JP COLLEGE OF ENGINEERING (9512)

SMART PUBLIC RESTROOM

PROJECT ID :Proj_21928_Team_1

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Phase _3 : Developement Part-1 :-

Sensors used :

1. Smell Sensor
2. Dirt Sensor
3. Sonic Sensor
4. Rf id Reader

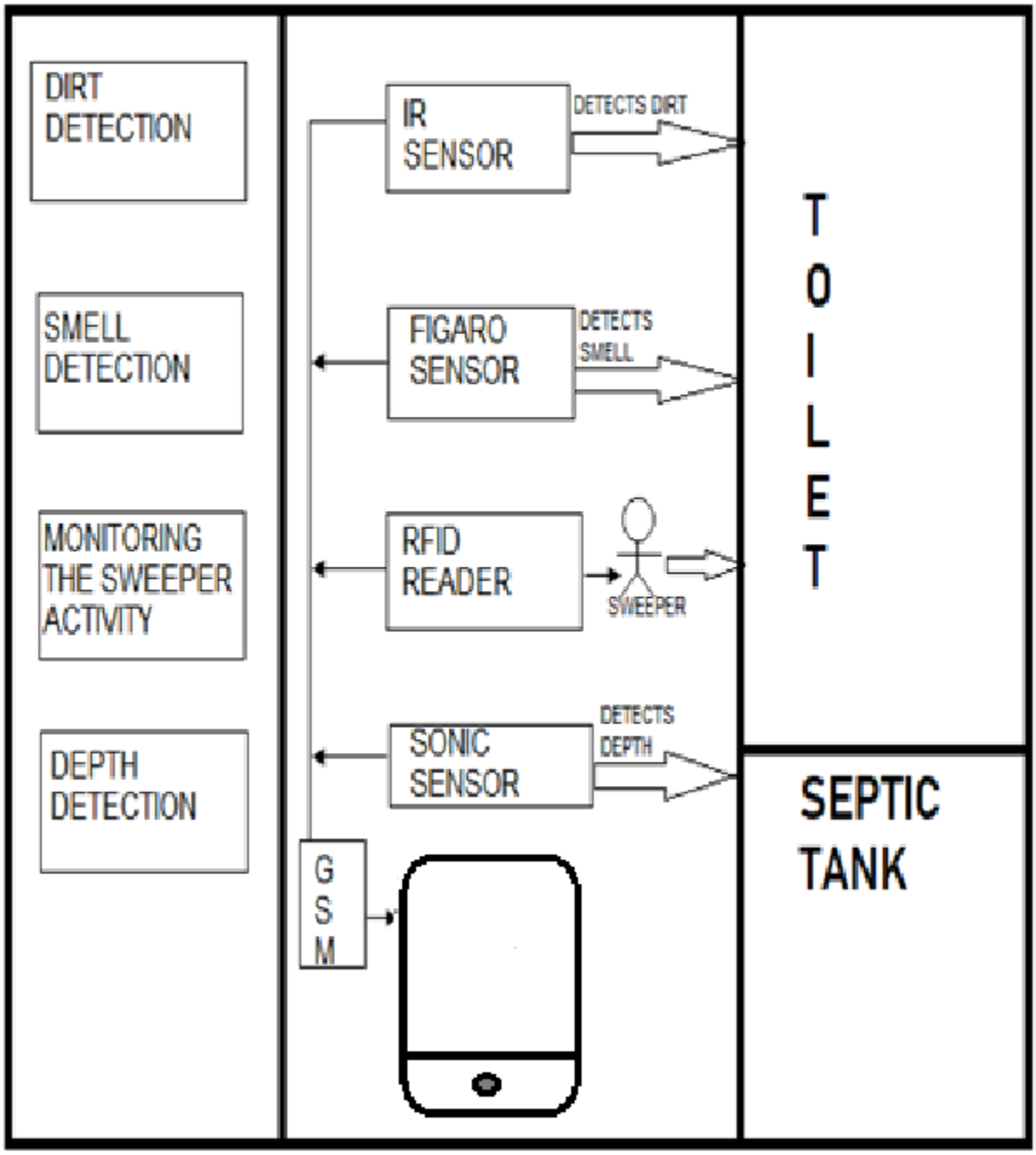
Rf ID Reader :

Sonic Sensor :

Dirt Sensor :

Smell Sensor :

ARCHITECTURE OF THE PROPOSED SYSTEM :



Python Code :

Algorithm :

Initialization:

Import necessary libraries (time and random).

Define two classes for sensors and actuators: `RestroomSensors` and `RestroomActuators`.

Initialize sensor attributes for occupancy, temperature, humidity, toilet paper level, and hand sanitizer level.

Initialize actuator attributes for lights and fan.

Sensor Data Simulation:

Create an instance of `RestroomSensors` to represent the restroom's sensor data.

In the `simulate` method, generate random data for:

Occupancy (True or False).

Temperature (random value between 20 and 30°C).

Humidity (random value between 40% and 60%).

Toilet paper level (reduce by a random amount between 0.5% and 2%).

Hand sanitizer level (reduce by a random amount between 0.5% and 2%).

Actuator Control:

Create an instance of `RestroomActuators` to represent the restroom's actuators.

Inside the `main` function, monitor restroom conditions:

If the restroom is occupied:

Check the temperature and control the fan:

If the temperature is greater than 28°C, turn the fan on.

If not, turn the fan off.

Check the humidity and control the fan:

If the humidity is greater than 60%, turn the fan on.

If not, turn the fan off.

If the restroom is unoccupied, turn the fan off.

Resource Level Check:

Check the toilet paper level and hand sanitizer level.

If either level is below 10%, print a message indicating that a refill is needed.

Display Restroom Status:

Print the current status of the restroom, including occupancy, temperature, humidity, resource levels, and the state of lights and fan.

Main Loop:

Start an infinite loop within the `main` function to continuously monitor and control the restroom.

Sleep for 5 seconds to simulate a time interval between updates.

Main Program Execution:

The `main` function is executed if the script is run as the main program.

Program :

```
# Import necessary libraries

import time

import random


# Simulated sensors and actuators

class RestroomSensors:

    def __init__(self):

        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()

Advantages Of Smart Public Restroom:

Improved Hygiene and Sanitation:

Smart sensors can monitor the usage of resources such as soap, hand sanitizer, and toilet paper. This ensures timely refills and reduces the chances of restroom users encountering empty dispensers, promoting better hygiene practices.

Energy Efficiency:

IoT-enabled systems can control lighting and ventilation based on occupancy. Lights and fans can be automatically turned on when someone enters and off when the restroom is empty, saving energy.

Cost Savings:

Efficient resource usage and predictive maintenance (replacing supplies before they run out) can lead to cost savings. Also, energy-efficient systems reduce utility costs.

Real-time Monitoring and Alerts:

Managers can monitor restroom usage, occupancy patterns, and supply levels in real-time. Automated alerts can be generated for issues such as low supplies, equipment malfunctions, or restroom misuse.

Enhanced User Experience:

Smart restrooms can offer features such as touchless faucets, soap dispensers, and flush systems, providing a more convenient and hygienic experience for users.

Data Analytics:

IoT sensors can collect data on restroom usage patterns, peak times, and popular amenities. This data can be analyzed to optimize cleaning schedules, supply management, and facility layouts.

Reduction in Vandalism and Misuse:

Real-time monitoring discourages vandalism and misuse of restroom facilities. Sensors can detect unusual activities and trigger alarms or notifications for immediate action.

Accessibility and User Safety:

Smart restrooms can be designed to be accessible to people with disabilities. IoT technology can be used to ensure the availability of accessible facilities and alert staff in case assistance is required.

Water Conservation:

IoT-enabled systems can monitor water usage, detecting leaks and optimizing flushing systems. This helps in conserving water, which is especially important in regions facing water scarcity.

Public Health:

Monitoring restroom conditions can contribute to public health by ensuring cleanliness and availability of essential supplies. Clean and

well-maintained restrooms are crucial for preventing the spread of diseases.

Customer Satisfaction and Reputation:

Providing clean, well-maintained, and technologically advanced restrooms enhances customer satisfaction. Positive experiences contribute to a positive public perception and can enhance the reputation of businesses and public facilities.

Compliance and Regulation:

Smart restrooms can aid in compliance with regulations and standards related to hygiene, safety, and accessibility. Automated systems can ensure that facilities adhere to legal requirements.

Conclusion :

In conclusion, the implementation of smart public restrooms using IoT technology brings about a multitude of benefits that significantly improve the overall restroom experience and operational efficiency. This innovative approach leverages sensors, data analytics, and automation to enhance hygiene, sustainability, user satisfaction, and public health