Project Thor

Design Document

Version 1.0

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1.   Introduction

This Design Document is a document to provide documentation which will be used to aid in the project development. Within are narrative and graphical representations of the designs for the project including UML diagrams, use case diagrams, database designs, website page wireframes, and system architecture. …..

1.1.   Purpose

Project Thor's main goal is to provide a simple method that uses data gathered from natural phenomena (in our case lightning) to produce more random numbers to be used as seeds for encryption key algorithms. Keeping in line with that goal, the purpose of this design document is to provide a description of the design of our project fully enough to allow for the development to proceed while giving those involved in the project an understanding of what is to be produced and how it is expected to be produced. This document is intended to be used alongside the Requirements Document and reflect the specifications described therein.

1.2.   Scope

As stated in the purpose section, this document is provided simply to provide a description of the design of the project. This description is limited to the project deliverables specified in the requirements document: web application, database, and data transfer automation. All other designs relating to tools, research, repositories, file management systems, etc., shall be considered outside the scope of this document and will be left to the team members to construct or source on an adjunct basis.

1.3.   Intended Audience

The intended audience for this document are the team members and developers of this project who are directly involved in the development of the project deliverables. However, this document may also be used by the faculty advisor and others who are involved in the project in a review capacity in order to gain an understanding of what will be developed and delivered to the client as well as how it will be developed.

1.4.   References

This document makes some references to external resources not defined or specified herein. Therefore, for ease of reference they have been listed and linked below.

- Project Thor: [Requirements Document](#)

2. System Design

This section of the document discusses the design aspects of our project's system from a high-level perspective. In the sections below, developers will be given an idea of the different components of our system along with how they will be expected to interact with each other to achieve our project's goal. Additionally, we have specified the design of some of the processes users will be expected to use to interact with our system.

2.1. Overview

The purpose of our system is to demonstrate our project's goal, which is to implement a high entropy data set created by natural phenomena into the process to generate encryption keys as referenced in the solution section of our Requirements Document. In doing so, the Project Thor team has designed a system that incorporates a database containing the data set, scripts that transfer new data into the database, and a web application that educates users about the project and shows them a working example. Each of these system components accomplishes a certain task towards that goal and the critical design aspects of each are described throughout the remainder of this document.

2.2. System Architecture
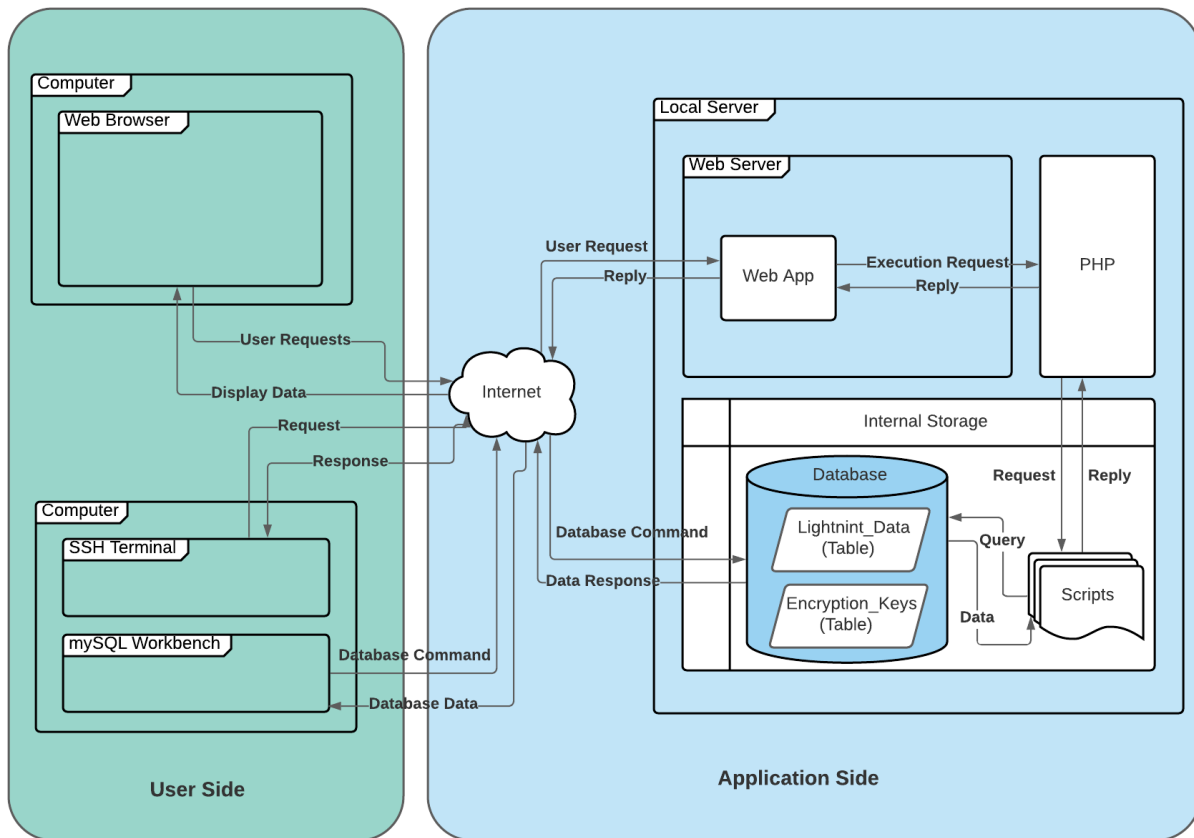

Figure 1: System Architecture Diagram

The system's layout and interactions are relatively simple as can be seen in figure one. It is broken down into two main areas: the user side and the application side. There is very little design to be done on the user side, but it's more important to understand the interactions taking place so that the application side can be designed to accommodate them. For example, per requirements WEB-4 and WEB-5, the web application must be accessible on specific operating systems and web browsers. Therefore, the team shall allow the users to interact with the web application via their home computers on their favorite web browser. On the other hand, the project team shall interface with the web application through any ssh terminal and the database, specifically through MySQL Workbench. On the other side, we have many more system design tasks.

Beginning with the database, the team must design two different tables to be stored there. More details on the design of those tables can be found in a later section of this document. However, the management of those tables will be handled by the team (via MySQL Workbench) and by two python scripts. The first script will be tasked

with the automated transfer of the data from an ASCII text file into the first table of the database. It will only transfer the specific lightning parameters needed for the project and examine and sort out bad data. The qualifications for "bad" data shall be determined by the team at a later time. The second script will pull data from the first table, combine it into one seed value, run that value through an encryption key algorithm, and then store the new key within the second table of the database.

In regards to the web server, the team will have to design a web application using PHP. The specific UI designs of the application are detailed within the Web Application Interface section of this document. However, in addition to the interface design, the team must also create a method that will retrieve a key and the lighting data used to create it from the appropriate tables within the database. Lastly, the team will also have a submitForm method in which users can send messages to them to request more information, report defects, etc.

2.3. Use Case Diagram
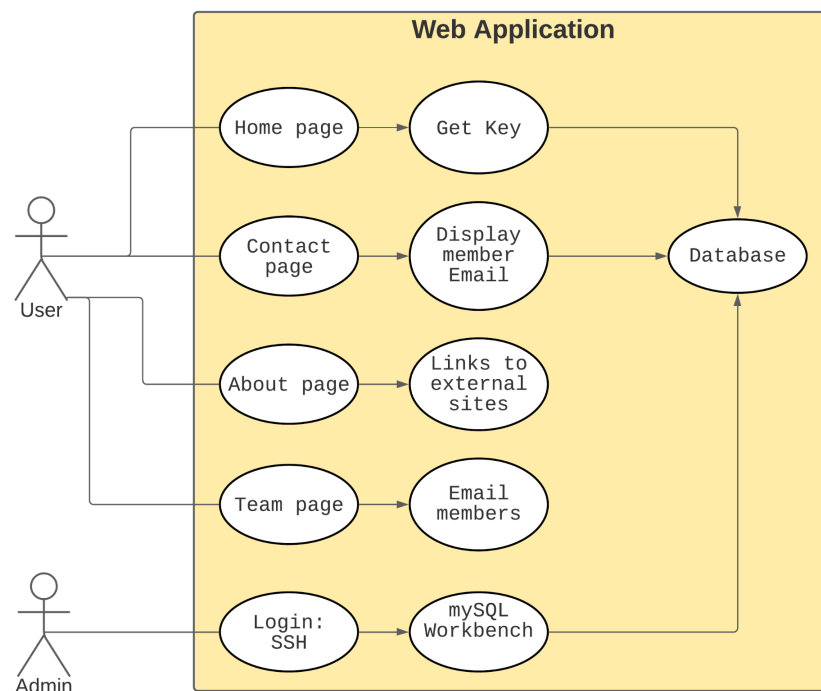
Figure 2: Use Case Diagram

Figure two presents a partial use case diagram detailing the main interactions that different actors will have with the system. Given the lack of a dedicated use case document for this project, this diagram has been modified to specify which use case corresponds to which actor and which system functions/features each use case shall interact with.

2.4. Methods

As referenced in the System Architecture section above, the web application shall have two methods. Each of these methods performs a key functionality of the web application as specified in the Requirements Document. They are as follows:

- GenerateKey():

  Retrieves a key from the database along with the lightning data that was used to create that key. It then displays the information to the user through the designated locations specified in the Web Application Interface section below. This method is only called whenever the user hits the Generate Key button specified in requirement WEB-8.1.

- SubmitForm():

  This method sends a message from a web form to the team email. The method will connect with the PHP server to send this email, and the stimulus-response actions for this method are as follows:

      Input: Form fields contact (email) and message (250 character message)

      Output: Green confirmation text saying the message was sent

  That shall fulfill requirement WEB-8.2.

3. Web Application Interface

3.1. Overview

The purpose of the web application is to provide a mode of communicating project information to an audience while providing an interactive demonstration of a cyber security application of the project. The information to be presented can be arranged into three categories: Project Background/Purpose, Application, and Project Team Members. For simplicity, each informative category has been given a designated page in which it is future organized and presented.

3.2. Page Layouts

3.2.1. About Page

The About page is the page that is dedicated to the information pertaining to the project's background and purpose. Any information pertaining to the explanation of the project shall be displayed on the page. In order to make this page clear and concise, it has been broken down into individual sections.

3.2.1.1.   Section 1: Landing Page
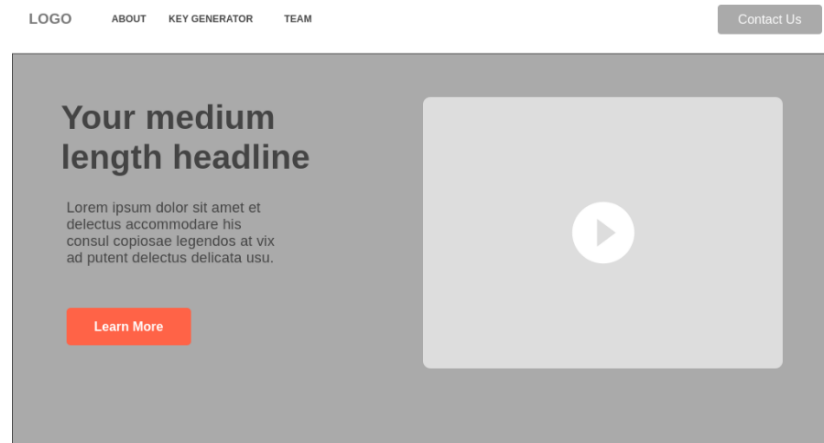
Figure 3: Landing Page Wireframe

This section of the about page will be used as the landing page for the web application. It should be the first thing the user sees when visiting. Among its contents will be the title "Project Thor," along with a short textual description of the project. Next to this there shall be either an image or video that offers the user a visual introduction to the project. In place of the grayed-out background, there will be a background image related to the project's themes (lightning, randomness, cyber security). Finally, the "Learn More" button shall shift the user's view to a relevant section further down on the page (most likely section two).

### 3.2.1.2.   Section Two: Problem Statement
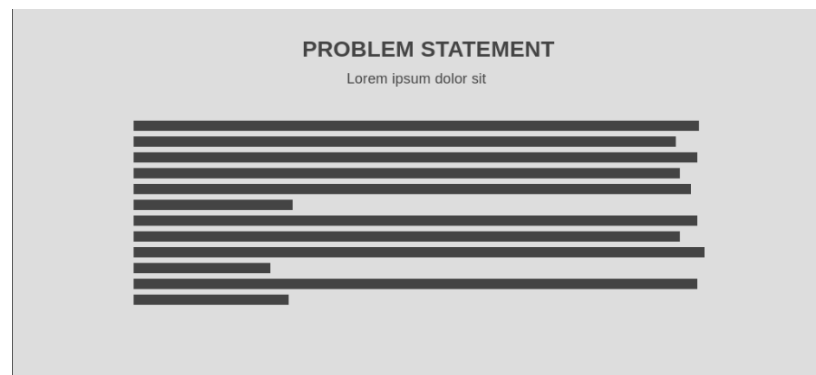
Figure 4: Problem Statement Wireframe

Section two of the about page is dedicated to presenting the reason this project is needed. It should contain the title "Problem Statement" or

other text of similar meaning. Below that title there should be a short quote that is relevant to the problem and helps make it more memorable for the audience. Finally, there should be a short paragraph or two that describes the background of the problem. It should be written in simple, easy to understand terminology and cover the ideas discussed in the Problem section of the Requirement Document.

3.2.1.3.   Section Three: Our Solution
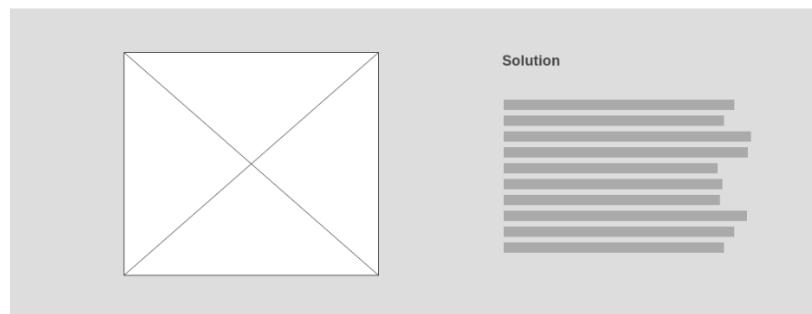
Figure 5: Our Solution Wireframe

This section is fairly simple with just three parts. The first is the title that will be phrased "Our Solution." The second should be a half page of text as shown in figure five, although it may be put on either side of the page. The text should outline our solution in simple terms and reflect the ideas expressed in the Solution section of the Requirements Document. Finally, there should be an image or some sort of graphic that either helps the user understand or remembers the solution.

3.2.1.4.   Section Four: Data
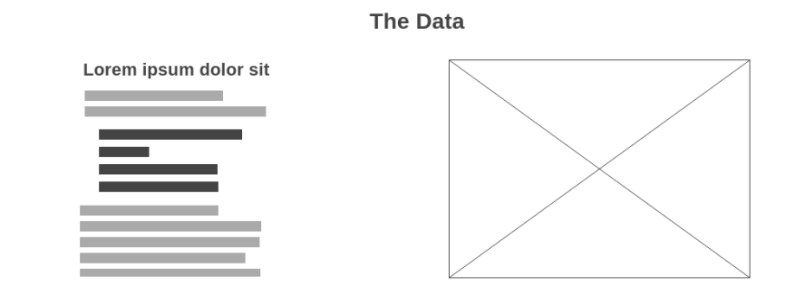
Figure 6: Data Wireframe

The data section of the about page should present information relating to the data. This includes an explanation of where the data comes from and how it is gathered as well as the specific parameters that we are using out of the 30 some different types of measurements collected for each strike. As always this information should be presented as clearly as possible and to avoid getting too text heavy, whenever possible it should be presented using a bulleted list, charts, graphs, images, etc. Finally, there should be a title/heading that reads "The Data" or similar.

3.2.1.5. Section Five: Other Applications
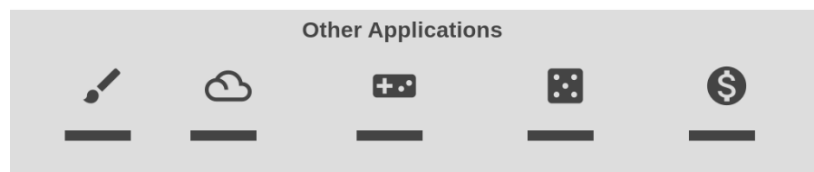
Figure 7: Other Applications Wireframe

The final section of the about page is the other applications section. This is a very small and short section containing the title "Other Applications" or similar and several icons representing other industries that our data could be applied to. Below each Icon should be the textual name of that industry. Consideration has been given to making each icon a link to an external resource supporting this claim, but this is not a requirement and is therefore extra if there is time.

3.2.2. Generate Key Page

The generate key page is dedicated to the presentation category. Here, users will be able to see how our random numbers/data can be applied to the cyber security field by creating encryption keys. Additionally, there will be an interactive element to the page that should help draw users interest. As before, this page is broken down into sections.

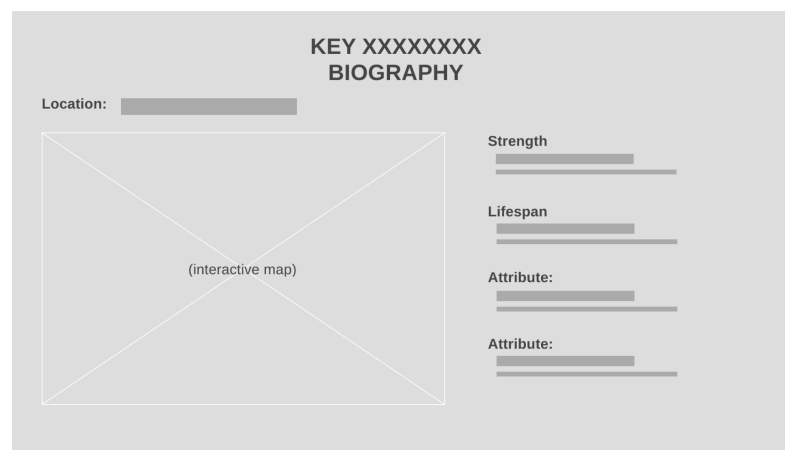### 3.2.2.1. Section One: Get Key

Generate Your Encryption Key

Click here to generate an encryption key using lightning data. We'll show you the information about your encryption key when you click generate.

🗘 **Generate Key**

Figure 8: Generate Key Wireframe

This section of the generate key page is straightforward. It should contain a title that says "Generate Your Encryption Key" and then a button the user clicks that allows them to do just that. The results should be displayed in section two of the page, and ideally, the page should jump down to that section for the user. There may be a short section of instructional text that tells the user what clicking the button will do and invites them to do it, but this is not necessarily required for the design.

3.2.2.2.   Section Two: Key Viewing

KEY XXXXXXXX BIOGRAPHY

Location:

(interactive map)

Strength

Lifespan

Attribute:

Attribute:

Figure 7: Other Applications Wireframe

The second section of this page will include details about how the key was made. The additional details will provide the user with a sense of familiarity as they will be able to relate to some of these attributes. The information the should be displayed is the key (as a heading), the parameters/data used to generate the key, and an interactive element.

This interactive element may be a map that drops a pin on the location of the strike that was used to generate the key or a map that shows live locations of lightning strikes across the globe.

3.2.3. Team Page
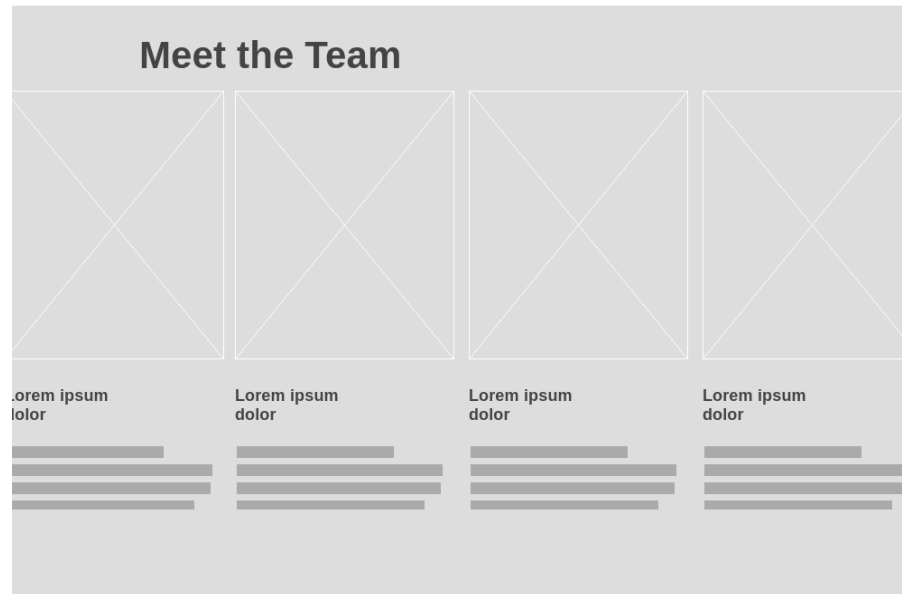
Figure 8: Team Wireframe

The team page is a single sectioned page that introduces the team members to the users. Each member will have their own profile, but for appearances, each profile should be laid out the same and contain similar information. Each will have a photo, member's name (first and last), major, professional about me, and link to resume and LinkedIn. Age, social media, and email shall be optional and left to the discretion of each team member.

3.2.4. Contact Page

Contact Us

CONTACT

Contact Us

Figure 9: Contact Wireframe

The contact page is another single section page. It shall contain a title that reads "Contact Us" and have a simple two part form. The first part should ask for the user's email and the second part should accept a 250 character message. Finally, there should be a button that allows the user to send the message. After the message is sent, a green confirmation message should display to show the message was successfully sent.

## 3.3. User Interface General Design Guidelines

Although the page layouts have been specified above along with the type of information that should be displayed, the section specifies some general guidelines that each page should conform to in order to establish a clear and uniform user interface. These guidelines are as follows:
- Structure: Clean and clutter-free
- Consistency: Use of colors, fonts, and layout should have high contrast and be easily readable.
- Focus Areas: Each page and section should have an area that draws the user's attention to it. Nothing should be designed to not attract attention so as to avoid user's not wanting to read or comprehend what is presented to the.

4. Database Design

The database is perhaps the most important part of this project besides examining the data. It is what will store and organize all of the data that will be used and what will be passed on to other teams for further development and research. Therefore, it is important that the database be well designed and organized and that the agreed-upon design is closely followed.

4.1.   Table Design
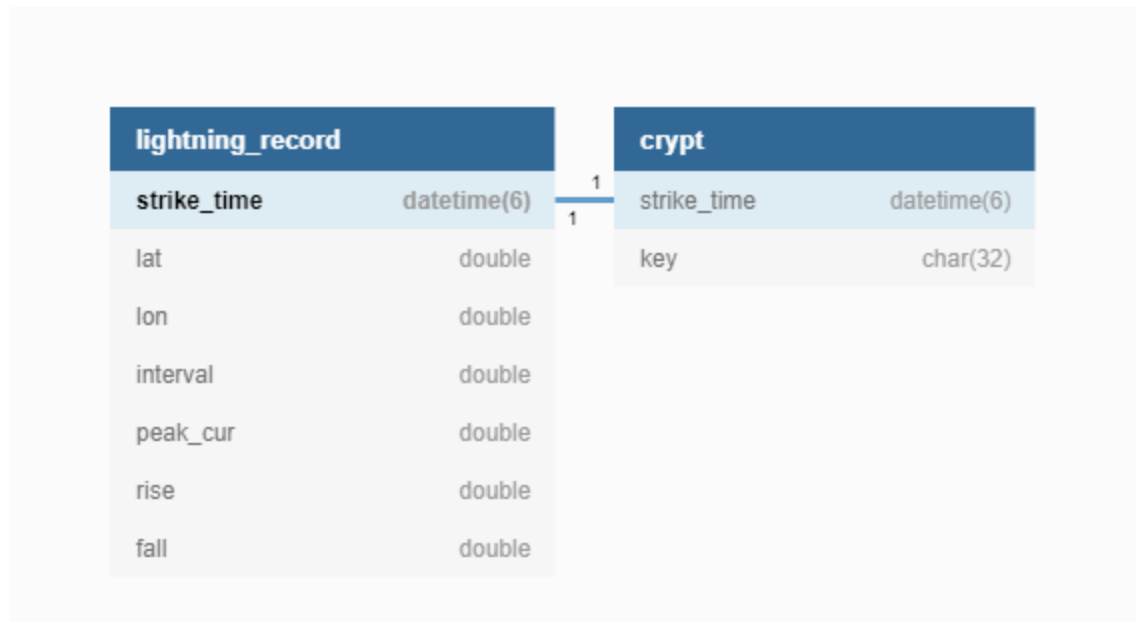
Figure 10: Database Data Formats

      As mentioned before in this document, the database will consist of two tables: one containing the lightning data, and the other containing the encryption keys generated from the lightning data. The data types for each parameter for both tables is specified in figure ten above. Finally, the most important aspect that should be considered in the design of the database is that it should be scalable to accommodate for future expansion.