SMART PUBLIC RESTROOM

TEAM MEMBER

Phase – 4 Document Submission

Naveen Kumar.A (510421106027)

INTRODUCTION:

IoT sensors can be installed to detect occupancy within individual stalls or the restroom as a whole. This data can be used to display real-time occupancy status on digital signage or mobile apps, allowing users to find available facilities quickly.

Smart restrooms can optimize energy usage by controlling lighting and ventilation systems based on occupancy. When no one is in the restroom, lights can be dimmed or turned off, and ventilation can be reduced, saving energy and reducing operational costs.

OVERVIEW OF SMART RESTROOM:

Automated Sensors: Smart restrooms often feature automated sensors for toilets, urinals, sinks, and soap dispensers. These sensors detect motion, proximity, or touch to trigger actions, reducing the need for physical contact and minimizing the spread of germs.

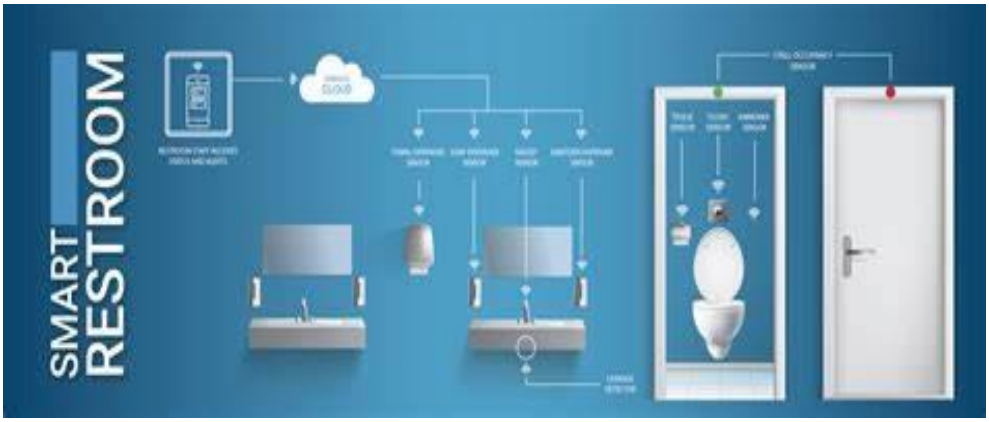
Energy Efficiency: To conserve energy and reduce operational costs, smart restrooms may use LED lighting, occupancy sensors, and timers to control lighting and ventilation systems. These systems can adjust settings based on usage patterns and natural light levels.

Water Conservation: Water-saving fixtures like low-flow toilets and waterless urinals are common in smart restrooms. Sensor-based faucets and flush valves also contribute to water conservation by minimizing water wastage.

Real-time Monitoring: Restroom operators can monitor the status of restroom fixtures and equipment in real-time through a central management system. This allows for proactive maintenance and resource management.

Maintenance Alerts: Smart restrooms can send maintenance alerts when fixtures require servicing or replenishment, reducing downtime and improving overall cleanliness.

Smart Dispensers: Automated soap and hand sanitizer dispensers help promote hand hygiene. They can be refilled more efficiently, and usage data can be collected to ensure proper maintenance.



COMPUTATIONAL TECHNOLOGY OF SMART RESTROOM:

Sensor Technology: Smart restrooms rely heavily on sensors to detect user presence and trigger various actions. Common sensors include motion sensors for lighting control, occupancy sensors for ventilation and maintenance alerts, and proximity sensors for touchless fixtures like faucets, soap dispensers, and flush valves.

Internet of Things (IoT): IoT technology connects various restroom fixtures and components to the internet. This enables real-time data collection and remote control. IoT devices can communicate with a central management system to provide insights into restroom usage and status.

Integration with Building Management Systems: Smart restrooms are often integrated into the larger building management system, enabling coordinated control of all building systems for optimized resource use and user comfort.

Machine Learning and Artificial Intelligence: AI and machine learning algorithms can be applied to analyze data and predict usage patterns, optimizing resource allocation and maintenance schedules.

Remote Monitoring and Control: Facility managers and maintenance personnel can remotely monitor and control various aspects of the smart restroom using mobile apps or web interfaces. This remote access allows for quick responses to issues and maintenance needs.

SENSORS OF SMART RESTROOM:

Motion Sensors: Motion sensors, often based on passive infrared (PIR) technology, are used to detect the presence of users in the restroom. They trigger actions like turning on lights or activating ventilation when someone enters the restroom. Motion sensors are commonly used for lighting control to conserve energy.

Occupancy Sensors: These sensors go beyond motion detection and provide more detailed information about restroom occupancy. They can count the number of users in the restroom and provide data on usage patterns. This information is valuable for optimizing cleaning schedules and resource allocation.

Proximity Sensors: Proximity sensors use infrared or ultrasonic technology to detect the presence or proximity of an object, such as a user's hand. They are often used for touchless fixtures, including automatic faucets, soap dispensers, and flush valves. Proximity sensors trigger these fixtures when a user's hand is near, reducing the need for physical contact.

Toilet and Urinal Sensors: Sensors can be integrated into toilets and urinals to detect when they need to be flushed automatically. These sensors monitor water levels and trigger flushes as needed, helping conserve water.

Toilet Seat Sensors: Some smart restrooms have sensors on toilet seats to determine whether they are occupied. These sensors can indicate whether a stall is in use and provide occupancy data for facility management.

Air Quality Sensors: Air quality sensors monitor various parameters, such as temperature, humidity, and air quality, within the restroom. They help control ventilation and air purification systems to ensure a comfortable and healthy environment for users.

PROGRAM FOR SMART RESTROOM:

```
const int occupancySensorPin = 2;
const int motionSensorPin = 3;
const int waterLevelSensorPin = 4;

const int lightPin = 5;
const int pumpPin = 6;

bool restroomOccupied = false;

void setup() {
  pinMode(occupancySensorPin, INPUT);
  pinMode(motionSensorPin, INPUT);
  pinMode(waterLevelSensorPin, INPUT);

  pinMode(lightPin, OUTPUT);
  pinMode(pumpPin, OUTPUT);

  Serial.begin(9600);
}

void loop() {
  // Simulated sensor readings
  int occupancySensorValue = digitalRead(occupancySensorPin);
  int motionSensorValue = digitalRead(motionSensorPin);
  int waterLevelSensorValue = digitalRead(waterLevelSensorPin);

  // Simulated smart restroom logic
  if (occupancySensorValue == HIGH) {
    restroomOccupied = true;
```

```
  } else if (motionSensorValue == HIGH) {
    // User detected, turn on lights
    digitalWrite(lightPin, HIGH);
    restroomOccupied = true;
  } else if (restroomOccupied && waterLevelSensorValue == LOW) {
    // No motion, water level low, turn on pump
    digitalWrite(pumpPin, HIGH);
  } else {
    // No occupancy, turn off lights and pump
    digitalWrite(lightPin, LOW);
    digitalWrite(pumpPin, LOW);
    restroomOccupied = false;
  }
  Serial.print("Restroom Status: ");
  Serial.println(restroomOccupied ? "Occupied" : "Vacant");

  delay(1000); // Simulated loop delay
}
```

OUTPUT FOR SMART RESTROOM:

```
Restroom Status: Vacant
Restroom Status: Occupied
Restroom Status: Occupied
Restroom Status: Vacant
```

BLOCK DIAGRAM: