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***TITLE: IoT Based Smart Public Restroom***

***Creating a smart public restroom with IoT devices involves several steps:***

*Building a project by deploying IoT devices for smart public restrooms involves integrating various technologies to enhance the functionality, efficiency, and user experience of these facilities. IoT (Internet of Things) devices can be used to monitor and manage different aspects of public restrooms, such as occupancy, cleanliness, maintenance, and resource utilization. By leveraging IoT technology, public restrooms can become more intelligent, automated, and responsive to the needs of users.*

*One of the key components of a smart public restroom is occupancy monitoring. IoT devices such as sensors or cameras can be deployed to detect the presence of individuals in different areas of the restroom. This information can be used to determine the availability of stalls or urinals and provide real-time updates to users through mobile applications or digital signage. Occupancy data can also be analyzed to identify peak usage times and optimize cleaning schedules accordingly.*

*Maintaining cleanliness is another crucial aspect of smart public restrooms. IoT devices can be utilized to monitor the usage of soap dispensers, paper towel dispensers, and toilet paper rolls. By tracking the levels of these supplies in real-time, facility managers can ensure that they are always adequately stocked. Additionally, sensors can be installed to detect spills or other cleanliness issues, triggering alerts for immediate attention.*

*IoT devices can also play a role in managing restroom maintenance. For example, water flow sensors can be installed to detect leaks or abnormal water consumption patterns. This enables proactive maintenance and reduces water wastage. Similarly, sensors can monitor air quality parameters such as temperature and humidity to ensure a comfortable environment for users.*

*Resource utilization is another area where IoT devices can make a significant impact in smart public restrooms. For instance, smart faucets equipped with motion sensors or proximity detectors can regulate water flow based on user presence, reducing water consumption. Similarly, automated lighting systems can adjust brightness levels based on occupancy or natural light conditions, leading to energy savings.*

*To enable seamless integration and communication between different IoT devices, a robust network infrastructure is essential. This includes reliable connectivity options such as Wi-Fi or cellular networks, as well as a centralized management system to monitor and control the various devices. Cloud-based platforms can be utilized to collect and analyze data from multiple restrooms, enabling facility managers to gain insights and make informed decisions.*

*In terms of user experience, IoT devices can provide convenience and accessibility features in smart public restrooms. For example, touchless interfaces can be implemented for flushing toilets, operating faucets, or dispensing soap and paper towels. Voice-activated controls or mobile applications can also be integrated to enable users to request assistance or provide feedback on restroom conditions.*

*Overall, deploying IoT devices for smart public restrooms offers numerous benefits such as improved hygiene, efficient resource utilization, proactive maintenance, and enhanced user experience. By leveraging the power of IoT technology, public restrooms can become more intelligent and responsive to the needs of users while optimizing operational efficiency.*

***Developing a Python script for IoT devices in a smart public restroom:***

*Creating a Python program for an IoT-based smart public restroom that detects occupancy, cleanliness, odorness, clean water level, supports automatic cleaning, and includes GSM (text message) notifications is a complex task. Below is a simplified example that demonstrates how you might set up and monitor these parameters using various sensors and a Raspberry Pi. Please note that this is a basic example and real-world implementations would require more advanced sensors and actuators, as well as integration with a GSM module.*

***Program:***

***Import RPi.GPIO as GPIO***

***Import time***

***# Set up GPIO pins for various sensors***

***PIR\_PIN = 17 # PIR motion sensor for occupancy***

***CLEANLINESS\_PIN = 18 # Cleanliness sensor (e.g., weight sensor)***

***ODOR\_SENSOR\_PIN = 22 # Odor sensor (e.g., gas sensor)***

***WATER\_LEVEL\_PIN = 23 # Water level sensor***

***CLEANING\_ACTUATOR\_PIN = 24 # Actuator for automatic cleaning***

***GPIO.setmode(GPIO.BCM)***

***GPIO.setup(PIR\_PIN, GPIO.IN)***

***GPIO.setup(CLEANLINESS\_PIN, GPIO.IN)***

***GPIO.setup(ODOR\_SENSOR\_PIN, GPIO.IN)***

***GPIO.setup(WATER\_LEVEL\_PIN, GPIO.IN)***

***GPIO.setup(CLEANING\_ACTUATOR\_PIN, GPIO.OUT)***

***Def detect\_occupancy():***

***While True:***

***Occupancy = GPIO.input(PIR\_PIN)***

***Cleanliness = GPIO.input(CLEANLINESS\_PIN)***

***Odorness = GPIO.input(ODOR\_SENSOR\_PIN)***

***Water\_level = GPIO.input(WATER\_LEVEL\_PIN)***

***Print(f”Occupancy: {‘Occupied’ if occupancy else ‘Vacant’}”)***

***Print(f”Cleanliness: {‘Clean’ if cleanliness else ‘Dirty’}”)***

***Print(f”Odor Level: {‘Normal’ if odorness else ‘High’}”)***

***Print(f”Water Level: {‘Adequate’ if water\_level else ‘Low’}”)***

***If occupancy and cleanliness and odorness and not water\_level:***

***# Activate cleaning***

***GPIO.output(CLEANING\_ACTUATOR\_PIN, GPIO.HIGH)***

***Print(“Cleaning activated”)***

***Else:***

***# Deactivate cleaning***

***GPIO.output(CLEANING\_ACTUATOR\_PIN, GPIO.LOW)***

***Time.sleep(2)***

***If \_\_name\_\_ == “\_\_main\_\_”:***

***Detect\_occupancy()***

*In this example:*

*1.We set up GPIO pins for various sensors, including PIR motion sensor (occupancy), cleanliness sensor (e.g., weight sensor), odor sensor (e.g., gas sensor), water level sensor, and an actuator for automatic cleaning.*

*2.The detect\_occupancy function reads sensor data and prints the status of occupancy, cleanliness, odor, and water level.*

*3.If the restroom is occupied, clean, has a normal odor level, and low water, it activates the cleaning actuator.*