# JP COLLEGE OF ENGINEERING

## Smart Public Restroom

**PROJECT ID : Proj_21928_Team_1**

**TEAM MEMBERS:**

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## IOT_PHASE_5 PROJECT DOCUMENTATION

### Project Objectives :

A smart public restroom in IoT combines technology and innovation to enhance user experience, efficiency, and sustainability. Key features include automated entry and exit, touchless fixtures, real-time maintenance alerts, eco-friendly design, user feedback systems, maintenance robots, environmental monitoring, security and safety measures, accessibility features, data analytics, sustainability initiatives, and integration with smart city infrastructure. Privacy and data security are essential considerations in the design. Such a restroom aims to provide a clean, convenient, and sustainable facility for the public while optimizing maintenance and resource management.

### What makes it innovative?

IoT Connectivity: The restroom is connected to the internet, enabling real-time data collection, analysis, and remote control of various systems, which enhances maintenance, resource management, and user services.

Automation: The restroom offers automation in entry and exit, fixtures, and maintenance, reducing the need for human intervention and improving overall efficiency.

Sensors and Data Analytics: Smart sensors continuously monitor various aspects such as occupancy, cleanliness, supply levels, and environmental conditions. Data analytics provide insights for optimizing operations and maintenance.

User-Centric Design: Innovative restrooms prioritize user experience with features like touchless fixtures, customizable settings, and feedback systems to ensure a clean, comfortable, and convenient experience.

Energy Efficiency: Smart restrooms incorporate energy-saving technologies such as LED lighting, occupancy-based controls, and solar panels, reducing the environmental footprint.

Water Conservation: High-efficiency toilets and urinals, along with leak detection sensors, contribute to water conservation efforts.

Predictive Maintenance: IoT sensors and data analysis enable predictive maintenance, ensuring that supplies are replenished and equipment serviced as needed, minimizing downtime.

Hygiene and Safety: The inclusion of features like UV-C or ozone disinfection in hand dryers and real-time security monitoring enhances hygiene and safety for users.

Accessibility and Inclusivity: Smart restrooms incorporate features to cater to individuals with disabilities, making them more accessible and inclusive.

Sustainability Initiatives: Integrating eco-friendly practices such as rainwater harvesting, recycling, and the use of sustainable materials promotes sustainability and environmental responsibility.

Integration with Smart City Infrastructure: Connecting the smart restroom to a broader smart city network ensures data sharing and contributes to a larger urban ecosystem.

Privacy and Data Security: Innovative smart restrooms prioritize user privacy and data security by implementing robust cybersecurity measures.

Community Engagement: Some smart restrooms engage with the community through features like public rating systems and provide information such as weather updates and news headlines on smart mirrors.

Emergency Response: Integration with emergency alert systems and the ability to call for help in emergencies enhance safety for users.

## CODE IMPLEMENTATION:

```
# Import necessary libraries import time import random # Simulated sensors and actuators
class RestroomSensors:
def    init    (self):
```

```python
        self.occupancy = False
        self.temperature = 25  # Initial temperature in Celsius
        self.humidity = 50
        # Initial humidity in percentage
        self.toilet_paper_level = 100
        # Initial toilet paper level (percentage)
        self.hand_sanitizer_level = 100
        # Initial hand sanitizer level (percentage)

    def simulate(self):
        self.occupancy = random.choice([True, False])
        self.temperature = random.uniform(20, 30)
        self.humidity = random.uniform(40, 60)
        self.toilet_paper_level -= random.uniform(0.5, 2)
        self.hand_sanitizer_level -= random.uniform(0.5, 2)


class RestroomActuators:
    def __init__(self):
        self.lights = False
        self.fan = False

    def control_lights(self, on):
        self.lights = on

    def control_fan(self, on):
        self.fan = on


# Main loop for the smart restroom system
def main():
    sensors = RestroomSensors()
    actuators = RestroomActuators()
    while True:
        # Simulate sensor data
        sensors.simulate()

        # Monitor restroom conditions
        if sensors.occupancy:
            if sensors.temperature > 28:
                actuators.control_fan(True)
            else:
                actuators.control_fan(False)
            if sensors.humidity > 60:
                actuators.control_fan(True)
            else:
                actuators.control_fan(False)
        else:
            actuators.control_fan(False)

        # Check resource levels
        if sensors.toilet_paper_level < 10:
            print("Low toilet paper! Refill needed.")
        if sensors.hand_sanitizer_level < 10:
            print("Low hand sanitizer! Refill needed.")

        # Display restroom status
        print("Restroom Status:")
        print(f"Occupancy: {sensors.occupancy}")
        print(f"Temperature: {sensors.temperature}°C")
        print(f"Humidity: {sensors.humidity}%")
        print(f"Toilet Paper Level: {sensors.toilet_paper_level}%")
        print(f"Hand Sanitizer Level: {sensors.hand_sanitizer_level}%")
```
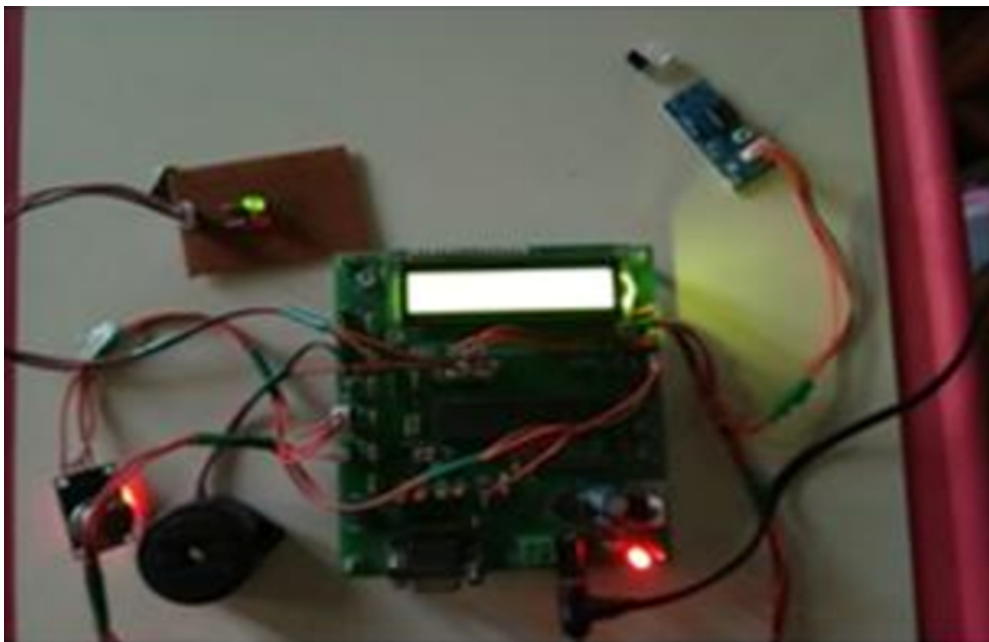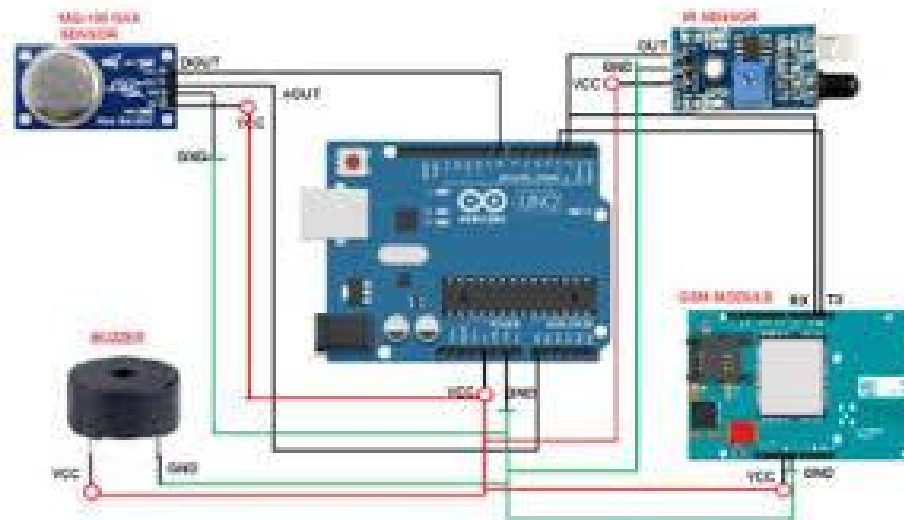
```
print(f"Lights: {'On' if actuators.lights else 'Off'}") print(f"Fan: {'On' if actuators.fan else 'Off'}")
print("\n") time.sleep(5)

# Simulate a 5-second interval if      name   == "    main   ":
main()
```
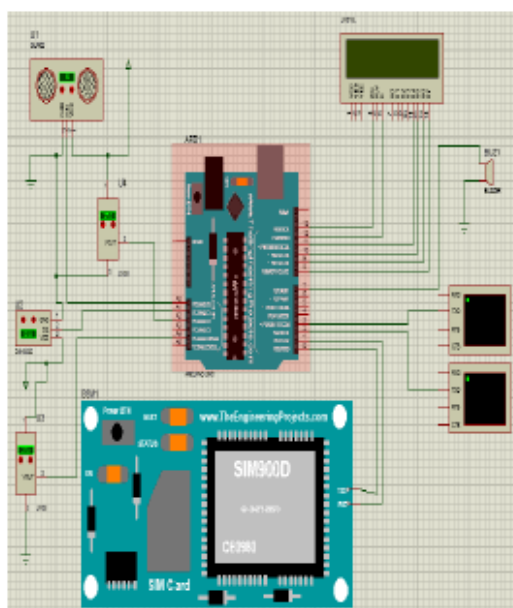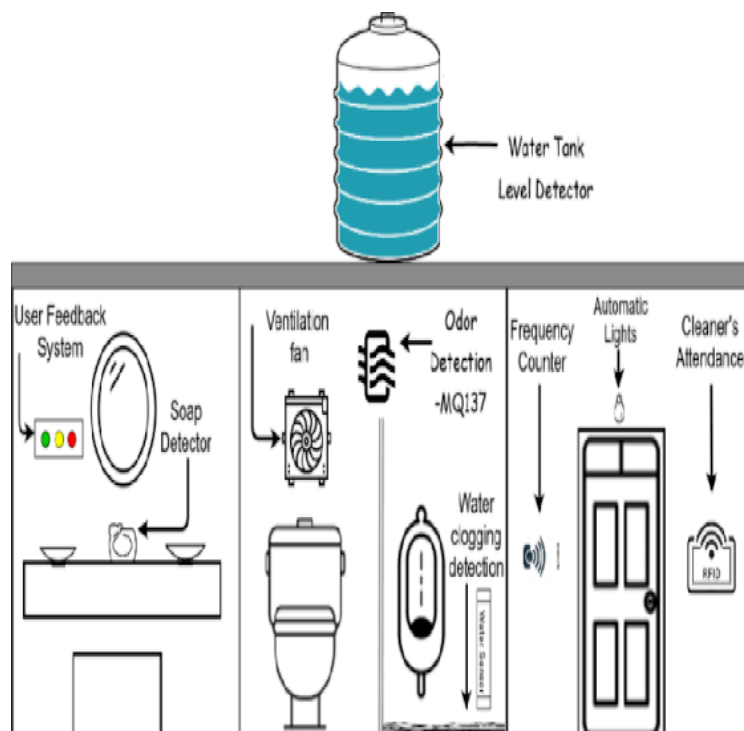
**IOT DEVICE SETUP:**

## PLATFORM DEVOLOPMENT:



## SHEMATIC :

**MODEL:**