



# WASTE WATCHER

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# PROJECT OVERVIEW

- WasteWatcher is an API platform and data visualization web application.
- WasteWatcher serves as a platform for waste management analysis to help address the global warming issue.





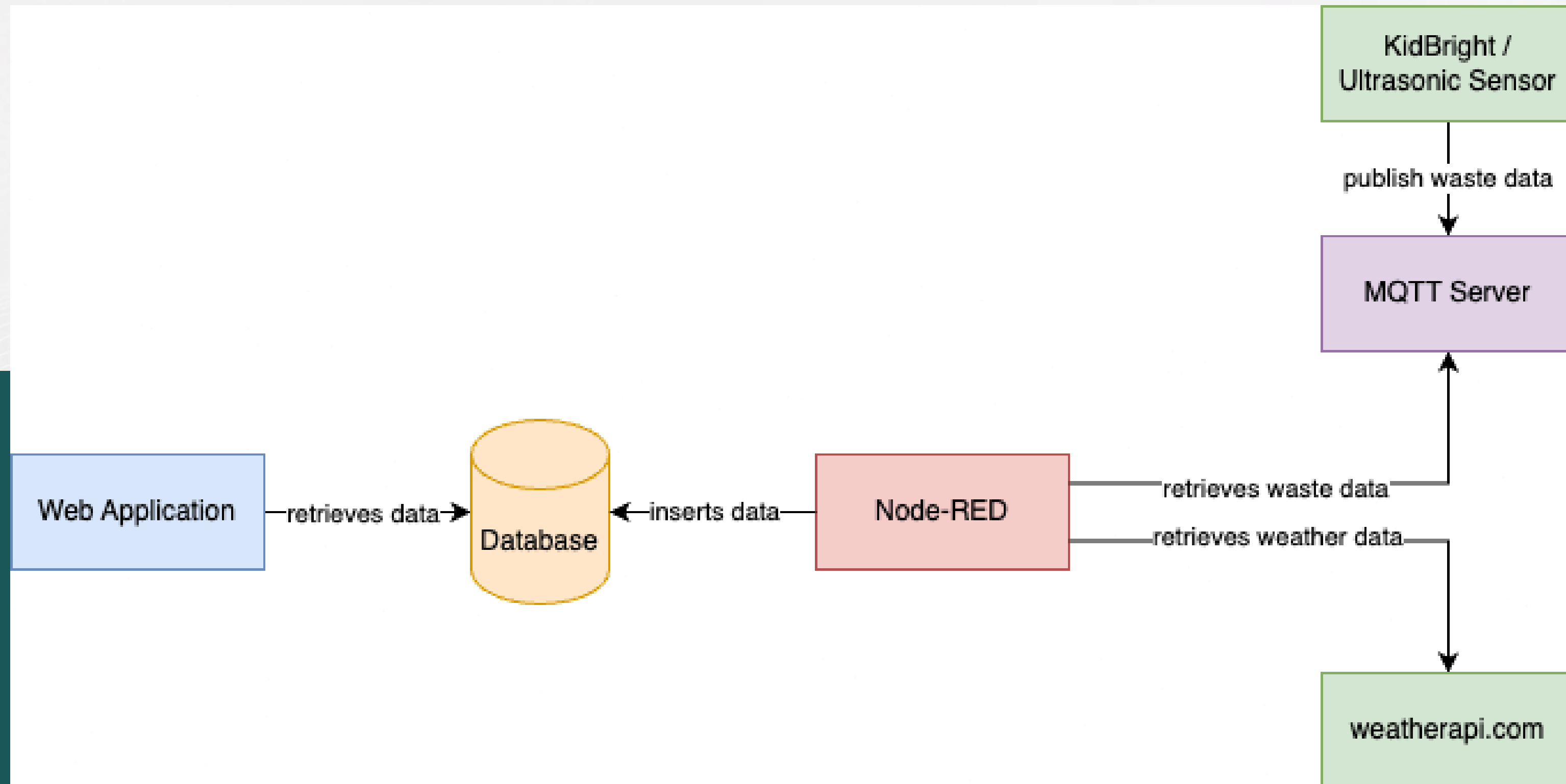
# BACKGROUND & MOTIVATION

- The world is currently impacted by global warming, largely due to waste.
- Understanding how weather influences waste generation can lead to solutions for the global waste problem.





# OVERALL ARCHITECTURE



# PRIMARY DATA SOURCE



## Waste level in the bin

- The ultrasonic sensor (HC-SR04) is placed under the bin lid.
- KidBright send the waste level added in the past hour to the MQTT server.
- Node-RED retrieves data from the MQTT server and records it to the database.



# SECONDARY DATA SOURCE



```
{
  "location": {
    "name": "London",
    "region": "City of London, Greater London",
    "country": "United Kingdom",
    "lat": 51.52,
    "lon": -0.11,
    "tz_id": "Europe/London",
    "localtime_epoch": 1613896955,
    "localtime": "2021-02-21 8:42"
  },
  "current": {
    "last_updated_epoch": 1613896210,
    "last_updated": "2021-02-21 08:30",
    "temp_c": 11,
    "temp_f": 51.8,
    "is_day": 1,
    "condition": {
      "text": "Partly cloudy",
      "icon": "http://cdn.weatherapi.com/weather/64x64/day/116.png",
      "code": 1003
    },
    "wind_mph": 3.8,
    "wind_kph": 6.1,
    "wind_degree": 220,
    "wind_dir": "SW",
    "pressure_mb": 1009,
    "pressure_in": 30.3,
    "precip_mm": 0.1,
```

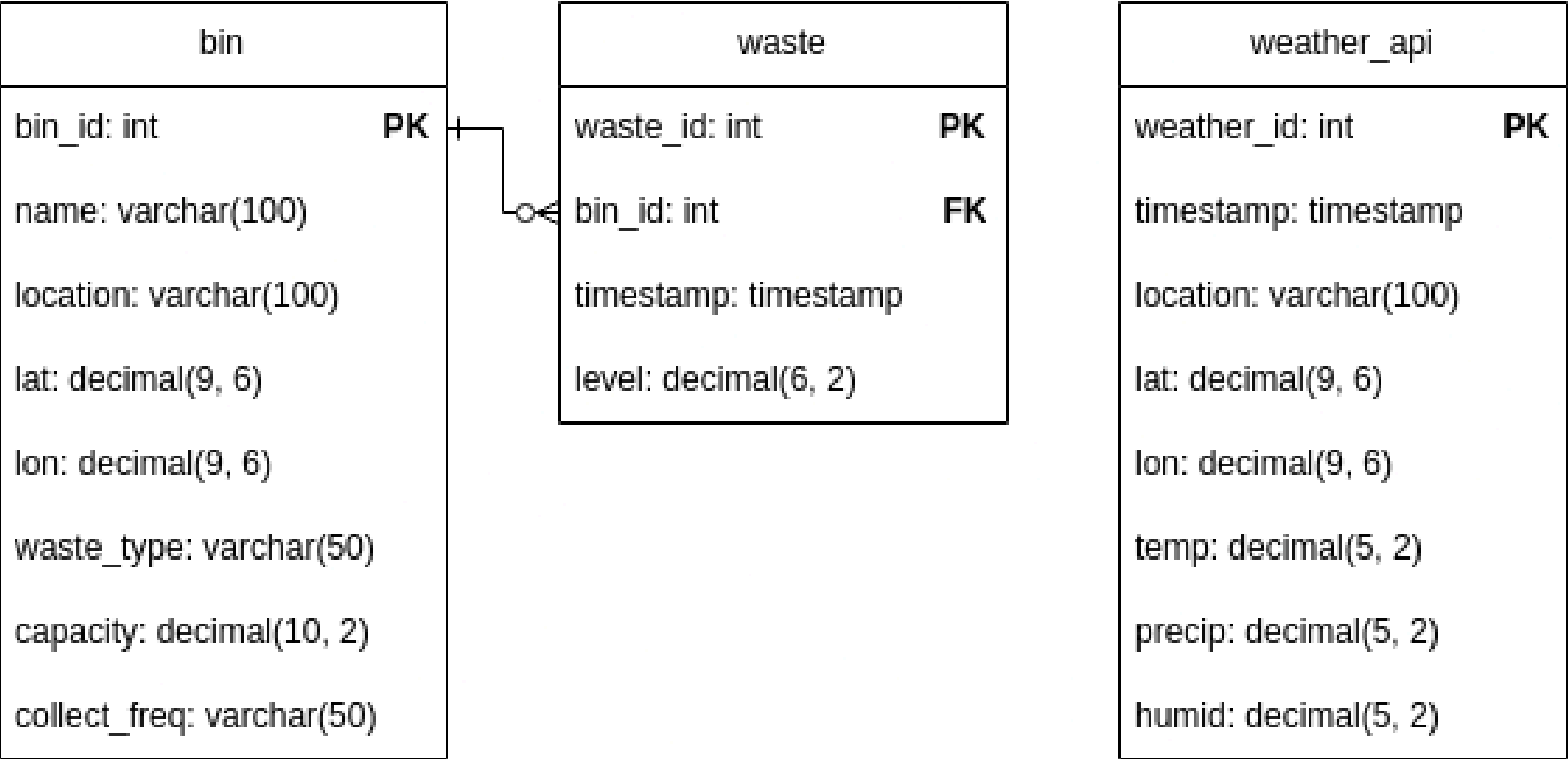
```
    "precip_in": 0,
    "humidity": 82,
    "cloud": 75,
    "feelslike_c": 9.5,
    "feelslike_f": 49.2,
    "vis_km": 10,
    "vis_miles": 6,
    "uv": 1,
    "gust_mph": 10.5,
    "gust_kph": 16.9,
    "air_quality": {
      "co": 230.3,
      "no2": 13.5,
      "o3": 54.3,
      "so2": 7.9,
      "pm2_5": 8.6,
      "pm10": 11.3,
      "us-epa-index": 1,
      "gb-defra-index": 1
    }
  }
}
```

## Weather condition data

- Node-RED retrieves weather condition data via API from WeatherAPI.com.
- Node-RED stores the selected data to the database.

# DATABASE SCHEMA

## Data Collection



## Data Integration

waste_record	
id: int	PK
timestamp: timestamp	
bin_id: int	
location: varchar(100)	
lat: decimal(9, 6)	
lon: decimal(9, 6)	
temp: decimal(5, 2)	
precip: decimal(5, 2)	
humid: decimal(5, 2)	
capacity: decimal(10, 2)	
level: decimal(6, 2)	



# DATA SHARING API

Bins	
GET	/api/bins/ List all bins
GET	/api/bins/{bin_id}/ Retrieve bin details
Waste	
GET	/api/waste/latest/ List latest waste data
GET	/api/waste/latest/bin/{bin}/ Retrieve latest waste data for a specific bin
GET	/api/waste/latest/location/{location}/ Retrieve latest waste data for a specific location
GET	/api/waste/{year}/{month}/{day}/ List waste data for a specific date
GET	/api/waste/{year}/{month}/{day}/bin/{bin}/ Retrieve waste data for a specific bin and date
GET	/api/waste/{year}/{month}/{day}/location/{location}/ Retrieve waste data for a specific location and date
GET	/api/waste/{year}/{month}/ List waste data for a specific month
GET	/api/waste/{year}/{month}/bin/{bin}/ Retrieve waste data for a specific bin and month
GET	/api/waste/{year}/{month}/location/{location}/ Retrieve waste data for a specific location and month
GET	/api/waste/{year}/ List waste data for a specific year



## BIN, WASTE AND WEATHER DATA

- There are 14 endpoints.
- These endpoints includes retrieving bin information and waste records along with their corresponding weather conditions.

# DATA SHARING API

**/api/bins/**

- Retrieve all bins information

Schema

```
[
  {
    "bin_id": 0,
    "name": "string",
    "location": "string",
    "lat": "string",
    "lon": "string",
    "waste_type": "string",
    "capacity": "string",
    "collect_freq": "string"
  }
]
```

Actual data

```
[
  {
    "bin_id": 1,
    "name": "Jullaphong House",
    "location": "Thanyaburi",
    "lat": "14.003589",
    "lon": "100.695032",
    "waste_type": "general",
    "capacity": "35.00",
    "collect_freq": "daily"
  },
  {
    "bin_id": 2,
    "name": "Phimnada House",
    "location": "Lam Luk Ka",
    "lat": "13.885775",
    "lon": "100.649384",
    "waste_type": "general",
    "capacity": "42.50",
    "collect_freq": "daily"
  }
]
```



# DATA SHARING API

**/api/waste/latest/**

- Retrieve latest waste data

Schema

```
[
  {
    "bin": 0,
    "total_waste": 0,
    "min_temp": 0,
    "max_temp": 0,
    "avg_temp": 0,
    "min_precip": 0,
    "max_precip": 0,
    "sum_precip": 0,
    "min_humid": 0,
    "max_humid": 0,
    "avg_humid": 0
  }
]
```

Actual data

```
[
  {
    "bin": 2,
    "total_waste": 14.04,
    "min_temp": 31,
    "max_temp": 38,
    "avg_temp": 33.146154,
    "min_precip": 0,
    "max_precip": 0,
    "sum_precip": 0,
    "min_humid": 45,
    "max_humid": 79,
    "avg_humid": 65.846154
  }
]
```

# DATA SHARING API

**/api/waste/{year}/{month}/location/{location}/**

- Retrieve waste data for a specific location and month

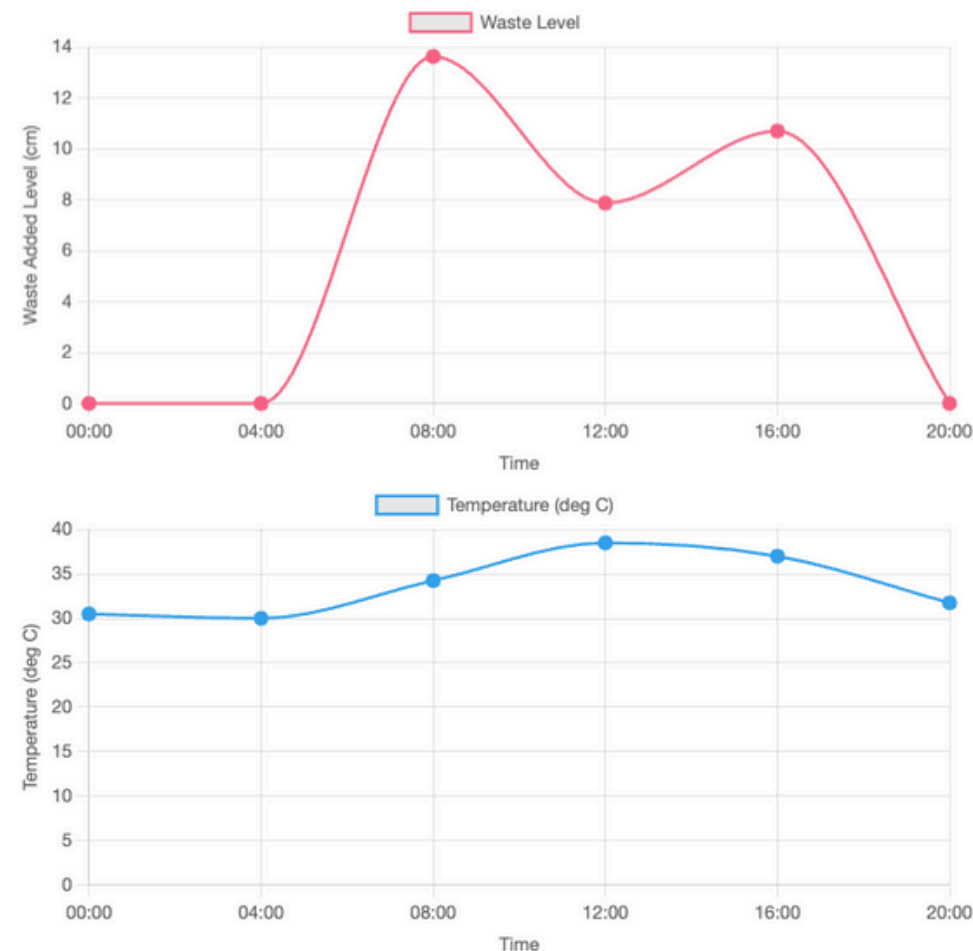
Schema

```
{
  "location": "string",
  "year": 0,
  "month": 0,
  "records": [
    {
      "datetime": "string",
      "bin": 0,
      "level": "string",
      "temp": 0,
      "precip": 0,
      "humid": 0
    }
  ]
}
```

Actual data

```
{
  "location": "Thanyaburi",
  "year": 2024,
  "month": 4,
  "records": [
    {
      "datetime": "2024-04-21T10:00:00Z",
      "bin": 1,
      "level": 0,
      "temp": 34,
      "precip": 0,
      "humid": 41
    },
    {
      "datetime": "2024-04-21T09:00:00Z",
      "bin": 1,
      "level": 0,
      "temp": 34,
      "precip": 0,
      "humid": 47
    }
  ]
}
```

# DATA VISUALIZATION



## TREND OF WASTE LEVEL AND WEATHER CONDITION

- Interactive visualization on the trend of waste level and weather condition throughout the time.
- Provide insights into the relationship between waste generation and weather conditions.





# DEMONSTRATION







# THANK YOU

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