

Environmental & Health Monitoring System

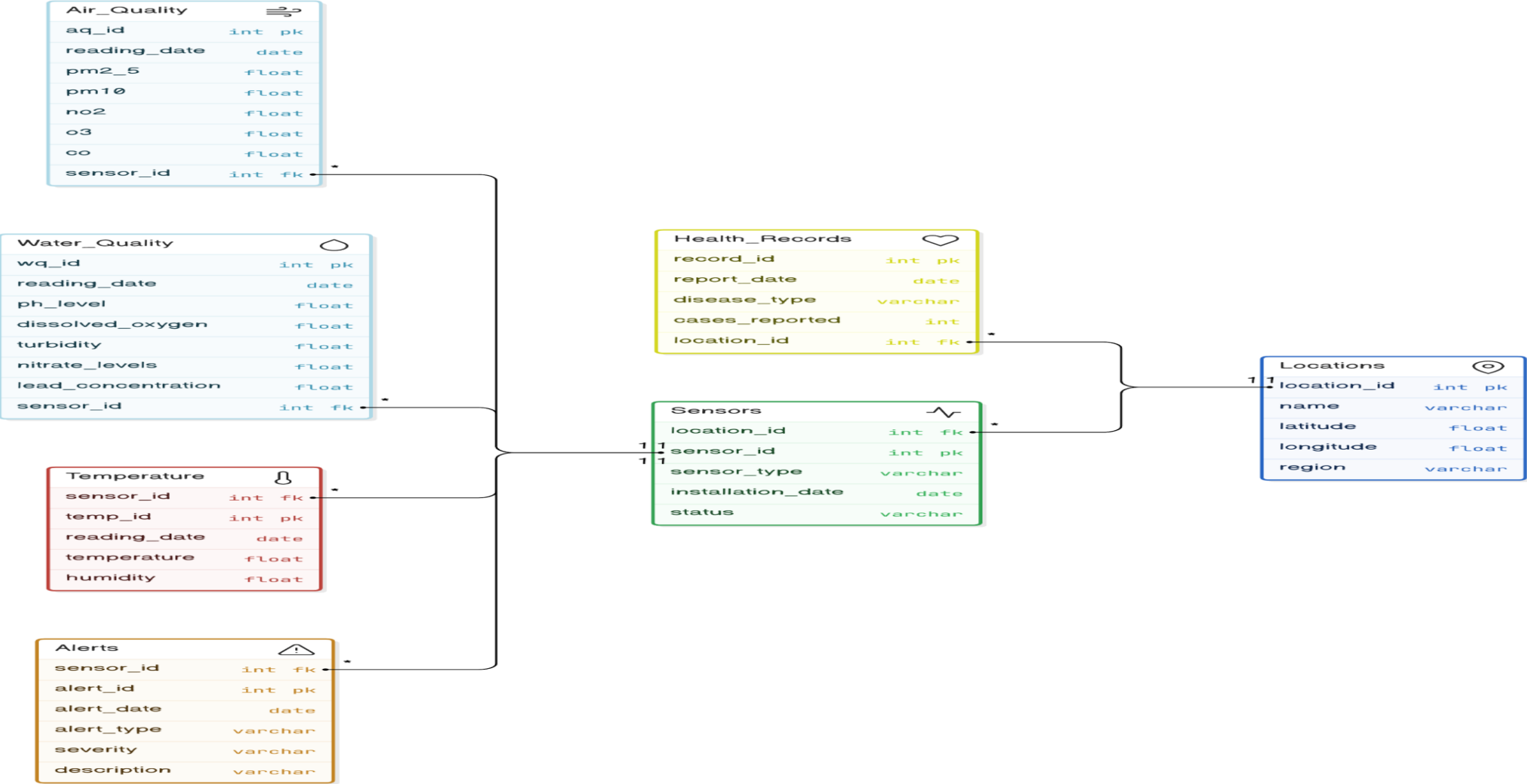


ABSTRACT

1. Aims to track and analyze various environmental factors, such as air and water quality, and temperature, across different locations.
2. By collecting data from sensors, the project provides insights into pollution levels, correlates them with health outcomes, and generates alerts for critical conditions.
3. This system helps in making informed decisions to protect public health and the environment.

ER-DIAGRAM

Environmental and Health Monitoring System



STRUCTURE OF THE TABLES

Locations Table

This table shows
different locations
with regions.

Syntax:

`DESC Locations;`

	Field	Type	Null	Key	Default	Extra
►	location_id	int(11)	NO	PRI	NULL	auto_increment
	name	varchar(100)	NO		NULL	
	latitude	float	NO		NULL	
	longitude	float	NO		NULL	
	region	varchar(50)	NO		NULL	

Sensors Table

This table shows different sensors installed at various locations.

Syntax:

DESC Sensors;

	Field	Type	Null	Key	Default	Extra
►	sensor_id	int(11)	NO	PRI	NULL	auto_increment
	location_id	int(11)	YES	MUL	NULL	
	sensor_type	varchar(50)	NO		NULL	
	installation_date	date	NO		NULL	
	status	varchar(20)	NO		NULL	

Health_Records Table

This table displays various health issues and its cases.

Syntax:

`DESC Health_Records;`

	Field	Type	Null	Key	Default	Extra
►	record_id	int(11)	NO	PRI	NULL	auto_increment
	location_id	int(11)	YES	MUL	NULL	
	report_date	date	NO		NULL	
	disease_type	varchar(50)	NO		NULL	
	cases_reported	int(11)	NO		NULL	

Alerts Table

This table displays different environmental alerts with severity.

Syntax:

DESC Alerts;

	Field	Type	Null	Key	Default	Extra
►	alert_id	int(11)	NO	PRI	NULL	auto_increment
	sensor_id	int(11)	YES	MUL	NULL	
	alert_date	date	NO		NULL	
	alert_type	varchar(50)	NO		NULL	
	severity	varchar(20)	NO		NULL	
	description	text	NO		NULL	

Temperature Table

This table shows
temperature and
humidity.

Syntax:

`DESC Temperature;`

	Field	Type	Null	Key	Default	Extra
►	temp_id	int(11)	NO	PRI	NULL	auto_increment
	sensor_id	int(11)	YES	MUL	NULL	
	reading_date	date	NO		NULL	
	temperature	float	NO		NULL	
	humidity	float	NO		NULL	

Water_Quality Table:

This table shows water quality based on various factors.

Syntax:

`DESC Water_Quality;`

	Field	Type	Null	Key	Default	Extra
►	wq_id	int(11)	NO	PRI	NULL	auto_increment
	sensor_id	int(11)	YES	MUL	NULL	
	reading_date	date	NO		NULL	
	ph_level	float	YES		NULL	
	dissolved_oxygen	float	YES		NULL	
	turbidity	float	YES		NULL	
	nitrate_levels	float	YES		NULL	
	lead_concentration	float	YES		NULL	

Air_Quality Table:

This table displays
air quality based on
different factors.

Syntax:

`DESC Air_Quality;`

	Field	Type	Null	Key	Default	Extra
►	aq_id	int(11)	NO	PRI	NULL	auto_increment
	sensor_id	int(11)	YES	MUL	NULL	
	reading_date	date	NO		NULL	
	pm2_5	float	YES		NULL	
	pm10	float	YES		NULL	
	no2	float	YES		NULL	
	o3	float	YES		NULL	
	co	float	YES		NULL	

CONTENTS OF THE TABLE

Locations

```
select * from Locations;
```

	location_id	name	latitude	longitude	region
►	1	Marine Drive	18.9435	72.8236	Mumbai
	2	India Gate	28.6129	77.2293	New Delhi
	3	Cubbon Park	12.9763	77.5929	Bengaluru
	4	Connaught Place	28.6315	77.2167	New Delhi
	5	Charminar	17.3616	78.4747	Hyderabad
	6	Vidhana Soudha	12.9797	77.5907	Bengaluru
	7	Gateway of India	18.922	72.8347	Mumbai
	8	Red Fort	28.6565	77.2425	New Delhi
	9	Juhu Beach	19.0982	72.8261	Mumbai
	10	Qutub Minar	28.5244	77.1855	New Delhi
	11	Marina Beach	13.0475	80.2829	Chennai
	12	Howrah Bridge	22.585	88.3468	Kolkata
	13	Victoria Memorial	22.5448	88.3426	Kolkata
	14	Meenakshi Temple	9.9195	78.1195	Madurai
	15	Mysore Palace	12.3052	76.6552	Mysore
	16	Rishikesh	30.1035	78.2943	Uttarakhand
	17	Sundarbans	21.9497	89.1833	West Bengal
	18	Golconda Fort	17.3833	78.4011	Hyderabad
	19	Dal Lake	34.1206	74.8222	Srinagar
	20	Ranthambore National Park	26.0173	76.5026	Rajasthan

Sensors

```
select * from Sensors;
```

	sensor_id	location_id	sensor_type	installation_date	status
▶	1	1	Air Quality	2023-01-15	Active
	2	2	Water Quality	2023-02-10	Active
	3	3	Temperature	2023-03-20	Inactive
	4	4	Air Quality	2023-01-15	Active
	5	5	Water Quality	2023-02-10	Active
	6	6	Temperature	2023-03-20	Inactive
	7	7	Air Quality	2023-04-05	Active
	8	8	Water Quality	2023-05-18	Maintenance
	9	9	Temperature	2023-06-22	Inactive
	10	10	Air Quality	2023-07-10	Active
	11	11	Water Quality	2023-08-11	Active
	12	12	Temperature	2023-09-15	Inactive
	13	13	Air Quality	2023-04-05	Active
	14	14	Water Quality	2023-05-18	Maintenance
	15	15	Temperature	2023-06-22	Inactive
	16	16	Air Quality	2023-07-10	Active
	17	17	Water Quality	2023-08-11	Active
	18	18	Temperature	2023-09-15	Inactive
	19	19	Air Quality	2023-01-15	Active
	20	20	Water Quality	2023-02-10	Active

Health_Records

```
select*from Health_Records;
```

	record_id	location_id	report_date	disease_type	cases_reported
▶	1	1	2024-01-01	Respiratory Issues	50
	2	2	2024-01-02	Waterborne Diseases	30
	3	3	2024-01-03	Heat Stroke	20
	4	4	2024-01-04	Asthma	40
	5	5	2024-01-05	Respiratory Issues	50
	6	6	2024-01-06	Waterborne Diseases	35
	7	7	2024-01-07	Heat Stroke	25
	8	8	2024-01-08	Asthma	45
	9	9	2024-01-09	Heat Stroke	20
	10	10	2024-01-10	Respiratory Issues	55
	11	11	2024-01-11	Waterborne Diseases	38
	12	12	2024-01-12	Heat Stroke	28
	13	13	2024-01-13	Asthma	40
	14	14	2024-01-14	Respiratory Issues	60
	15	15	2024-01-15	Asthma	45
	16	16	2024-01-16	Heat Stroke	28
	17	17	2024-01-17	Waterborne Diseases	42
	18	18	2024-01-18	Respiratory Issues	65
	19	19	2024-01-19	Asthma	48
	20	20	2024-01-20	Heat Stroke	30

Alerts

```
select * from Alerts;
```

	alert_id	sensor_id	alert_date	alert_type	severity	description
▶	1	1	2024-01-01	High PM2.5	High	Active
	2	2	2024-01-02	High NO2	Medium	Resolved
	3	3	2024-01-03	Low Dissolved Oxygen	Critical	Active
	4	4	2024-01-04	High Temperature	Medium	Acknowledged
	5	5	2024-01-05	High PM10	High	Active
	6	6	2024-01-06	High CO	Critical	Active
	7	7	2024-01-07	High PM2.5	High	Resolved
	8	8	2024-01-08	High NO2	Medium	Active
	9	9	2024-01-09	Low Dissolved Oxygen	Critical	Resolved
	10	10	2024-01-10	High Temperature	Medium	Active
	11	11	2024-01-11	High PM2.5	High	Active
	12	12	2024-01-12	High CO	Critical	Acknowledged
	13	13	2024-01-13	High PM10	High	Resolved
	14	14	2024-01-14	Low Dissolved Oxygen	Critical	Active
	15	15	2024-01-15	High Temperature	Medium	Resolved
	16	16	2024-01-16	High PM2.5	High	Acknowledged
	17	17	2024-01-17	High NO2	Medium	Active
	18	18	2024-01-18	High CO	Critical	Resolved
	19	19	2024-01-19	High PM10	High	Acknowledged
	20	20	2024-01-20	High NO2	Medium	Resolved

Temperature

```
select * from Temperature;
```

	temp_id	sensor_id	reading_date	temperature	humidity
►	1	1	2024-01-01	25.6	60
	2	2	2024-01-02	26.1	58
	3	3	2024-01-03	27.3	57
	4	4	2024-01-04	28	56
	5	5	2024-01-05	25.6	60
	6	6	2024-01-06	26.8	59
	7	7	2024-01-07	27.5	55
	8	8	2024-01-08	28.2	54
	9	9	2024-01-09	27.3	57
	10	10	2024-01-10	28.5	53
	11	11	2024-01-11	29	52
	12	12	2024-01-12	29.5	51
	13	13	2024-01-13	28	56
	14	14	2024-01-14	30	50
	15	15	2024-01-15	28.2	54
	16	16	2024-01-16	29.5	51
	17	17	2024-01-17	30.5	49
	18	18	2024-01-18	31	48
	19	19	2024-01-19	31.5	47
	20	20	2024-01-20	32	46

Water_Quality

```
select * from Water_Quality;
```

	wq_id	sensor_id	reading_date	ph_level	dissolved_oxygen	turbidity	nitrate_levels	lead_concentration
▶	1	1	2024-01-01	7.2	8.5	1	2.1	0.01
	2	2	2024-01-02	6.8	8.3	1.5	2.5	0.02
	3	3	2024-01-03	7	8	2	2.8	0.03
	4	4	2024-01-04	7.4	8.2	1.8	3	0.01
	5	5	2024-01-05	7.2	8.5	1	2.1	0.01
	6	6	2024-01-06	6.9	8.1	1.7	2.9	0.04
	7	7	2024-01-07	7.3	8.4	1.2	3.2	0.02
	8	8	2024-01-08	7.5	8.6	1.4	3.4	0.03
	9	9	2024-01-09	7	8	2	2.8	0.03
	10	10	2024-01-10	7.6	8.7	1.6	3.6	0.05
	11	11	2024-01-11	7.7	8.8	1.3	3.8	0.01
	12	12	2024-01-12	7.8	8.9	1.1	4	0.02
	13	13	2024-01-13	7.4	8.2	1.8	3	0.01
	14	14	2024-01-14	7.9	9	1.4	4.2	0.03
	15	15	2024-01-15	7.5	8.6	1.4	3.4	0.03
	16	16	2024-01-16	7.6	8.7	1.6	3.6	0.05
	17	17	2024-01-17	8	9.1	1.5	4.5	0.04
	18	18	2024-01-18	8.1	9.2	1.9	4.7	0.02
	19	19	2024-01-19	8.2	9.3	1.7	5	0.06
	20	20	2024-01-20	8.3	9.4	2.1	5.2	0.07

Air_Quality

```
select * from Air_Quality;
```

	aq_id	sensor_id	reading_date	pm2_5	pm10	no2	o3	co
►	1	1	2024-01-01	45.2	70.3	25.1	15.6	0.8
	2	2	2024-01-02	50.1	80	30.2	18.4	0.7
	3	3	2024-01-03	55	85.1	35.3	20.5	1
	4	4	2024-01-04	60.2	90.5	40.7	22.3	1.2
	5	5	2024-01-05	45.2	70.3	25.1	15.6	0.8
	6	6	2024-01-06	65.4	95.7	45.9	25	1.3
	7	7	2024-01-07	70.6	100.2	50.4	28.7	1.5
	8	8	2024-01-08	75.8	105.5	55.6	30.1	1.6
	9	9	2024-01-09	55	85.1	35.3	20.5	1
	10	10	2024-01-10	80	110.8	60.7	32.5	1.8
	11	11	2024-01-11	82.1	115.3	62.9	34.1	1.9
	12	12	2024-01-12	85.4	120.7	65	36	2.1
	13	13	2024-01-13	60.2	90.5	40.7	22.3	1.2
	14	14	2024-01-14	87.5	125	68.1	37.8	2.2
	15	15	2024-01-15	90.2	130.1	70.4	40	2.4
	16	16	2024-01-16	92.3	135.4	73.2	41.5	2.5
	17	17	2024-01-17	95	140.8	75.6	43	2.6
	18	18	2024-01-18	97.4	145.9	77.8	44.3	2.7
	19	19	2024-01-19	100	150	80	46	2.9
	20	20	2024-01-20	105	160	85	50	3

SUB- QUERIES

Find all the sensors which measures water quality and status is active.

```
SELECT sensor_id, sensor_type FROM Sensors WHERE status = 'Active' AND sensor_id  
IN
```

```
(SELECT sensor_id FROM Sensors
```

```
WHERE sensor_type = 'Water Quality');
```

	sensor_id	sensor_type
▶	2	Water Quality
	5	Water Quality
	11	Water Quality
	17	Water Quality
	20	Water Quality
●	NULL	NULL

Display all the locations where cases of respiratory issues reported.

```
SELECT location_id, name FROM Locations WHERE location_id IN  
(SELECT location_id FROM Health_Records  
WHERE disease_type = 'Respiratory Issues');
```

	location_id	name
▶	1	Marine Drive
	5	Charminar
	10	Qutub Minar
	14	Meenakshi Temple
	18	Golconda Fort
●	NULL	NULL

Display Name of the locations where No. of Asthma cases >40.

```
SELECT name, region FROM Locations WHERE location_id IN  
(SELECT location_id FROM Health_Records WHERE  
disease_type='Asthma' AND cases_reported>40);
```

	name	region
▶	Red Fort	New Delhi
	Mysore Palace	Mysore
	Dal Lake	Srinagar

Show the reading dates where temperature>30 and humidity is>40

```
SELECT reading_date, temperature, humidity FROM Temperature  
WHERE sensor_id  
IN (SELECT temp_id WHERE temperature>30 AND humidity>40);
```

	reading_date	temperature	humidity
►	2024-01-17	30.5	49
	2024-01-18	31	48
	2024-01-19	31.5	47
	2024-01-20	32	46

Display the locations where either Heat stroke or Waterborne diseases reported.

```
SELECT name, region FROM locations WHERE location_id IN  
(SELECT location_id FROM Health_Records WHERE disease_type= 'Heat Stroke'  
OR  
disease_type='Waterborne Diseases');
```

	name	region
►	India Gate	New Delhi
	Cubbon Park	Bengaluru
	Vidhana Soudha	Bengaluru
	Gateway of India	Mumbai
	Juhu Beach	Mumbai
	Marina Beach	Chennai
	Howrah Bridge	Kolkata
	Rishikesh	Uttarakhand
	Sundarbans	West Bengal
	Ranthambore National Park	Rajasthan

Display Alerts whose severity is either high or critical and is currently active

```
SELECT alert_type FROM alerts WHERE sensor_id IN  
(SELECT alert_id WHERE severity='High' OR severity='Critical' AND  
description='Active');
```

	alert_type
▶	High PM2.5
	Low Dissolved Oxygen
	High PM10
	High CO
	High PM2.5
	High PM2.5
	High PM10
	Low Dissolved Oxygen
	High PM2.5
	High PM10

Find dates where co emission > 2 and no2 emission between 65 and 80.

```
SELECT reading_date,co,no2 FROM Air_Quality WHERE sensor_id IN  
(SELECT aq_id WHERE co>2 AND no2 BETWEEN 65 AND 80);
```

	reading_date	co	no2
►	2024-01-12	2.1	65
	2024-01-14	2.2	68.1
	2024-01-15	2.4	70.4
	2024-01-16	2.5	73.2
	2024-01-17	2.6	75.6
	2024-01-18	2.7	77.8
	2024-01-19	2.9	80

JOINS

Find the locations where sensors detect air quality and are active.

```
SELECT sensor_id IN, l.name FROM Sensors s  
JOIN Locations l ON s.location_id = l.location_id  
WHERE s.sensor_type = 'Air Quality' AND s.status = 'Active';
```

	sensor_id	name
►	1	Marine Drive
	4	Connaught Place
	7	Gateway of India
	10	Qutub Minar
	13	Victoria Memorial
	16	Rishikesh
	19	Dal Lake

Retrieve the location names and the count of active sensors installed at each location.

```
SELECT l.name, COUNT(s.sensor_id) AS active_sensor_count  
FROM Locations l JOIN Sensors s ON l.location_id = s.location_id WHERE s.status = 'Active'  
GROUP BY l.name;
```

	name	active_sensor_count
►	Charminar	1
	Connaught Place	1
	Dal Lake	1
	Gateway of India	1
	India Gate	1
	Marina Beach	1
	Marine Drive	1
	Qutub Minar	1
	Ranthambore National Park	1
	Rishikesh	1
	Sundarbans	1
	Victoria Memorial	1

Display location name where cases of waterborne diseases reported with number of cases.

```
SELECT l.name, hr.disease_type,  
SUM(hr.cases_reported) AS total_cases  
FROM locations l  
LEFT JOIN health_records hr ON  
l.location_id = hr.location_id  
WHERE  
hr.disease_type='Waterborne Diseases'  
GROUP BY  
l.name, hr.disease_type;
```

	name	disease_type	total_cases
▶	India Gate	Waterborne Diseases	30
	Marina Beach	Waterborne Diseases	38
	Sundarbans	Waterborne Diseases	42
	Vidhana Soudha	Waterborne Diseases	35

Retrieve top 5 locations with high temperature and its corresponding humidity.

```
SELECT l.name, MAX(t.temperature)
AS max_temperature,
MAX(t.humidity) AS max_humidity
FROM locations l
LEFT JOIN sensors s ON l.location_id =
s.location_id
LEFT JOIN temperature t ON s.sensor_id =
t.sensor_id
GROUP BY l.name
ORDER BY max_temperature DESC
LIMIT 5;
```

	name	max_temperature	max_humidity
►	Ranthambore National Park	32	46
	Dal Lake	31.5	47
	Golconda Fort	31	48
	Sundarbans	30.5	49
	Meenakshi Temple	30	50

Display locations with ph level above 7.5

```
SELECT l.name, wq.reading_date,  
wq.ph_level  
FROM water_quality wq  
RIGHT JOIN locations l ON  
wq.sensor_id = l.location_id  
WHERE  
ph_level>7.5;
```

	name	reading_date	ph_level
►	Qutub Minar	2024-01-10	7.6
	Marina Beach	2024-01-11	7.7
	Howrah Bridge	2024-01-12	7.8
	Meenakshi Temple	2024-01-14	7.9
	Rishikesh	2024-01-16	7.6
	Sundarbans	2024-01-17	8
	Golconda Fort	2024-01-18	8.1
	Dal Lake	2024-01-19	8.2
	Ranthambore National Park	2024-01-20	8.3

Show No. of cases and nitrate level when disease type is waterborne diseases.

```
SELECT hr.disease_type,  
hr.cases_reported, wq.nitrate_levels  
FROM water_quality wq  
RIGHT JOIN health_records hr  
ON  
wq.sensor_id = hr.location_id  
WHERE  
disease_type='Waterborne  
Diseases';
```

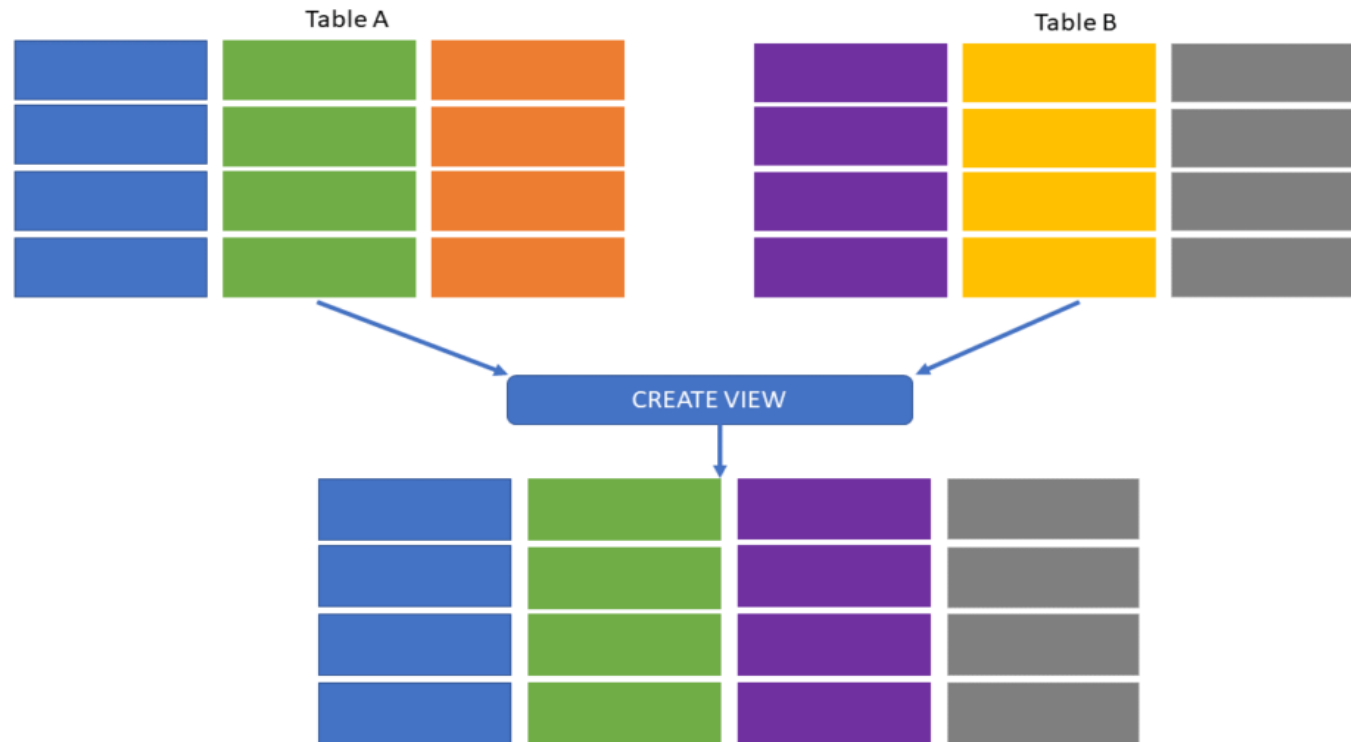
	disease_type	cases_reported	nitrate_levels
▶	Waterborne Diseases	30	2.5
	Waterborne Diseases	35	2.9
	Waterborne Diseases	38	3.8
	Waterborne Diseases	42	4.5

Display all locations with their pm2.5 and pm10 readings.

```
SELECT l.name, aq.reading_date,  
aq.pm2_5, aq.pm10  
FROM air_quality aq  
RIGHT JOIN locations l  
ON  
aq.sensor_id = l.location_id;
```

	name	reading_date	pm2_5	pm10
▶	Marine Drive	2024-01-01	45.2	70.3
	India Gate	2024-01-02	50.1	80
	Cubbon Park	2024-01-03	55	85.1
	Connaught Place	2024-01-04	60.2	90.5
	Charminar	2024-01-05	45.2	70.3
	Vidhana Soudha	2024-01-06	65.4	95.7
	Gateway of India	2024-01-07	70.6	100.2
	Red Fort	2024-01-08	75.8	105.5
	Juhu Beach	2024-01-09	55	85.1
	Qutub Minar	2024-01-10	80	110.8
	Marina Beach	2024-01-11	82.1	115.3
	Howrah Bridge	2024-01-12	85.4	120.7
	Victoria Memorial	2024-01-13	60.2	90.5
	Meenakshi Temple	2024-01-14	87.5	125
	Mysore Palace	2024-01-15	90.2	130.1
	Rishikesh	2024-01-16	92.3	135.4
	Sundarbans	2024-01-17	95	140.8
	Golconda Fort	2024-01-18	97.4	145.9
	Dal Lake	2024-01-19	100	150
	Ranthambore National Park	2024-01-20	105	160

VIEWS IN MYSQL



Create a View to display average pm 2.5 level of all locations .

```
CREATE VIEW View_AirQualityByLocation  
AS
```

```
SELECT l.name, AVG(a.pm2_5) AS  
avg_pm25_level
```

```
FROM Locations l
```

```
JOIN Sensors s ON l.location_id =  
s.location_id
```

```
JOIN Air_Quality a
```

```
ON
```

```
s.sensor_id = a.sensor_id
```

```
GROUP BY l.name;
```

```
SELECT * from View_AirQualityByLocation;
```

	name	avg_pm25_level
►	Charminar	45.20000076293945
	Connaught Place	60.20000076293945
	Cubbon Park	55
	Dal Lake	100
	Gateway of India	70.5999984741211
	Golconda Fort	97.4000015258789
	Howrah Bridge	85.4000015258789
	India Gate	50.099998474121094
	Juhu Beach	55
	Marina Beach	82.0999984741211
	Marine Drive	45.20000076293945
	Meenakshi Temple	87.5
	Mysore Palace	90.19999694824219
	Qutub Minar	80
	Ranthambore N...	105
	Red Fort	75.80000305175781
	Rishikesh	92.30000305175781
	Sundarbans	95
	Victoria Memorial	60.20000076293945
	Vidhana Soudha	65.4000015258789

Create a view that shows the total number of alerts by severity level for each location.

```
CREATE VIEW
View_AlertsByLocation AS

SELECT l.name, a.severity,
COUNT(a.alert_id) AS total_alerts
FROM Locations l
JOIN Sensors s ON l.location_id =
s.location_id
JOIN Alerts a ON s.sensor_id =
a.sensor_id
GROUP BY l.name, a.severity;

select * from
View_AlertsByLocation;
```

	name	severity	total_alerts
▶	Charminar	High	1
	Connaught Place	Medium	1
	Cubbon Park	Critical	1
	Dal Lake	High	1
	Gateway of India	High	1
	Golconda Fort	Critical	1
	Howrah Bridge	Critical	1
	India Gate	Medium	1
	Juhu Beach	Critical	1
	Marina Beach	High	1
	Marine Drive	High	1
	Meenakshi Temple	Critical	1
	Mysore Palace	Medium	1
	Qutub Minar	Medium	1
	Ranthambore N...	Medium	1
	Red Fort	Medium	1
	Rishikesh	High	1
	Sundarbans	Medium	1
	Victoria Memorial	High	1
	Vidhana Soudha	Critical	1



Prepared By

ASHUTOSH SANTOSH
RANE

T324/DS&DA/July2024
/1-3pm/PS/R/Data
Science

THANK YOU