Vehicle Tracking System

Arduino to MQTT Data Transmission

Overview

The Arduino code is designed to gather location data using a GPS module and transmit it along with passenger count information to an MQTT broker.

```
// Arduino Code for MQTT Data Transmission
// (Includes TinyGPS++, ArduinoJson, ArduinoMqttClient libraries)
#include <ArduinoJson.h>
#include <TinyGPS++.h>
#include <ArduinoMqttClient.h>
#include <ESP8266WiFi.h>

#define IRPIN_IN 9
#define IRPIN_OUT 10

DynamicJsonDocument doc(200);
TinyGPSPlus gps;
WiFiClient wifiClient;
MqttClient mqttClient(wifiClient);

const char broker[] = "192.168.29.170";
int port = 1883;
const char topic[] = "pto_data";
int totalPas = 0;
unsigned long previousMillis = 0;
const long interval = 10000;  // 10 seconds interval

void addLocationData(JsonDocument &doc, float latitude, float longitude) {
  JsonObject location = doc.createNestedObject("location");
  location["lat"] = latitude;
  location["lng"] = longitude;
}

void addRidershipData(JsonDocument &doc, int totalPassengers) {
  JsonObject ridership = doc.createNestedObject("ridership");
  ridership["total"] = totalPassengers;
}

void connectWiFi() {
  Serial.print("Connecting to WiFi");
  WiFi.begin("Rahul's Galaxy S20+", "Rahul@123");
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("\nConnected to WiFi!");
```

```
}

bool connectToMQTT() {
  int attempt = 0;
  while (!mqttClient.connect(broker, port)) {
    Serial.print("MQTT connection failed! Error code = ");
    Serial.println(mqttClient.connectError());
    if (attempt > 5) {
      Serial.println("Exceeded maximum attempts. Please check MQTT
broker.");
      return false;
    }
    delay(2000);
    attempt++;
  }
  Serial.println("Connected to MQTT broker!");
  return true;
}

void setup() {
  Serial.begin(115200);
  pinMode(IRPIN_IN, INPUT);
  pinMode(IRPIN_OUT, INPUT);
  connectWiFi();

  if (!connectToMQTT()) {
    while (1) {
      // Stay in a loop if MQTT connection fails for safety measures
      delay(1000);
    }
  }
}

void loop() {
  mqttClient.poll();
  unsigned long currentMillis = millis();

  while (Serial.available() > 0) {
    if (gps.encode(Serial.read())) {
      break;
    }
  }

  if (!mqttClient.connected()) {
    if (!connectToMQTT()) {
      // Handle reconnection attempts or safety measures here
      // For now, we will just try to reconnect
      return;
    }
  }

  if (currentMillis - previousMillis >= interval) {
    previousMillis = currentMillis;
    mqttClient.beginMessage(topic);
    addLocationData(doc, gps.location.lat(), gps.location.lng());

    if (digitalRead(IRPIN_IN) == HIGH) {
      totalPas++;
    }
    if (digitalRead(IRPIN_OUT) == HIGH) {
      totalPas--;
    }

    addRidershipData(doc, totalPas);

    serializeJson(doc, mqttClient);
    mqttClient.endMessage();
    doc.clear();
  }
}
```

Fetching MQTT Data into Server

Overview

This Python code snippet utilizes the Paho MQTT client to receive data from the MQTT broker. The received JSON payload is decoded and stored for use in a server application.

```
# Python Code for Fetching MQTT Data into Server
# (Utilizes Paho MQTT Client and Flask framework)
import json
import paho.mqtt.client as mqtt
from flask import Flask, render_template, jsonify
from flask_cors import CORS

app = Flask("PTO_Backend")
CORS(app)

data = {}  # Initialize data variable

def on_message(client, userdata, message):
    global data
    data = json.loads(message.payload.decode("utf-8"))
    print("Received message:", data)

mqtt_client = mqtt.Client(protocol=mqtt.MQTTv5)
mqtt_client.on_message = on_message

try:
    mqtt_client.connect("192.168.29.170", 1883)
    topic = "pto_data"
    mqtt_client.subscribe(topic)
    print("Subscribed to topic:", topic)
    mqtt_client.loop_start()  # Start the MQTT client loop
```

```
except Exception as e:
    print(f"Error: {str(e)}")
    mqtt_client.disconnect()

@app.route('/')
def index():
    return render_template('index.html')

@app.route('/data', methods=['GET'])
def get_data():
    return jsonify(data)

if __name__ == "__main__":
    app.run(port=5500, threaded=True)
```

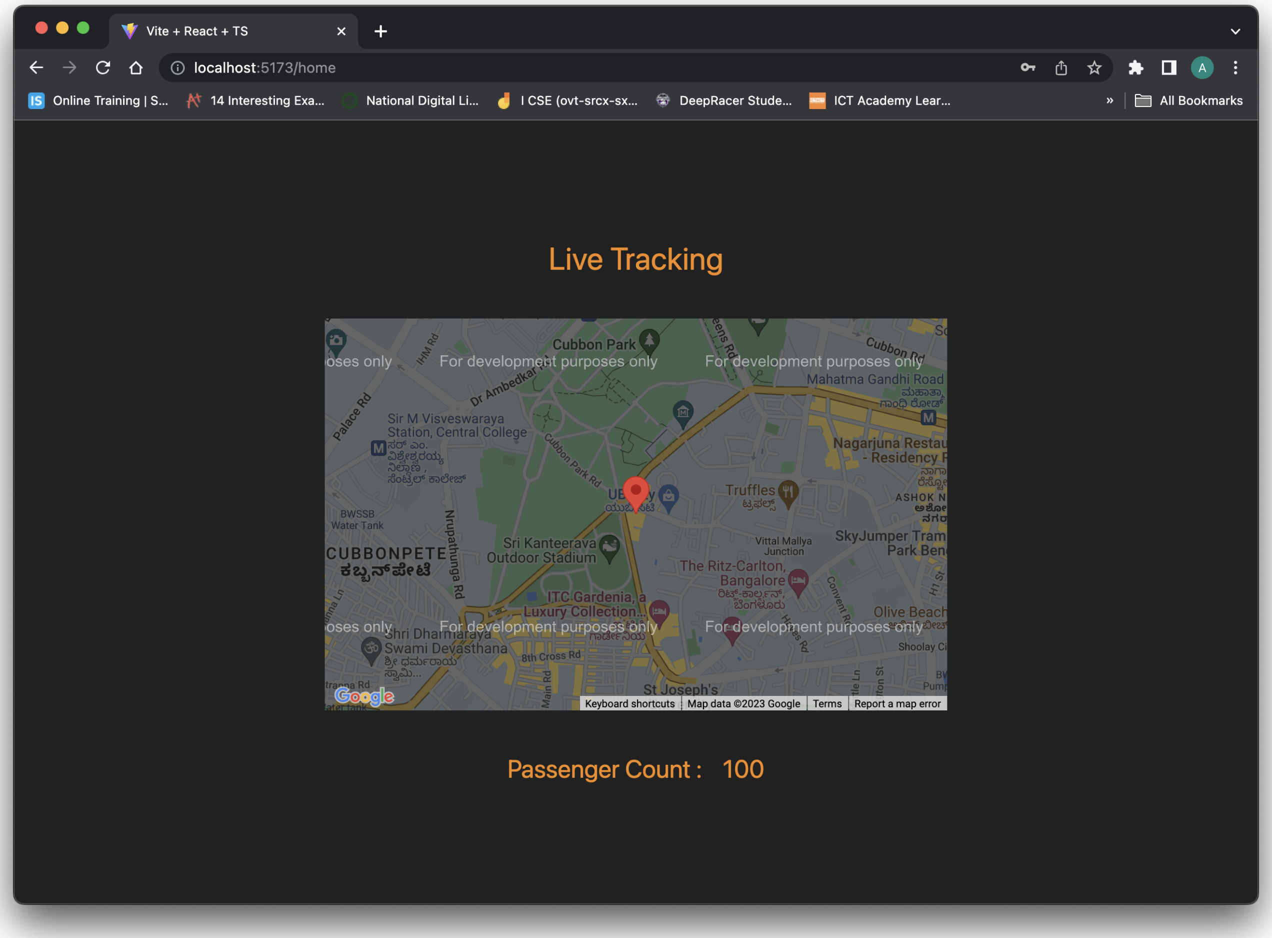
Frontend for Vehicle Tracking

Overview

This React code snippet demonstrates a frontend application designed to visualize the real-time location of the vehicle on a Google Map, along with the current passenger count.

```
// Frontend React Code for Vehicle Tracking
// (Utilizes @react-google-maps/api and Axios for data retrieval)
import { useJsApiLoader, GoogleMap, Marker } from "@react-google-
maps/api";
import { useEffect, useState } from "react";
import axios from "axios";

const Home = () => {
  const [currentLocation, setCurrentLocation] = useState({
    lat: 0,
    lng: 0,
  });
  const [passengerCount, setPassengerCount] = useState(0);

  useEffect(() => {
    const fetch = async () => {
      await axios.get(import.meta.env.VITE_API_URL! + "/data").then((res)
=> {
        console.log(res.data);
        setCurrentLocation({
          lat: parseFloat(res.data.location.lat),
          lng: parseFloat(res.data.location.lng),
        });
        setPassengerCount(res.data.ridership.total);
      });
    };
    setTimeout(() => {
      fetch();
    }, 5000);
  }, [currentLocation]);

  const { isLoaded } = useJsApiLoader({
    id: "google-map-script",
    googleMapsApiKey: import.meta.env.VITE_MAPS_API_KEY!,
  });

  return (
    <div className="flex flex-col gap-10">
      <h2 className="text-3xl text-primary text-center">Live Tracking</h2>
      {isLoaded ? (
        <GoogleMap
          center={currentLocation}
          zoom={15}
          mapContainerStyle={{ width: "50vw", height: "50vh" }}
          options={{
            zoomControl: false,
            streetViewControl: false,
            mapTypeControl: false,
            fullscreenControl: false,
          }}
        >
          <Marker position={currentLocation} />
        </GoogleMap>
      ) : null}

      <div className="flex flex-row gap-5 items-center justify-center">
        <h2 className="text-2xl text-primary">Passenger Count : </h2>
        <h2 className="text-2xl text-primary">{passengerCount}</h2>
      </div>
    </div>
  );
};

export default Home;
```

App Snapshot



Live Tracking

Passenger Count : 100

Each segment serves a specific purpose:

- **Arduino Code**: Transmits location and passenger count data via MQTT.
- **Python Server Code**: Receives MQTT data and stores it for a server-side application.
- **Frontend React Code**: Visualizes live vehicle location and passenger count.

This system allows for real-time tracking and monitoring of a vehicle's location and occupancy.