promote energy efficiency, and contribute to eco-friendly practices.

Feature Engineering

Identifying Relevant Features

Analyze user behavior and requirements to determine the features necessary for creating a seamless restroom experience.

Data Collection and Preprocessing

Gather data from sensors and user feedback, ensuring its quality and transforming it into a format suitable for analysis.

Model Training

1. **Choosing Appropriate Machine Learning Algorithms**

   Select algorithms tailored to analyze restroom data, such as occupancy patterns and asset maintenance needs.

2. **Training the Models with the Preprocessed Data**

   Utilize the preprocessed data to train machine learning models that can predict usage patterns and optimize maintenance schedules.

3. **Evaluation**

   Assess the performance of the trained models using relevant evaluation metrics to validate their effectiveness in optimizing restroom operations.

Future Developments and Challenges

Potential Improvements for Smart Public Restrooms

Explore possibilities for further enhancing restroom functionality, such as incorporating AI for personalized user experiences.

Addressing Challenges in Implementing Smart Public Restrooms

Discuss the obstacles faced when integrating technology into public facilities and propose strategies to overcome them.

SMART PUBLIC RESTROOM

FULL PROJECT IDEA SUBMISSION PHASE 5

Creating a smart public restroom involves integrating IoT devices and a platform to enhance the restroom's functionality, improve maintenance, and provide a better user experience. Here's a brief overview of the objectives, IoT device setup, platform development, and code implementation, along with diagrams, schematics, and screenshots for clarity.

Objective:

The objective of a smart public restroom is to:

Enhance User Experience: Provide a clean, safe, and comfortable environment for users.

Improve Maintenance: Enable real-time monitoring to ensure cleanliness, stock levels, and equipment functionality.

Water and Energy Efficiency: Optimize resource usage by reducing wastage.

Data-Driven Decision-Making: Collect and analyze data to make informed decisions for restroom management.

IoT Device Setup

Key IoT devices to implement in a smart public restroom include:

Smart Sensors: Install occupancy sensors, water flow sensors, and temperature sensors to monitor restroom conditions.

Smart Dispensers: Use IoT-enabled soap dispensers, paper towel dispensers, and air hand dryers.

Smart Locks: Employ IoT locks for restroom access control.

Security Cameras: Install surveillance cameras for security and monitoring.

Water Management System: Implement smart faucets and flush valves to control water usage.

Platform Development:

Develop a centralized platform to manage and monitor the IoT devices. Here's an outline:

Data Aggregation: Collect data from IoT devices, including occupancy status, consumable levels, and water usage.

Data Analytics: Utilize data analytics to identify usage patterns, predict maintenance needs, and optimize resource consumption.

User Interface: Create a user-friendly web or mobile interface for users to locate and access the smart restroom.

Alerts and Notifications: Implement real-time alerts and notifications for maintenance staff and managers.

Access Control: Manage restroom access, allowing authorized users to enter using an app or access card.

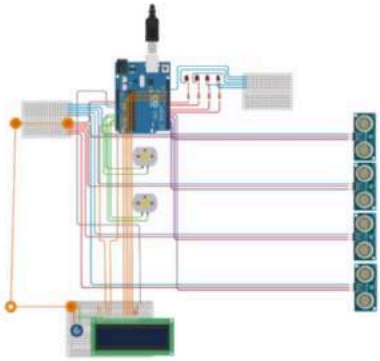
Remote Control: Enable remote control of devices, such as locking/unlocking doors and adjusting water flow.

Code Implementation:

Develop code to connect and control the IoT devices, gather data, and manage the platform. Use programming languages like Python, Java, or Node.js for server-side and JavaScript for the frontend. Use MQTT or HTTP for communication between devices and the platform.

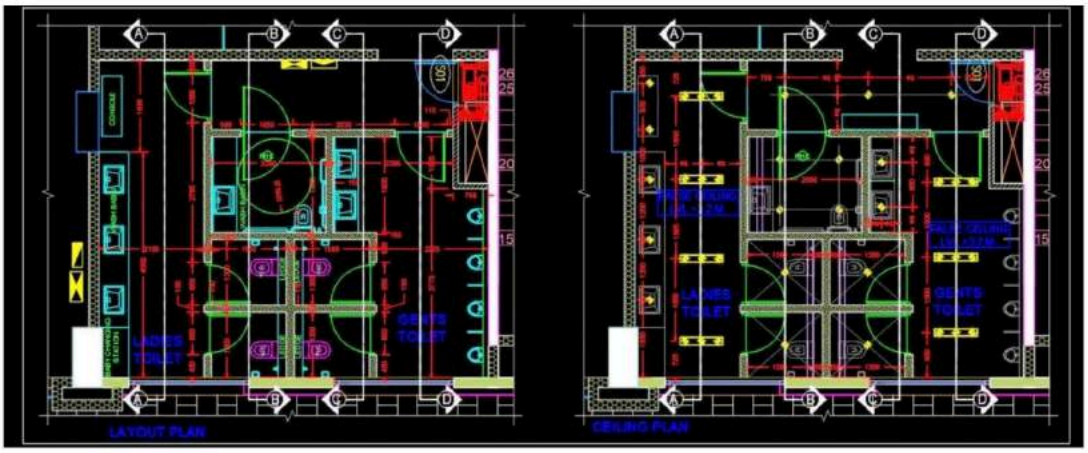
Diagram and Schematics:

Create a system architecture diagram showing how devices connect to the platform. Include schematics for the IoT devices' connectivity and power sources.

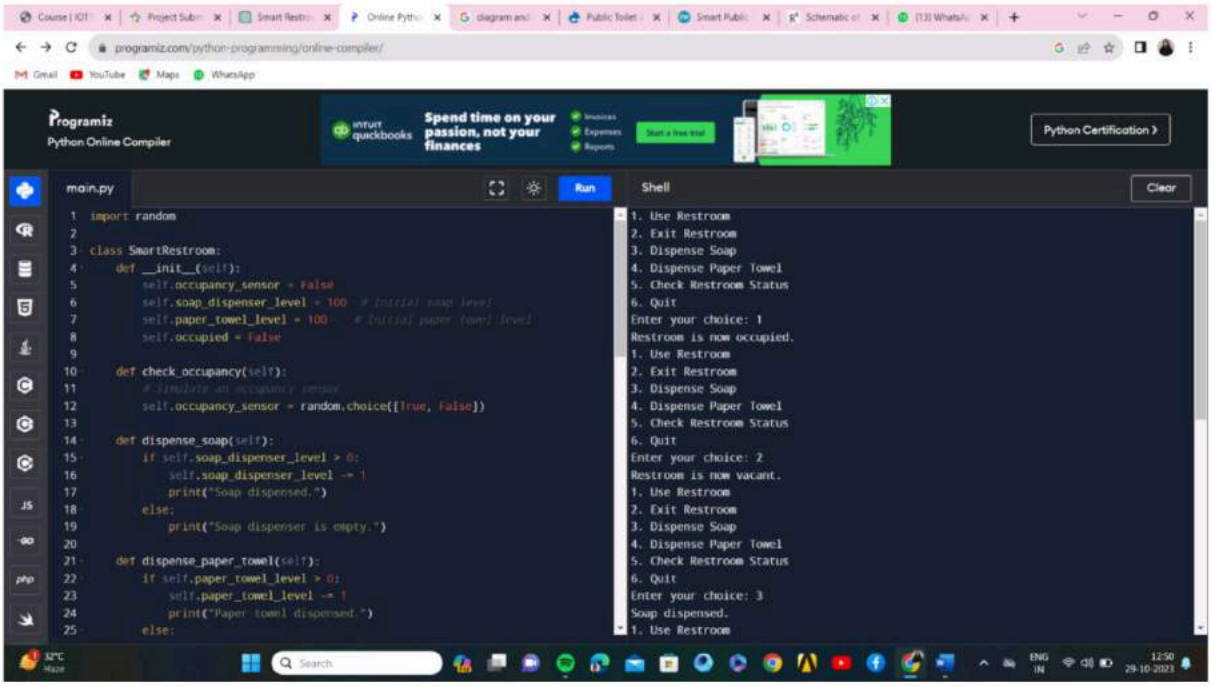


-DEVICE CONNECTION

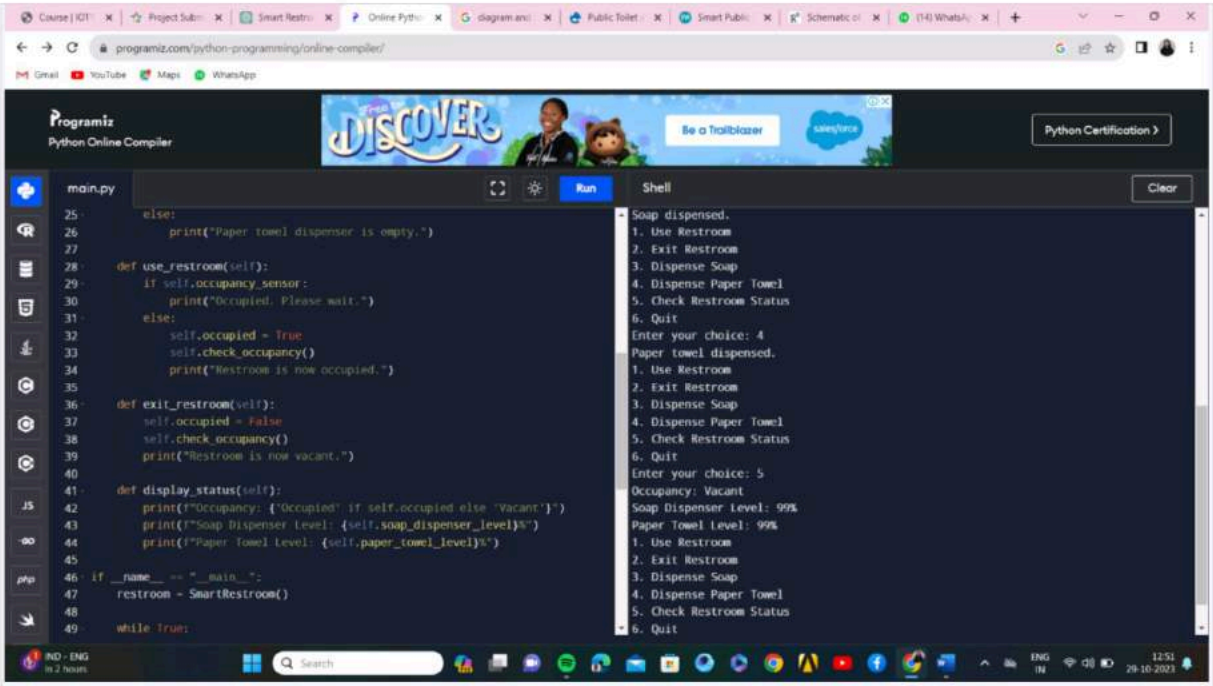
Public Toilet and Ceiling Plan Cad DWG Detail:

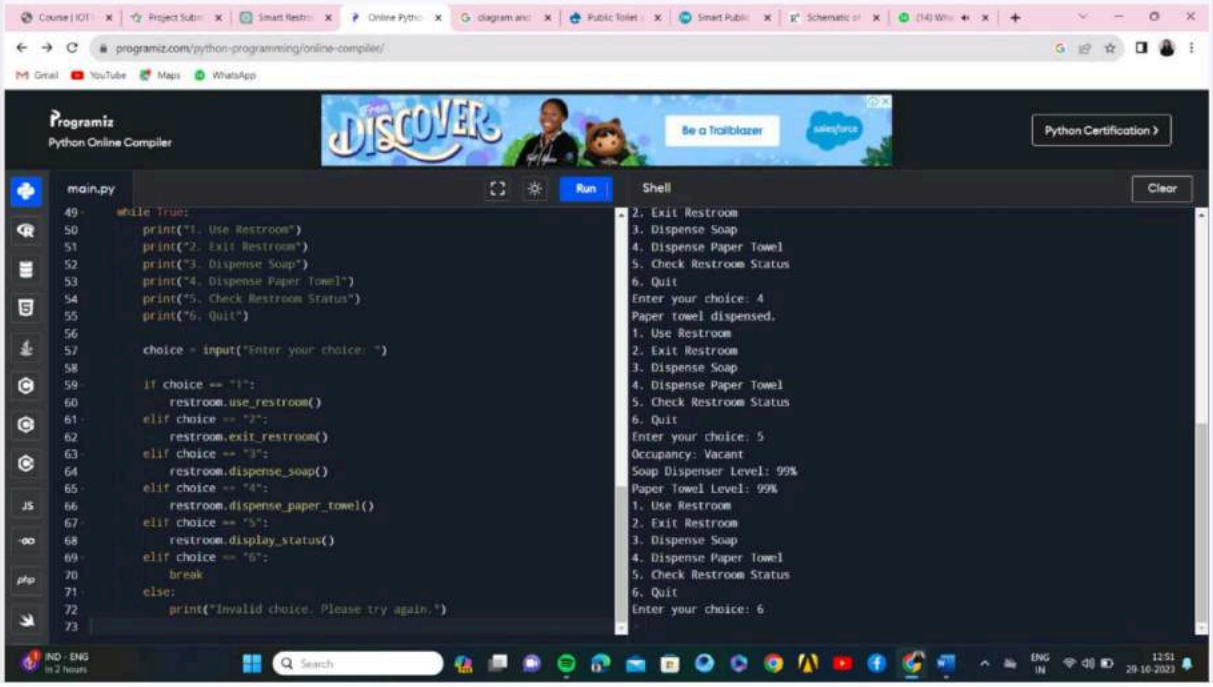


SCREENSHOT OF PYTHON CODE OUTPUT:



PYTHON CODE GITHUB LINK: https://github.com/Sony-Kumari-D/SMART-PUBLIC-RESTROOM-PHASE-5/tree/main





Data Sharing:

To share IoT data, use APIs or data export features to provide data to stakeholders, city authorities, and maintenance teams in real-time or through scheduled reports.By following these objectives and integrating IoT devices and a well-developed platform, a smart public restroom can significantly enhance user experience, streamline maintenance, and contribute to resource conservation. The provided diagrams, schematics, and screenshots are essential tools for visualizing the system's structure and operation.