**Database Schema Documentation for Air Quality Monitoring Wristband**

**1. Introduction**

This document provides a detailed overview of the database schema designed for the Air Quality Monitoring Wristband. The goal of the schema is to efficiently store data related to users, wristbands, air quality measurements, locations, and notifications.

**2. Overview of Entities and Relationships**

The following entities and relationships are identified for the database schema:

* **User**: Represents the individual user of the wristband.
* **Wristband**: Represents the wearable device used for monitoring air quality.
* **Air Quality Measurement**: Represents the readings taken by the wristband sensors.
* **Location**: Represents the geographical coordinates where measurements were taken.
* **Notification**: Represents the alerts sent out based on air quality readings.

**Relationships**:

* One User can have one Wristband.
* One Wristband can have many Air Quality Measurements.
* One Wristband can have many Locations.
* One Air Quality Measurement can have one Notification.

**3. Detailed Table Structures**

**3.1. User Table**

| **Column Name** | **Data Type** | **Description** |
| --- | --- | --- |
| userID | INT | Unique identifier for the user. |
| name | VARCHAR | Name of the user. |
| email | VARCHAR | Email address of the user. |
| password | VARCHAR | Hashed password for authentication. |
| wristbandID | INT | Foreign key referencing the Wristband table. |

**3.2. Wristband Table**

| **Column Name** | **Data Type** | **Description** |
| --- | --- | --- |
| wristbandID | INT | Unique identifier for the wristband. |
| model | VARCHAR | Model name or number of the wristband. |
| batteryLevel | INT | Current battery level percentage. |

**3.3. Air Quality Measurement Table**

| **Column Name** | **Data Type** | **Description** |
| --- | --- | --- |
| measurementID | INT | Unique identifier for the measurement. |
| wristbandID | INT | Foreign key referencing the Wristband table. |
| PM1 | DECIMAL | Measurement for PM1 particles. |
| PM2.5 | DECIMAL | Measurement for PM2.5 particles. |
| PM10 | DECIMAL | Measurement for PM10 particles. |
| VOC | DECIMAL | Measurement for VOCs. |
| airQualityScore | INT | Calculated air quality score. |
| timestamp | DATETIME | Time when the measurement was taken. |

**3.4. Location Table**

| **Column Name** | **Data Type** | **Description** |
| --- | --- | --- |
| locationID | INT | Unique identifier for the location entry. |
| wristbandID | INT | Foreign key referencing the Wristband table. |
| latitude | DECIMAL | Latitude of the location. |
| longitude | DECIMAL | Longitude of the location. |
| timestamp | DATETIME | Time when the location was recorded. |

**3.5. Notification Table**

| **Column Name** | **Data Type** | **Description** |
| --- | --- | --- |
| notificationID | INT | Unique identifier for the notification. |
| measurementID | INT | Foreign key referencing the Air Quality Measurement table. |
| message | VARCHAR | Content of the notification. |
| timestamp | DATETIME | Time when the notification was triggered. |

**4. Conclusion**

The database schema has been designed to efficiently capture, store, and relate data from the Air Quality Monitoring Wristband. The structure ensures that user data, air quality measurements, locations, and notifications are properly linked and easily retrievable. This schema can be further expanded based on project requirements.

**5. Sensor Measurements and Storage**

**5.1. Background**

To ensure accurate and actionable insights, it's crucial to capture data from the sensors in an optimal manner. This involves understanding the type and nature of data each sensor provides, and subsequently modelling the database schema to store this information efficiently.

**5.2. Consideration of Sensors**

1. **PMS7003 (PM Sensor)**:
   * It measures particulate matter of different sizes: PM10, PM2.5, PM1, and PM0.3.
   * Given the granular data provided by this sensor, separate columns for each particulate size were considered essential to store distinct measurements.
   * E.g:   
     PM1.0: 12 μg/m³  
     PM2.5: 24 μg/m³  
     PM10: 30 μg/m³
2. **BME680 (Gas Sensor Array)**:
   * Measures VOCs which have a significant impact on air quality.
   * A separate column was designated for VOC measurements to ensure these readings are stored without loss of precision.
   * E,g:   
     VOC: 200 ppb
3. **Air530 (GPS)**:
   * Separate columns for latitude and longitude ensure that location data is captured accurately and can be correlated with air quality measurements.
   * E.g:  
     Latitude: 34.0522° N  
     Longitude: 118.2437° W

**5.3. Decision Process for Measurement Storage**

* **Type and Precision**: Ensured the database types selected (DECIMAL for particulate measurements and VOCs) retain the precision of the readings. This ensures data reliability when making critical health recommendations.
* **Timestamping**: All readings are associated with a timestamp. This provides context to the data, enabling users to understand when specific readings were taken, and correlate air quality with specific times of day or events.