IOT PROJECT PHASE -4

TITLE : DEVELOPING SMART RESTROOM USING IOT

INTRODUCTION :

IOT is the technology of the future.it is getting very popular due to its vast application possibilities. A general idea behind IOT is a network of various devices being electronic or mechanical connected together to perform a certain task in unison. These tasks can be repetitive and can be effectively handled by IOT. Based on the functionality of the IOT system, they are divided into tiers, and each tier represents a level of the IOT system. We will be designing an IOT system for monitoring the hygiene of public toilets by various using various sensors. These sensors will be connected to a microcontroller which will send the data to the backend, where it will be stored and processed. This data can be fetched and monitored by using a frontend , either an android app or a website.

OBJECTIVES:

The objective of this system is to keep track of all cleaning activities so that the toilets are kept clean and hygienic at all times. The technical working of the system starts with parameters used to identify the hygiene of the toilet. Various sensors are available, like ammonia sensor, H2S gas sensor, turbidity sensor, etc. can be used. Depending upon the complexity of the system, microcontrollers can be used.

SYSTEM ARCHITECTURE:

A, USER COUNTER:

The requirement is that sensor that can be mount on the head (top) of the door/ gate to count the user, with reasonable accuracy. Also, it should be rigid enough to protect from vandalism. There are multiple ways to do user counting, considering the public toilet and environment, we decided to use a PIR sensor, with some customization. When a person passes beneath the PIR sensor which will be mounted on the head (top) of the Toilet, it detects the motion of the person. This gives a high pulse at the output. This pulse will remain High for a specific timeout and then become low for a certain time and become ready again to detect another motion. It can detect motion within 18 feet. PIR Sensor for User

Counting we can use a Single Triggering Mode with some timing hacks. Using the time (Tx) adjustment potentiometer, we can set the POT to the minimum HIGH time (Tx) period.

B, SMALL SENSOR:

- A smell sensor Node is a wi-fi-based sensor that will detect the level of gases that causes the bad smell in the Toilet.
- Selection of sensor.
- Need to detect gas H2S (Hydrogen Sulphide) which is produced from Human waste.
- Need to detect NH3 (Ammonia) which is produced in Urine.
- It should not consume more power.
- It should get less affected by ambient environment factors like temperature, humidity, etc.
- It should have a long life.

C, WATER LEVEL SENSOR:

The water level sensor node is a wi-fi-based device that is used to detect four levels i.e. 25%, 50%,

75%, and 100% (full) in the tank. There are many water level sensors are present in the market. But, we need to use cost-effective water level sensor, so we have selected Conductivity based water level sensor which is as follows:

Normal Conductor Carbon Plated Conductor we used carbon plated water level sensor to avoid rusting because of water.

To detect 4 different levels, we have to insert 5 carbon-plated conductors. Out of which one is connected to the ground placed at the bottom of the tank. And the other 4 conductors placed at different detecting levels which are connected to different inverting terminals of comparator LM324 Circuit connection of water level sensor with LM3244 conductors are placed at 25%, 50%, 75%, and 100% level in the tank, and the conductor which is connected to the ground is placed at the bottom of the tank. Water Level Sensor at the time of assembly, we don't have 12v on PCB SMPS, so we used an external adapter here.

D, USER FEEDBACK MACHINE:

The user feedback system is a wireless-based device that takes user feedback in terms of

Toilet cleaning. There are three switches for Clean, average, and Dirty feedback.

E, STAR LIGHT DISPLAY:

Star Light Display is a wi-fi-based device that will display a Star rating of Toilet.

F, INDIVIDUAL RESTROOM DASHBOARD:

Individual Toilet Dashboard Toilet wise -Monitoring.

The smart toilet system provided real-time visibility of the whole city's toilet state, which helped for easy governance and keeping them clean.

G, IOT BACKEND AND DASHBOARD:

All devices are wi-fi capable which can send data directly to the cloud each minute. We used custom Timescale DB and microservices for monitoring.

SOURCE CODE:

```
import random
```

```
import time

# Simulated sensors data
occupancy_sensor = False
water_usage_sensor = 0
cleanliness_sensor = 100

# Functions to simulate sensor data
def update_occupancy():
    global occupancy_sensor
    occupancy_sensor = not occupancy_sensor

def update_water_usage():
    global water_usage_sensor
    water_usage_sensor = random.randint(0, 10)

def update_cleanliness():
    global cleanliness_sensor
    cleanliness_sensor -= random.randint(1, 5)
```

```
# Function to control the restroom based on sensor data
def smart_restroom_controller():
    global cleanliness_sensor
    if occupancy_sensor:
        print("Restroom occupied.")
    else:
        print("Restroom vacant.")

    print(f"Water Usage: {water_usage_sensor} gallons.")

    if cleanliness_sensor > 70:
        print("Restroom is clean.")
elif 30 <= cleanliness_sensor <= 70:
        print("Restroom needs cleaning.")
    else:
        print("Restroom is dirty. Immediate cleaning required!")
```

```
# Simulate the smart restroom
while True:
    update_occupancy()
    update_water_usage()
    update_cleanliness()
    smart_restroom_controller()
    time.sleep(5)  # Simulate a delay of 5 seconds between updates.
```

SOURCE CODE EXPLANATION:

This Python source code simulates a simple smart restroom using IoT. It includes simulated sensor data for occupancy, water usage, and cleanliness. Here's a breakdown of the code:

1.Simulated sensor data:

- **'occupancy_sensor'** (boolean) represents whether the restroom is occupied or not.
- **' water_usage_sensor'** (integer) simulates the amount of water used in gallons.

- **‘ cleanliness_sensor’** (integer) simulates the cleanliness of the restroom on a scale of 0 to 100.

2.Functions to simulate sensor data:

- **‘update_occupancy()’** simulates changes in the occupancy sensor.
- ‘**update_water_usage()**’ simulates changes in the water usage sensor.
- ‘**update_cleanliness()’** simulates changes in the cleanliness sensor.

3.Function to control the restroom based on sensor data:

- ‘**smart_restroom_controller()’** checks the sensor data and prints the current status of the restroom, including occupancy, water usage, and cleanliness.

4.Simulation loop:

- The while loop continuously updates the sensor data by calling the sensor update functions.
- It then calls the ‘**smart_restroom_cooontroller()’** function to print the current status of the smart restroom.
- **‘time.sleep(5)’** function simulates a delay of 5 seconds between updates.

This code provides a basic framework for simulating a smart restroom using IoT. In a practical implementation, you would replace the simulated data with real data from physical sensors and devices. Adjustments would be necessary based on the specific hardware and software used in the IoT project.

CONCLUSION:

In conclusion, the implementation of a smart restroom project involves a comprehensive understanding of IoT technologies, sensor integration, data analytics, and user-centric design principles. A successful smart restroom project can significantly enhance user satisfaction, optimize resource utilization, and streamline maintenance processes, ultimately contributing to a more sustainable and efficient facility management system.

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