

Weather Chronicles

A Historical Weather Database

The historical weather database acquaints public users with weather conditions of coastal locations in North Carolina during the period from May 2014 to August 2014. The data for a chosen date range is displayed in a table or graphically to present weather trends.

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Scope of Work

The scope of work is to design a historical weather database that will provide the user with information about temperature, humidity, precipitation, tides, the moon (rise, set and phase), the sun (rise and set), ocean conditions and the occurrence of a shark attack based on user selection. Users will be able to view a maximum of two weeks of record at a given time. Users can view hourly weather records for a particular day, as well as the minimum, maximum, and average records. Additionally, users will also be able to graphically view weather trends over the four month period. The database maintains weather information for four months (May 2014 to August 2014) for coastal regions in North Carolina where a shark attack occurred in 2014. This database is projected to be completed by December 2015.

Business Rules

Public users will be able to access a historical weather database. On the first page, the user will be prompted to enter a zip code or city/state for the area of the desired weather information. The user will be limited to coastal regions in the state of North Carolina. The user will also be prompted to enter the date, or range of dates, they wish to research. A user may not enter a date range longer than 14 days. The user will select the desired weather conditions to describe the selected date(s).

After submitting the above information, the user will view the desired historical weather information. A grid of dates and weather conditions will be displayed (dates as rows, weather conditions as columns). The following weather conditions are available to be selected for display: temperature (minimum, maximum and average), humidity level (minimum, maximum, and average), precipitation total, wind speeds (minimum, maximum, and average), time of sunrise and sunset, time of moonrise and moonset and the moon phase. The following information on ocean conditions will also be available for selection to be displayed: ocean temperature, time of high tides, time of low tides and if there was a recorded shark attack. If the date range selected is more than one day, a row titled "Range" at the bottom of the table will display the weather conditions for the entire date range selected. The information for a range of dates selected will exclude time of sunrise and sunset, time of moonrise and moonset and the moon phase. Each date will be a hyperlink that will show hourly data for all of the selected weather conditions, excluding data on the sun, moon, tide and precipitation.

The user will be able to access a second page that will show weather trends in a selected region over a desired time frame of the four month span. The user will be prompted to enter the zip code, date range, and type of graph they wish to use to display the information. The average values of the weather conditions will be shown in the graphs. Therefore, no graphs for sun rise/set, moon phase, tides or shark attack will be displayed.

Constraints

- Weather details are only shown for costal regions in the state of North Carolina where a shark attack occurred in 2014.
- Only dates that fall within the selected four-month span (May 2014 to August 2014) are accepted. No current or future dates are accepted.
- Only time zone UTC-5:00 time is displayed.
- Weather details are not shown for date ranges more than 14 days.
- This system does not show any weather predictions.
- Only zip codes in numbers are accepted.
- Weather details are displayed only for the requested zip code. Weather details for the surrounding areas are not displayed.
- Only the average values of weather conditions are shown for trends.
- Hour-by-hour weather details are displayed if user selects a particular day.

User Interface Requirements

The home page of the website should have a labeled textbox in which the user enters the zip code of the city for which the weather history should be fetched. If the entered zip code does not exist or is out of scope (currently available coastal region is North Carolina), provide the user with an error message that explains the error to the user and how to rectify it. The user should be able to select a date range (mm/dd/yyyy) from the calendar menu that pops up when the date text box is clicked. If the range selected by user exceeds the range of 14 days, a pop up with an error message explaining the error and how to rectify it will be displayed. The selectable range of data should be four months (May 1, 2015 to September 1, 2015).

The user is given various check boxes to select the desired weather condition(s) for which descriptive data is displayed for the selected zip code and period of time. The available weather conditions to choose from are temperature, humidity level, precipitation total, wind speeds, sun and moon rise and set, moon phase, tides, ocean conditions and shark attacks. The user must select at least one check box for the above mentioned weather conditions. Failing to select at least one check box will result in a pop up error message that explains the error and how to rectify it.

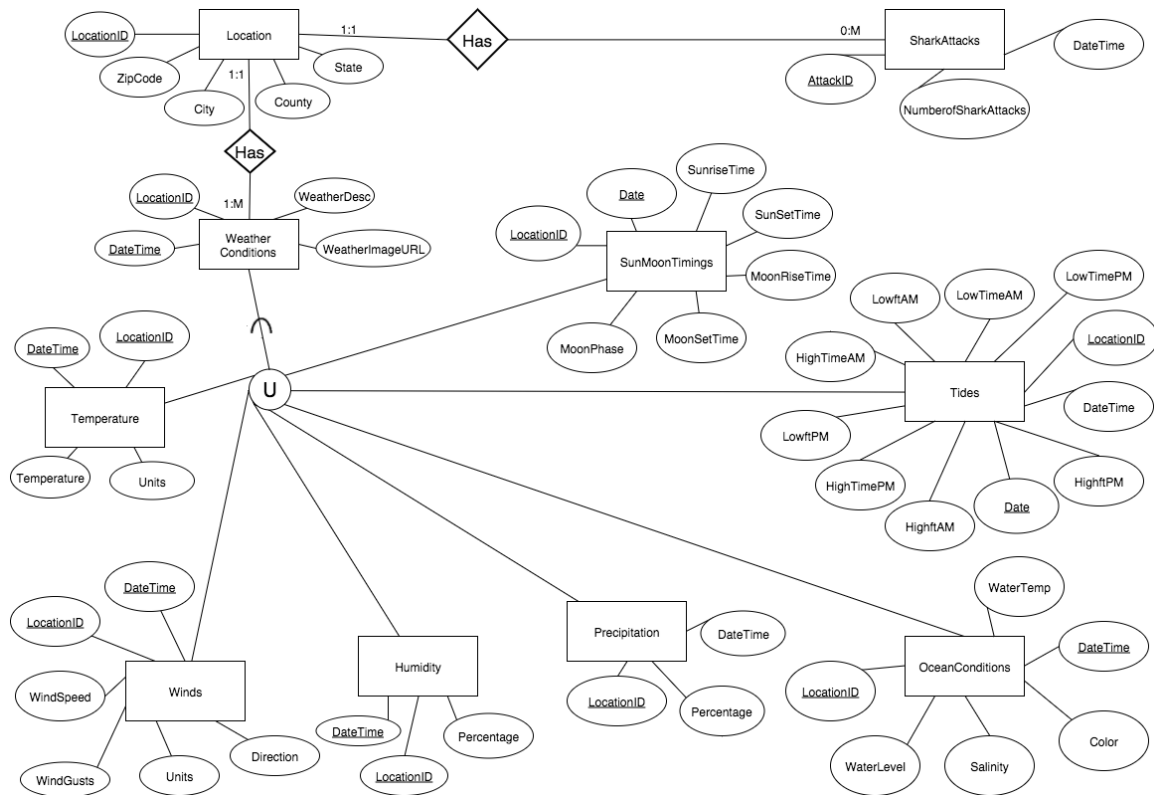
The second page will provide the user with a table containing the weather data (the data of the requested columns that was selected in the check boxes) for the period of time that was selected by the user. The row headers will display the date for which the weather condition data in the row is describing and the column headers will display the weather condition shown.

The trends add on page will enable the user to view the distribution of the weather condition graphically. This page will have a textbox for the user to enter the zip code of the target zip code for which the user requires the distribution of the climatic condition. The user then has to select a date range (mm/dd/yyyy) from the calendar menu that pops up when the date text box is clicked. The user then can select the type of condition to display using the check boxes that are available. The user, upon submission of this page, must be shown the graphical representation of the distribution of the specified weather condition for the requested period of time in the specified city. The graphical representations must clearly mention the key and the scale used in the representation. The graphs should be responsive and must be scaled according to the device on which it is being viewed. This page must enable the user to refresh with different inputs for the required values and must be robust and respond according to the specified values.

User and User Privileges

This database is open to the public.

EER Diagram



EERD Narrative and Features

The above diagram shows the entity relationships in the Weather Chronicles Database. Every location is stored in a Location table. A location can have one to many weather conditions. A weather condition will have one and only one location. A Weather Condition may or may not have a relationship with entities Temperature, Winds, Precipitation, Humidity, Sun/Moon Timings, Tides and Ocean Conditions. A Location can have zero to many Shark Attacks recorded. A Shark Attack will have one and only one Location recorded. The database is accessible by the public.

All tables are in 3rd Normal Form.

Due to the nature of the database created, the generalization/specialization and the many-to-many relationship requirement is fulfilled through the use of a union. Weather Conditions is a subclass of the union of superclasses Temperature, Winds, Precipitation, Humidity, Sun/Moon Timings, Tides and Ocean Conditions.

Tables

Locations

Location_ID (PK)	INT(11)
Zip_code	INT(11)
City	VARCHAR(45)
State	VARCHAR(45)
County	VARCHAR(45)

Temperature

Date_Time (PK)	DATETIME
Location_ID (PK, FK)	INT(11)
Temperature	FLOAT
Units	VARCHAR(10)

Winds

DateTime (PK)	DATETIME
Location_ID (PK, FK)	INT(11)
Wind_Speed	FLOAT
Wind_Gusts	FLOAT
Units	VARCHAR(10)
Direction	VARCHAR(10)

Humidity

DateTime (PK)	DATETIME
Location_ID (PK, FK)	INT(11)
Percentage	FLOAT

Precipitation

DateTime (PK)	DATETIME
Location_ID (PK, FK)	INT(11)
Percentage	FLOAT

Tides

Date (PK)	DATE
Location_ID (PK, FK)	INT(11)
Station_ID	INT(11)
Highft_PM	FLOAT
HighTime_PM	DATETIME
Highft_AM	FLOAT
HighTime_AM	DATETIME
Lowft_PM	FLOAT
LowTime_PM	DATETIME
Lowft_AM	FLOAT
LowTime_AM	DATETIME

SunMoonTimings

Date (PK)	DATE
Location_ID (PK, FK)	INT(11)
Sunrise_Time	VARCHAR(45)
SunSet_Time	VARCHAR(45)
MoonRise_Time	VARCHAR(45)
MoonSet_Time	VARCHAR(45)
MoonPhase	VARCHAR(10)

OceanConditions

Date_Time (PK)	DATETIME
Location_ID (PK, FK)	INT(11)
Water_Level	FLOAT
Salinity	FLOAT
Color	VARCHAR(10)
Water_Temp	FLOAT

SharkAttacks

Attack_ID (PK)	INT(11)
Location_ID (FK)	INT(11)
Occurance_date	DATE
Injury_caused	VARCHAR(100)

Weather Conditions

DateTime (PK)	DATETIME
LocationID (PK, FK)	INT(11)
WeatherDesc	VARCHAR(45)
WeatherImageURL	VARCHAR(500)

Test Data

The test data for all of the weather conditions, except for Tides and Ocean Conditions, was downloaded from World Weather Online (www.worldweatheronline.com) using API: <http://api.worldweatheronline.com/premium/v1/past-weather.ashx> with key:

The test data for Ocean Conditions was found at Carolinas Regional Costal Ocean Observing System, which can be found at <http://carolinasrcoos.org/queryStation.php?tab=5><http://carolinasrcoos.org/queryStation.php?tab=5>.

The test data for Shark Attacks was found through the Global Shark Attack File Incident Log at www.sharkattackfile.net.

For Tides, dummy data was entered in order for demonstration purposes of the database.

Database Implementation Features

Create and insert statements:

A sample database creation script is embed as below. Double click on the icon to view the script. Script has several CREATE and INSERT statements along with the TRIGGER.



Sample queries for Weather Chronicles

- 1) Display all the cities where the weather description is sunny

```
Select distinct weather_conditions.WeatherDesc, locations.City AS cities
From locations
Inner join weather_conditions
ON locations.Location_ID=weather_conditions.LocationID
where weather_conditions.WeatherDesc='Sunny';
```


Non-detailed output:

	WeatherDesc	cities
►	Sunny	"Coligny Beach
	Sunny	"Figure Eight Island
	Sunny	"Juan Ponce de León Landing
	Sunny	3 to 4 miles west of Indian P...
	Sunny	Anahimicola Bay

2) Display the temperature in the location where the weather description is overcast

```
Select distinct weather_conditions.WeatherDesc, temperature.Temperature
FROM temperature
Inner join weather_conditions
ON weather_conditions.LocationID=temperature.Location_ID
where weather_conditions.WeatherDesc='Overcast';
```

Non-detailed output:

	WeatherDesc	Temperature
►	Overcast	66
	Overcast	65
	Overcast	67
	Overcast	69
	Overcast	70

3) Display cities where shark attack happened when weather description is patchy rain nearby

```
Select distinct weather_conditions.WeatherDesc, locations.City
From locations
Join weather_conditions
ON weather_conditions.LocationID=locations.Location_ID
Join sharkattacks
ON weather_conditions.LocationID=sharkattacks.Location_ID
Where weather_conditions.WeatherDesc='Patchy rain nearby';
```

Non-detailed output:

	WeatherDesc	City
►	Patchy rain nearby	New Smyrna Beach
	Patchy rain nearby	"Juan Ponce de León Landing
	Patchy rain nearby	Bethel Shoals
	Patchy rain nearby	Masonboro Island
	Patchy rain nearby	Indialantic

4) Display injury caused in shark attacks where humidity percentage > 50

Select distinct sharkattacks.Injury_caused, humidity.Percentage
 From sharkattacks
 Join humidity
 ON sharkattacks.Location_ID=humidity.Location_ID
 Where percentage > 50;

Non-detailed output:

	Injury_caused	Percentage
	Laceration to right hand and cuts on fingertips	54
	Laceration to right hand and cuts on fingertips	56
	Laceration to right hand and cuts on fingertips	59
	Laceration to right hand and cuts on fingertips	62
	Laceration to right hand and cuts on fingertips	65

5) Display the location, when temperature < 50 and precipitation percentage > 0.1

Select locations.City, locations.State, temperature.Temperature, precipitation.Percentage
 From locations
 Join temperature
 On locations.Location_ID=temperature.Location_ID
 Join precipitation
 On temperature.Location_ID=precipitation.Location_ID
 where temperature.Temperature <50 and precipitation.Percentage >= 0.1;

Non-detailed output:

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	City	State	Temperature	Percentage
►	Bethel Shoals	Florida	47	0.1
	Bethel Shoals	Florida	46	0.1
	Bethel Shoals	Florida	45	0.1
	Bethel Shoals	Florida	48	0.1
	Assateague National Seashore	Maryland	40	0.1

- 6) Display all the zip code where shark attacks happened , when precipitation percentage = 0 and humidity <60

```

Select locations.Zip_code, sharkattacks.Attack_ID, precipitation.Percentage,
humidity.Percentage
from locations
Join sharkattacks
ON locations.Location_ID=sharkattacks.Location_ID
Join precipitation
On sharkattacks.Location_ID=precipitation.Location_ID
Join humidity
ON precipitation.Location_ID=humidity.Location_ID
where precipitation.Percentage=0 and humidity.Percentage<60;

```

Non-detailed output:

	Zip_code	Attack_ID	Percentage	Percentage
►	32168	1	0	54
	32168	1	0	56
	32168	1	0	59
	32168	1	0	58
	32168	15	0	54

- 7) Display the temperature when sunrise time = moonrise time and sunset time = moonset time.

```

Select temperature.Temperature, locations.City, sunmoontimings.Sunrise_Time,
sunmoontimings.Moonrise_Time, sunmoontimings.Sunset_Time,
sunmoontimings.Moonset_Time
from temperature
Join locations
ON locations.Location_ID=temperature.Location_ID
Join sunmoontimings
on temperature.Location_ID=sunmoontimings.Location_ID

```

where sunmoontimings.Sunrise_Time=sunmoontimings.Moonrise_Time and
sunmoontimings.Sunset_Time=sunmoontimings.Moonset_Time;

Non-detailed output:

Temperature	City	Sunrise_Time	Moonrise_Time	Sunset_Time	Moonset_Time
-------------	------	--------------	---------------	-------------	--------------

- 8) Display the date on which the temperature was the highest in all the places of north Carolina

```
select temperature.Temperature, locations.City, locations.State, temperature.Date_Time
from temperature
Join locations
on temperature.Location_ID=locations.Location_ID
where locations.State='North Carolina' and max(temperature.Temperature);
```

Non-detailed output:

	Temperature	City	State	Date_Time
▶	67	Masonboro Island	North Carolina	2015-05-02 00:00:00
	70	Masonboro Island	North Carolina	2015-05-02 00:00:00
	72	Masonboro Island	North Carolina	2015-05-02 00:00:00
	75	Masonboro Island	North Carolina	2015-05-02 00:00:00
	73	Masonboro Island	North Carolina	2015-05-02 00:00:00

- 9) Date range where shark attacks happened

```
select sharkattacks.Occurance_date, locations.State
from sharkattacks
join locations
on sharkattacks.Location_ID=locations.Location_ID
where Occurance_date between '2014-05-06' and '2014-05-15';
```

Non-detailed output:

	Occurance_date	State
►	2014-05-06	Hilton Head"
	2014-05-11	Georgia
	2014-05-13	Florida
	2014-05-15	Melbourne Beach"
	2014-05-16	Florida

10) Moon phase when attack happened

```
select distinct sharkattacks.Location_ID, Attack_ID, sunmoontimings.MoonPhase
from sunmoontimings
join sharkattacks
on sharkattacks.Location_ID=sunmoontimings.Location_ID;
```

Non-detailed output:

	Location_ID	Attack_ID	MoonPhase
►	1	1	<{MoonPhase: }>
	1	15	<{MoonPhase: }>
	1	29	<{MoonPhase: }>
	2	2	<{MoonPhase: }>
	3	3	<{MoonPhase: }>

Stored Procedure:

Triggers:

This database have trigger called LunarPhase which calculates day of Moon cycle on particular given date. While inserting new row in 'sunmoontimings' table, this trigger will take action and calculated day of lunar cycle will be inserted in 'MoonPhase' column. Below is the trigger definition.

```
DELIMITER $$
CREATE DEFINER = CURRENT_USER TRIGGER
`weather_chronicles`.`LunarPhase` BEFORE INSERT ON
`sunmoontimings` FOR EACH ROW
BEGIN
set @ref = '2014-01-01';
set NEW.MoonPhase = ((SELECT datediff(NEW.Date,@ref))%29);
END$$
DELIMITER ;
```

Transaction

Explain

Query Optimization Techniques

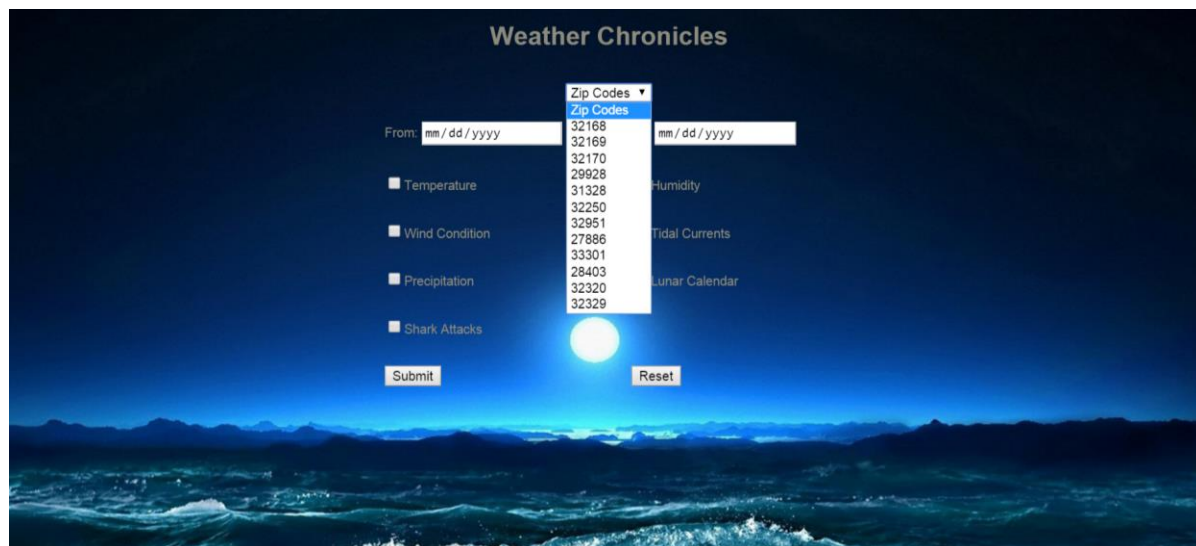
Indexes

Views

GUI Interface

Below is the rudimentary first page. Zip code drop down is populated from the database table. This restricts the user to select the Zip code only from North Carolina.

Front end will have subsequent changes in the next release of the project.



Future Scope

- **Additional Dates:** Expanding the date ranges to a period longer than four months in the year of 2014 would produce a larger database.
- **Additional Locations:** Expanding the locations to the entire East Coast would add to the size of the database and allow users to study the shark attacks that occurred in other locations than North Carolina.
- **Updating of the Database using Federated Tables:**

Method of Communication and Project Planning

The Spartans created a Google Group that was used for communication as well as file sharing through Google Drive. The group also communicated more informally through a WhatsApp group.

Project Plan

Tuesday, October 6, 2015: Report II

- Report I (Edited)
- EER Diagram Normalized with narrative
- Must include:
 - Generalization/specialization
 - At least one many to many relationship resolved
 - List of Tables, Attributes, Data Types (Data Dictionary)
 - Groups must implement 8 to 12 entities

Tuesday, October 27th: Project Part III Report and SQL Script File

Tuesday, November 24th: Project Part IV GUI/Final Report

- A graphical user interface (GUI) for the proposed database application.
- Final project report, which may contain the revised version of all the previous reports.
 - Discussion of query optimization, database tuning and physical design: tuning decisions taken and design of indexes, security issues.
 - Section on future work.

Spartan Member Information

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