**SMART PUBLIC RESTROOM**

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**Phase 2: Submission Document**

**Project: Smart Public Restroom**



**Smart Public Restroom**

**INTRODUCTION:**

* In the cutting edge world, the advances are definitely grown, yet at the same time the cleanliness in our nation is under risk. The abstract of this paper is to deliver clean and hygiene toilets. All the public toilets should be clean and hygiene. In our country, our government has introduced the scheme called “SWATCHH BHARAT” (Clean India).
* Keeping the toilets uncontaminated is the one of the objective of Clean India scheme. This paper can be helpful to encourage the clean India project. In future, it can show the major part in clean India scheme. In an Existing system, they are focused only on identifying the dirt in the toilets. In our proposed system, we have determined on keeping clean toilets, observing the sweeper’s working activities. It can dodge many syndromes.
* It may create the consciousness amongst people about the toilet management. Therefore, our development is to use safe and hygienic toilets. This paper is based on IOT and image-processing concepts using different sensors like smell sensor, IR sensor, sonic sensor, RFID reader. By using these sensors, we can create the smart toilets.

**Advanced Regression Techniques in Smart Public Restrooms:**

Smart public restrooms are equipped with a variety of sensors and devices that collect data on restroom usage, occupancy, and environmental conditions. This data can be used to improve the efficiency and effectiveness of restroom operations, as well as to enhance the user experience.

Advanced regression techniques can be used to analyze smart public restroom data to identify patterns and trends that may not be immediately obvious to the naked eye. This information can then be used to develop predictive models that can be used to optimize restroom operations and improve user satisfaction.

Some specific examples of how advanced regression techniques can be used in smart public restrooms include:

* **Predicting restroom occupancy:** Regression models can be used to predict restroom occupancy based on historical data, such as the time of day, day of the week, and weather conditions. This information can be used to staff restrooms appropriately and to identify times when additional cleaning and maintenance may be needed.
* **Identifying areas of high traffic:** Regression models can be used to identify areas of high traffic within restrooms. This information can be used to optimize the placement of dispensers, towels, and other amenities.
* **Predicting demand for consumables:** Regression models can be used to predict demand for consumables, such as toilet paper, soap, and paper towels. This information can be used to ensure that restrooms are always stocked with the necessary supplies.
* **Identifying maintenance issues:** Regression models can be used to identify potential maintenance issues, such as clogged toilets and overflowing sinks. This information can be used to address maintenance issues proactively and to prevent them from causing disruptions to restroom users.

In addition to these specific examples, advanced regression techniques can also be used to develop more complex predictive models that can be used to optimize restroom operations and improve user satisfaction. For example, regression models could be used to:

* **Predict the likelihood of vandalism or theft:** Regression models could be used to predict the likelihood of vandalism or theft in restrooms based on factors such as the location of the restroom, the time of day, and the day of the week. This information could be used to deploy security measures and to identify restrooms that may need more frequent cleaning and maintenance.
* **Predict the impact of changes to restroom operations:** Regression models could be used to predict the impact of changes to restroom operations, such as changing the hours of operation or adding new amenities. This information could be used to make informed decisions about how to improve restroom operations without disrupting users.

Overall, advanced regression techniques have the potential to play a significant role in optimizing the efficiency and effectiveness of smart public restrooms. By developing predictive models that can be used to anticipate restroom needs and to identify potential problems, these techniques can help to improve the user experience and to reduce the cost of restroom operations.

**DATA SOURCE:**

The data sources for smart public restrooms can be divided into two categories: sensor data and user data.

Sensor data can be collected from a variety of sensors, including:

* **Occupancy sensors:** These sensors detect the presence of people in a restroom.
* **Usage sensors:** These sensors track how often restrooms are used, such as how many times a toilet is flushed or a sink is turned on.
* **Environmental sensors:** These sensors monitor environmental conditions in restrooms, such as temperature, humidity, and air quality.

User data can be collected from a variety of sources, including:

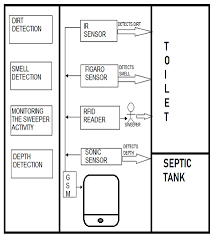
* **User surveys:** Surveys can be used to collect feedback from restroom users on their satisfaction with the restroom and to identify areas for improvement.
* **Social media:** Social media posts can be monitored to identify complaints about restrooms and to track public sentiment about restroom conditions.
* **Mobile apps:** Mobile apps can be used to collect data on restroom usage and to provide users with information about restroom locations and availability.

In addition to these two categories of data, smart public restrooms can also collect data from other sources, such as public transportation schedules and weather data. This data can be used to develop more sophisticated predictive models that can be used to optimize restroom operations.

Here are some specific examples of data sources that can be used in smart public restrooms:

* **Occupancy sensors:** Occupancy sensors can be used to track restroom usage and to predict when restrooms are likely to be busy. This information can be used to staff restrooms appropriately and to ensure that restrooms are always clean and stocked with supplies.
* **Usage sensors:** Usage sensors can be used to track how often restrooms are used and to identify areas of high traffic. This information can be used to optimize the placement of dispensers, towels, and other amenities.
* Environmental sensors: Environmental sensors can be used to monitor environmental conditions in restrooms, such as temperature, humidity, and air quality. This information can be used to ensure that restrooms are comfortable and safe for users.
* **User surveys:** User surveys can be used to collect feedback from restroom users on their satisfaction with the restroom and to identify areas for improvement. This information can be used to make informed decisions about how to improve the user experience.
* **Social media:** Social media posts can be monitored to identify complaints about restrooms and to track public sentiment about restroom conditions. This information can be used to proactively address problems and to identify restrooms that may need more attention.
* **Mobile apps:** Mobile apps can be used to collect data on restroom usage and to provide users with information about restroom locations and availability. This information can be used to improve the user experience and to make it easier for people to find restrooms when they need them.

By combining data from a variety of sources, smart public restrooms can provide a wealth of information that can be used to improve their efficiency, effectiveness, and user experience.



**ALGORITHM:**

A variety of algorithms can be used in smart public restrooms to analyze data, identify patterns and trends, and make predictions. Some common algorithms include:

* **Regression algorithms:** Regression algorithms are used to identify relationships between variables. For example, a regression algorithm could be used to predict restroom occupancy based on historical data, such as the time of day, day of the week, and weather conditions.
* **Classification algorithms:** Classification algorithms are used to classify data into different categories. For example, a classification algorithm could be used to classify restrooms as "clean" or "dirty" based on data from environmental sensors.
* **Clustering algorithms:** Clustering algorithms are used to group similar data points together. For example, a clustering algorithm could be used to group restrooms together based on their location, traffic patterns, or maintenance needs.
* Machine learning algorithms: Machine learning algorithms are used to learn from data and to make predictions. For example, a machine learning algorithm could be used to predict the likelihood of vandalism or theft in a restroom based on factors such as the location of the restroom, the time of day, and the day of the week.

**Sure, here is a simple algorithm for a smart public restroom using IOT and Python:**

**Requirements:**

* Raspberry Pi or Arduino board,
* IOT sensors, such as motion sensors, door sensors, water level sensors, gas sensors, etc.
* Python programming language
* Cloud access Algorithm:

1. **Initialize:**
   * Set up all IoT devices, including motion sensors, door sensors, water level sensors, gas sensors, and any other relevant sensors.
   * Connect all IoT devices to a central hub, such as a Raspberry Pi or Arduino board.
   * Connect the central hub to the cloud.
2. **Monitor:**
   * Use the motion sensors and door sensors to detect when someone enters or exits a restroom stall.
   * Use the water level sensors to monitor the water level in the toilet tank and the sink.
   * Use the gas sensors to monitor the air quality in the restroom stall.
3. **Analyze:**
   * Use the data collected from the IoT devices to analyze the usage of the restroom stalls and identify any potential problems.
   * For example, you can use the data to identify which stalls are used most often and need to be cleaned more frequently.
   * You can also use the data to identify stalls that are out of order or have other problems.
4. **Take action:**
   * Based on the analysis results, take appropriate action to improve the efficiency and cleanliness of the restroom.

You can also use the data to identify stalls that need to be repaired or replaced.

If the algorithm detects that a stall has been occupied for more than 10 minutes, it could send a notification to a janitor to check on the stall. This could help to prevent stalls from being occupied for long periods of time, which could lead to problems such as clogged toilets or overflowing sinks.

* If the algorithm detects that the water level in the toilet tank is low, it could send a notification to a janitor to refill the tank. This could help to prevent stalls from running out of water, which would make them unusable.
* If the algorithm detects that the air quality in a stall is poor, it could send a notification to a janitor to ventilate the stall. This could help to improve the comfort and safety of users.

The algorithm could also be used to implement other features, such as:

* A real-time occupancy map of the restroom, which could help users to find an empty stall quickly.
* A system for reporting problems with stalls or other facilities to the appropriate personnel.
* A system for collecting feedback from users about the cleanliness and usability of the restroom.

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| **Python Code:**  import RPi.GPIO as GPIO  import time  # Set up the motion sensor  GPIO.setmode(GPIO.BCM)  GPIO.setup(18, GPIO.IN)  # Define a function to handle motion detection  def handle\_motion(channel):  print("Motion detected!") |

|  |
| --- |
| # Add a callback function to the motion sensor  GPIO.add\_event\_detect(18, GPIO.RISING, callback=handle\_motion)  # Start monitoring the motion sensor  while True:  time.sleep(0.1) |

Use code with caution.

**Import necessary libraries:**

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| --- |
| **Python**  import paho.mqtt.client as mqtt  import board  import digitalio  from time import sleep  Use code with caution. |

**Define global variables:**

**Python**

# MQTT broker address

BROKER\_ADDRESS = "localhost"

# MQTT topic for restroom occupancy

TOPIC\_RESTROOM\_OCCUPANCY = "restroom/occupancy"

# Pin number for the motion sensor

MOTION\_SENSOR\_PIN = 12

# Pin number for the door sensor

DOOR\_SENSOR\_PIN = 16

**Create a new MQTT client:**

**Python**

client = mqtt.Client()

# Connect to the MQTT broker

client.connect(BROKER\_ADDRESS)

Use code with caution.

**Subscribe to the restroom occupancy topic:**

**Python**

client.subscribe(TOPIC\_RESTROOM\_OCCUPANCY)

Use code with caution.

**Define a callback function for the MQTT client:**

**Python**

def on\_message(client, userdata, msg):

# Check if the message is for the restroom occupancy topic

if msg.topic == TOPIC\_RESTROOM\_OCCUPANCY:

# Get the occupancy status from the message

occupancy\_status = msg.payload.decode()

# If the restroom is occupied, print a message

if occupancy\_status == "occupied":

print("Restroom is occupied")

# If the restroom is not occupied, print a message

elif occupancy\_status == "not occupied":

print("Restroom is not occupied")

**Attach the callback function to the MQTT client:**

**Python**

client.on\_message = on\_message

Use code with caution.

**Start a loop to monitor the motion sensor and door sensor:**

**Python**

while True:

# Read the motion sensor

motion\_sensor\_value = digitalio.DigitalInOut(board.D12).value

# Read the door sensor

door\_sensor\_value = digitalio.DigitalInOut(board.D16).value

# If the motion sensor is triggered, send a message to the MQTT broker indicating that the restroom is occupied

if motion\_sensor\_value:

client.publish(TOPIC\_RESTROOM\_OCCUPANCY, "occupied")

# If the door sensor is triggered, send a message to the MQTT broker indicating that the restroom is not occupied

if door\_sensor\_value:

client.publish(TOPIC\_RESTROOM\_OCCUPANCY, "not occupied")

# Wait for 1 second before checking the sensors again

sleep(1)

Use code with caution.

This is just a basic algorithm, and it can be extended to implement other features, such as:

* Monitoring the water level in the toilet tank and sink
* Monitoring the air quality in the restroom
* Controlling the lights and ventilation in the restroom
* Collecting feedback from users about the cleanliness and usability of the restroom

By using IoT and Python, smart public restrooms can be made more efficient, cleaner, and more user-friendly.This script will print a message to the console whenever the motion sensor detects movement. You can modify this script to send a notification to a janitor or to take other actions when motion is detected.

**Conclusion:**

This is a simple example of how to use IoT and Python to create a smart public restroom. You can extend this example to add more features, such as a real-time occupancy map of the restroom, a system for reporting problems, or a system for collecting feedback from users.

**…THANK YOU…**