



# CIS\*4300

# Final Report

**starzone:** the beginner astronomy app to meet all your galactic needs!

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# 1. Introduction

Welcome to my report for **starzone**: the beginner astronomy app to meet all your galactic needs! Recently, I developed an interest in astronomy - *“the study of objects and matter outside the Earth's atmosphere”*. Since we can't really go anywhere these days, I started looking up at the sky from my backyard and wondering what was going on up there. While learning about astronomy, I found myself wishing for some kind of **central dashboard** I could use to feed my interest and help me keep up to date on astronomical topics in an easy, user-friendly way. Identifying this need is what inspired me to build the *starzone* interface for my CIS\*4300 term project!

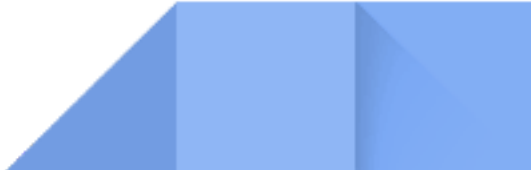
This report contains an overview of my design process and the results I have obtained through my UI implementation study. I will go over the requirements, scenarios, task analyses, prototypes, design considerations, and design evaluation plan. I will also discuss the limitations of my project and some potential areas for improvement.

Please click the links below to access:

- *starzone* implementation online: [www.maddieg.ca/starzone](http://www.maddieg.ca/starzone)
- *starzone* source code: [www.github.com/maddiegabriel/starzone](https://www.github.com/maddiegabriel/starzone)
- Figma wireframe: [figma.com/file/xHv1Ktf3TRuVBTvDJdzluN/starzone\\_wireframe](https://figma.com/file/xHv1Ktf3TRuVBTvDJdzluN/starzone_wireframe)
- Usability feedback questionnaire: <https://forms.gle/fLZV66mkqoYWxJAq6>
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## 1.1 Description

*starzone* is a tool for the everyday astronomer. This web application is accessible from any internet browser on any computer or mobile device. The main *starzone* interface is laid out in a dashboard format; this was partially inspired by certain COVID-19 dashboards which have been floating around, like [this one](#).



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Each piece of *starzone* provides some tool or information related to astronomy. Everything is framed in the context of a beginner or hobby astronomer. Before we dive into the report, I would like to describe, at a high level, the main components of functionality in *starzone*:

1. **Account Services:** to use *starzone*, users need to create a free account.
  - a. Login Page: this is where every user lands when they navigate to [www.starzone.com](http://www.starzone.com). From here, they can login or register.
  - b. Register Page: If a user doesn't have an account yet, they will need to create one before proceeding.
  - c. Account Settings Page: this page contains all the personal user details stored by *starzone*, which users can view or update. It also contains a list of the user's *starzone* content preferences, which they can edit. For example, if a user is interested in Stellar Astronomy but not in Planetary Science, they can specify this on their Account Settings page. Each user's dashboard content is then tailored to their specific interests.
2. **Dashboard:** the dashboard is the main component of *starzone*, and is where a user lands once they login to their account. There are 3 main sections on the dashboard:
  - a. Starzone News Feed: this scrollable column is an aggregation of the latest global astronomical news, fully tailored to the user's specific interests defined in their Account Settings. Each news item links to the original news source.
  - b. Celestial Event Alert: this component of the dashboard displays upcoming celestial events, such as meteor showers and eclipses. *starzone* bases these event recommendations on the user's interests and location, which they can update through their Account Settings.
  - c. The Astronomer's Forecast: it's very important to know your region's cloud forecast if you're planning on viewing the sky at night. This dashboard section provides the weather & cloud forecast for the user's region, including various metrics like Cloud Cover and Light Pollution.
3. **Star Searcher:** the *starzone* star searcher provides an interface for users to search for any star in our galaxy! Each star has a photo and an associated summary page where

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users can learn more about the star, including information about its nomenclature, history, coordinates, and astronomic characteristics (like mass and magnitude).

I hope this section has given you an idea of the scope/complexity of the *starzone* User Interface!

## 1.2 Existing Solutions

Though other astronomy dashboards do exist online, *starzone* is unique in that it is very beginner-friendly. Many astronomy tools I have encountered are unapproachable because they use industry jargon and show complex metrics with little to no explanation. Here are some examples of existing astronomy dashboards I have come across through my research and design process: [Astronomy Online](#), [Blackfoot Sky Chart](#), and [Astronomy Forecast Dashboard](#). I feel that, when compared to these existing solutions, *starzone* is a focused, clean, modern and beginner-friendly resource. It is a free application designed for the hobby astronomer or the backyard stargazer. My main goal when designing the User Interface for *starzone* was to make it as approachable and user-friendly as possible!

## 1.3 Primary Usability Objectives

As a precursor to my requirements gathering process, I produced some primary usability objectives for *starzone*. These are split into *usability goals* and *user experience goals*. I have also included a set of potential *user goals* to help you grasp the purpose of the application.

### Usability Goals

In order to optimize user interactions, *starzone* aims to meet the following usability criteria:

- **Effectiveness**: as this application is designed for beginners, it's very important that each component of *starzone* does exactly what it is supposed to do. For example, the Astronomer's Forecast must be designed in a way that is actually useful to a beginner astronomer using the application to schedule attending a celestial event.
- **Efficiency**: the dashboard layout of *starzone* is intentional and contributes to the efficiency goal of minimizing the number of operations required for a user to complete a task. Part of the simplicity of *starzone* is its ease of use; all the functionality is instantly available and requires little effort to access from the home page.

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- Utility: the main purpose of *starzone* is to amalgamate the tools and services which beginner astronomers find useful into one application. *starzone*'s dashboard functionality accommodates a range of different potential user tasks.
  - Memorability: users may not use *starzone* every day, meaning that memorability is an important goal to consider. The use of meaningful icons and clear directions to complete tasks contributes to the memorability of the User Interface.

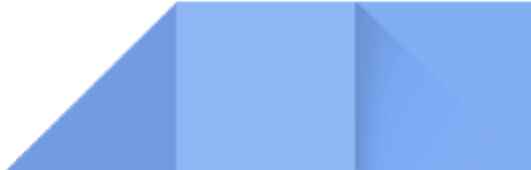
### User Experience Goals

User experience quality is an extremely important aspect of any design. The following five user experience goals are the most important to *starzone*:

- Motivating: the last thing we want is for a beginner astronomer to give up because the tool is too difficult to use! *starzone* should motivate users to continue learning.
- Aesthetically Pleasing: though this is a subjective goal, it was very important to me when designing that the *starzone* interface be attractive and visually pleasing.
- Helpful: as an application designed for beginner astronomers, the *starzone* interface must be very helpful. Even if a user is brand new and clueless, they should be able to learn to use the application to achieve their desired goal.
- Fun: my goal is that users not only have fun while using *starzone*, but are encouraged and excited to use it again.
- Enjoyable: similarly to the last goal, it's important that using *starzone* is an enjoyable experience causing minimal frustrations (unlike many existing astronomy dashboards).

### Potential User Goals

The purpose of *starzone* is to provide a centralized source of astronomy news, tools and information for beginner astronomers. It's a great way to foster an interest in the field, whether you're using it for yourself or to educate others. A user may have one or more of the following main goals while using *starzone*:

- Read the dashboard news feed to keep up to date on the latest news in astronomy.
  - Be alerted of any upcoming celestial events in their region.
  - Check the weather and cloud forecast in their region to verify if the conditions are optimal for night sky gazing.
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- Search up a specific star to learn about its history and characteristics, or determine its coordinates for star gazing.

## 1.4 Potential Users

There are many potential users for *starzone*. When identifying potential users, I took a look into the demographics of people who are typically interested in astronomy. *starzone*, which is available anywhere in the world, could be a useful application for the following user groups.

**Primary Users:** the people who would use *starzone* frequently.

- Beginner Astronomers: *starzone* is definitely not designed for seasoned, expert astronomers who likely already have more advanced tools at their disposal. It's a resource for beginners who don't have all day to sink into their new hobby, but who would like to get into astronomy and keep up to date on the field in a fun way.
- Engineering & Physical Sciences Majors: data from the United States shows that up to 60% of astronomers come from engineering education backgrounds, while over 35% come from backgrounds in the physical sciences. This means that college or university students majoring in these subject areas are the most likely to find *starzone* useful as a tool for general research or for exploring a personal interest in astronomy.

**Secondary Users:** the people who would use *starzone* occasionally.

- Middle / High School Teachers: *starzone* could be a great teaching resource for science teachers who are teaching students about astronomical science. The approachable interface means it could be a student-friendly tool for children in sixth grade and up. It's important to have free digital tools like this available in the era of online learning. Teachers could ask their students to schedule a stargazing event using the *starzone* dashboard, or write a report on a star they find through the Star Searcher.
- Students in High School: these days, high school students face a lot of pressure to decide what they want to study. At such a young age, it can be intimidating to make this huge decision; you need all the resources you can get. As the sciences are a more popular study choice than ever, *starzone* could be used as an introductory tool for students hoping to determine if physics/astronomy could be potential areas of study.

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**Tertiary Users:** the people who would be affected by *starzone*'s introduction.

- The Competition: the owners of any competitor applications for hobby astronomers, including those mentioned in Section 1.2 (Existing Solutions).

## 1.5 Implementation Details

To implement *starzone*, I used a combination of HTML, CSS and JavaScript. I do have experience using HTML, CSS and JavaScript to do basic web design, but I really enjoyed learning more by implementing this dashboard. I really focused on using best practices, both in the design and interface implementation process. I developed the application locally, and it is hosted online through my personal website. To build *starzone*, I employed the Bootstrap framework. I find that Bootstrap pairs very well with any dashboard-based layout because it allows for the easy creation of responsive columns.

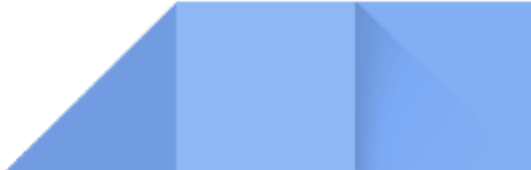
All the data displayed through the *starzone* interface is hardcoded. This includes the newsfeed articles, stars, and celestial events. Doing this allowed me to stay focused on the user interface and user experience design, rather than getting bogged down by writing code to scrape news websites and such. However, I still wanted the experience to be realistic; this is why I choose current astronomy articles, real upcoming celestial events, and actual stars to be displayed throughout the entire application. I hope that using real data gives you an idea of the potential of *starzone* if it were to be fully implemented!

## 2. Requirements

### 2.1 Requirements Gathering Process

The requirements gathering process for *starzone* involved a few different steps. In order to curate a list of what *starzone* should do, I had to really think about the potential users and their needs. My primary usability objectives (described in Section 1.3) proved very helpful.

To start, I researched many existing solutions; this includes other astronomy dashboards, astronomy news sites, and tools for astronomers. I took note of the features, characteristics and functionality of each solution.





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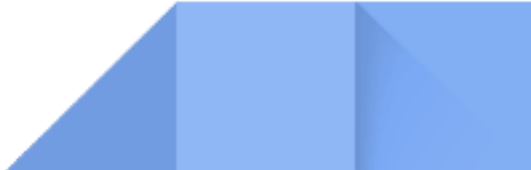
Next, I would have liked to perform some data gathering with potential users and stakeholders. Unfortunately, due to the scope of this project I wasn't able to perform a formal data gathering process. I would have performed semi-structured interviews with at least one user from each of the potential primary and secondary user groups outlined in Section 1.4. I would choose the semi-structured interview format to allow for exploration through conversation with potential users, while still using the same core questions for each participant. If I had the time, I may have distributed a questionnaire to gather more data from a larger population of potential users. It would have also been nice to observe a beginner astronomer attempting to use some of the existing astronomy tools online, asking them to think aloud as they perform their tasks.

As a hobby astronomer myself, I was able to partially represent the needs and interests of the main *starzone* user group. When gathering my requirements, I asked myself the following questions: What aspects are required to fulfill the goals of *starzone*? What features, information and functionality are *necessary* to achieve these goals? What things would be nice to have, but are not *essential* to the proper functioning of the application? What things are definitely not to be included? Is there anything that could enhance the user experience?

The below list of requirements covers the five primary types: functional, data, environmental, user, and usability requirements. This list steered the design of *starzone*. The requirements gathering process allowed me to decide which features were worth spending time designing, and which ones were probably out of scope for this primary iteration of *starzone*.

## 2.2 List of Requirements

Below I have detailed my list of assumed requirements for *starzone*. I organized each requirement into one of four categories: "Must", "Should", "Could" and "Won't". I chose to design my requirements this way because it makes the most important requirements very obvious. I also find it makes the list more useful when it comes to later stages of design like prototyping and user testing. I curated this list before beginning the prototyping process; this means that some requirements, especially in the "Could" section, are not met by the final *starzone* design and implementation presented with this report.



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### **“Must” Requirements**

1. Must allow the user to create a new *starzone* account.
2. Must allow the user to login to their existing *starzone* account.
3. Must be usable from any internet browser on any computer.
4. Must allow the user to read current astronomy news.
5. Must display the temperature and weather in the user’s region.
6. Must show the cloud and night-sky forecast for the user’s region.
7. Must allow the user to see upcoming celestial events.
8. Must ask the user for location permissions.

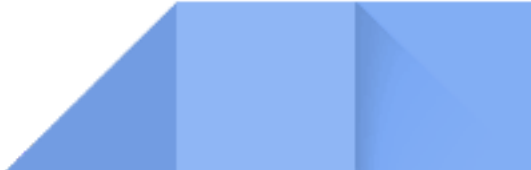
### **“Should” Requirements**

1. Should be responsive and usable from any internet browser on any mobile device.
2. Should allow users to view their personal account details.
3. Should allow users to update their personal account details.
4. Should tailor the dashboard news feed content to the user’s interests.
5. Should provide links to outside news sources for more detail from the news feed.
6. Should give the user the option to narrow their content preferences.
7. Should base the upcoming celestial events on the user’s location.
8. Should include links to outside resources for more detail on star information provided.

### **“Could” Requirements**

1. Could show the user a sky chart along with the star searcher results photo.
2. Could allow users to “star” their favourite stars to read about later.
3. Could give the user the option to subscribe for a weekly *starzone* newsletter.
4. Could let the user subscribe for celestial event email reminders.
5. Could tailor the dashboard news feed content to the user’s location.
6. Could allow users to delete their *starzone* account.
7. Could show users their weekly cloud/temperature forecast, not just nightly.
8. Could allow users to change their account password.

### **“Won’t” Requirements**

1. Won’t require any payment or subscription from the user.
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2. Won't require the user to specify content preferences in order to see general content.
  3. Won't require the user to give location permissions to see a general dashboard.

## 3. Task Analysis

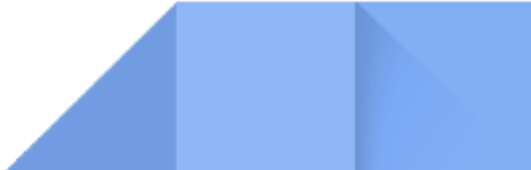
In this section you will find three important scenarios describing how users from different potential user groups may use *starzone* to achieve some goal. I have broken each main scenario down into tasks using the Hierarchical Task Analysis (HTA) method. Each HTA task breakdown includes a description of the plans, as well as a drawing of the Hierarchical Task Graph (HTG).

I created my scenarios based on my potential user groups and user goals for *starzone*. Each scenario represents a different potential user group and exercises a different piece of *starzone* functionality. My scenario choices reflect what I see as the most important or interesting components of the application interface. My storyboards (presented in Section 4) are heavily based on these scenarios.

### 3.1 Scenario A: Check Upcoming Celestial Events

#### Scenario Description

Jolanda, a Canadian physics student at the University of Guelph, has been learning about basic astronomy through her classes at school. She finds the subject intriguing and decides to learn more about it on her own time. Last week, Jolanda discovered *starzone* online and made an account. Since then, she has become familiar with the dashboard interface and has been checking her newsfeed a few times a week. Tonight, Jolanda and her physics classmates are planning to hang out. Since her friends are also interested in astronomy, Jolanda is hoping they can watch a celestial event together. Jolanda opens her browser and goes to [www.starzone.com](http://www.starzone.com) where she is greeted by the login page. She logs into her account using her existing account details and is presented with her personalized *starzone* dashboard. Jolanda first looks at the "Celestial Event Alert" section and notices that there is a major meteor shower happening tonight. She clicks the event to read more details about it on an external site. Once Jolanda determines that her friends would be interested, she wants to make sure the conditions in Guelph are favourable for watching the meteor shower tonight, especially the Cloud Cover.



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She heads back to the *starzone* dashboard and scrolls to the “Astronomer’s Forecast” section to view the cloud forecast chart. After reading the legend, Jolanda hovers over her desired section of chart. She notices that the Cloud Cover metric is rather low tonight at 10%, which is perfect for viewing a meteor shower. Jolanda logs out of *starzone* and texts her friends to make the plan, then has a blast watching the meteor shower that night!

## Hierarchical Task Analysis

1. Login to *starzone*
  - 1.1. Navigate to *starzone* login page
    - 1.1.1. Unlock laptop, phone or other device
    - 1.1.2. Open internet browser
    - 1.1.3. Type [www.starzone.com](http://www.starzone.com) into URL bar and press enter
  - 1.2. Complete login form
    - 1.2.1. Enter your username in the ‘username’ field
    - 1.2.2. Enter your password in the ‘password’ field
    - 1.2.3. Click the ‘login’ button
2. View Upcoming Celestial Events
  - 2.1. Navigate to your *starzone* dashboard
  - 2.2. View the ‘Celestial Event Alert’ section
  - 2.3. Hover and click on an upcoming celestial event which interests you
  - 2.4. Read about the event on the external site to decide if you want to attend
3. Check The Astronomer’s Forecast
  - 3.1. Navigate back to your *starzone* dashboard
  - 3.2. Read ‘The Astronomer’s Forecast’ for your region
    - 3.2.1. Read the temperature section
    - 3.2.2. Read the cloud forecast chart
      - 3.2.2.1. Read the legend to decide which metric you need to know
      - 3.2.2.2. Hover over the corresponding colour to see the value of the metric
      - 3.2.2.3. Repeat for each metric you need to know
4. Logout of *starzone*
  - 4.1. Navigate back to your *starzone* dashboard

## 4.2. Click 'Logout'

### Plans

**Plan 0:** if already logged into *starzone*, do 2. Otherwise, do 1.

**Plan 1:** if already on your *starzone* dashboard, do 2.2. Otherwise, do 2.1.

**Plan 2:** do 2.2. If there are no upcoming celestial events which interest you, skip to 4.

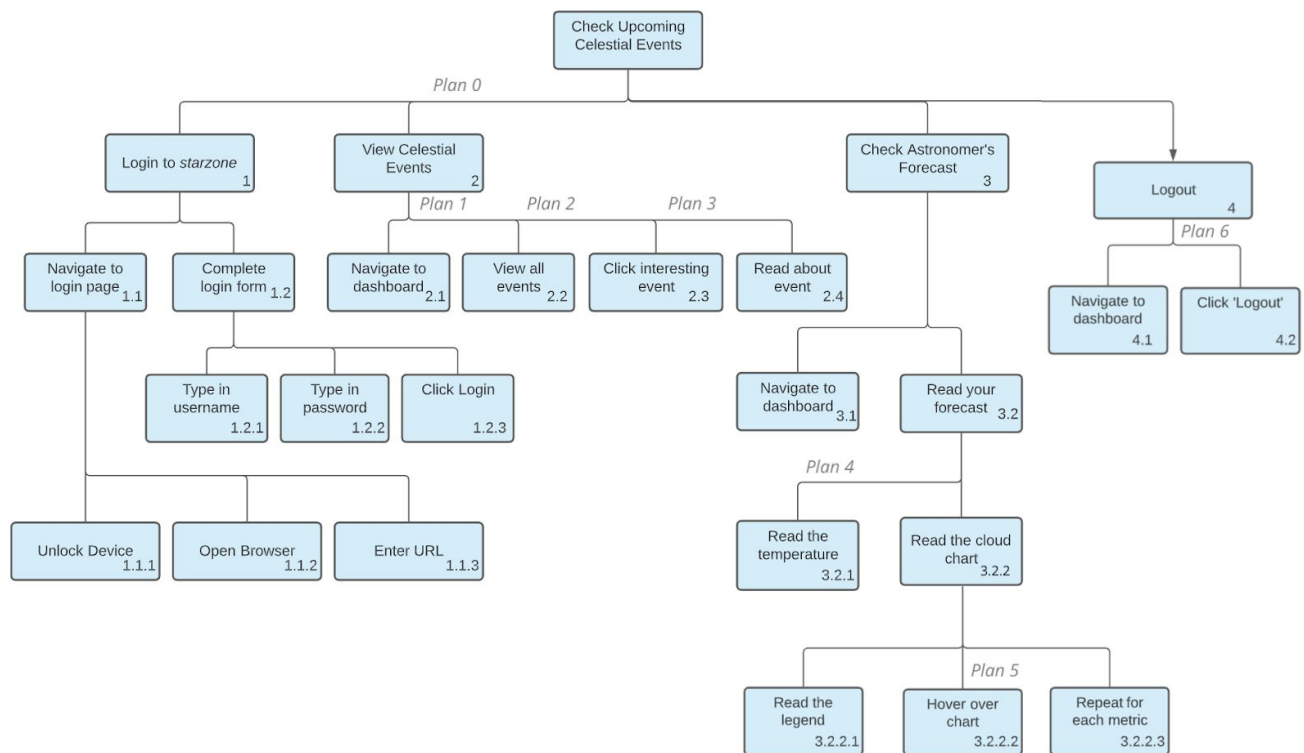
**Plan 3:** do 2.3. If this celestial event does not interest you, restart at 2.1.

**Plan 4:** do 3.2.1. If the temperature is unacceptable, skip to 4.

**Plan 5:** do 3.2.2.2. If the metric is unacceptable, skip to 4.

**Plan 6:** if already on your *starzone* dashboard, do 4.2. Otherwise, do 4.1.

### Hierarchical Task Graph



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## 3.2 Scenario B: Create a New Account

### Scenario Description

Nathan, a high school teacher, is teaching Grade 10 science online this semester due to COVID-19 school closures. He is currently creating lesson plans for the physics & astronomy unit. Nathan has been searching for some good online resources to help his students learn astronomy and encourage an interest in the subject. However, most astronomy tools he has come across so far are much too advanced for his students and tend to have very cluttered interfaces, which might be confusing. While researching his options, Nathan comes across *starzone*; he thinks it looks like it could be the perfect tool for his class. From the *starzone* login page, Nathan clicks “Create an account” because he is a first-time user and doesn’t have an account set up yet. He fills in each field on the registration form (name, username, email, and password) then clicks the “Register Now” button. After registering, Nathan is redirected to an “Account Settings” page where he can verify that all his personal details are pre-filled correctly. Nathan also notices the “Content Preferences” section on the “Account Settings” page, where he sees that he can customize the content he sees on *starzone* by defining his specific interests within the field of astronomy. Since his lesson plans are mostly related to solar & stellar astronomy, Nathan checks off those boxes and clicks “Update Content Preferences” to save his choices. An alert modal appears informing Nathan that his *starzone* content preferences have been saved. After dismissing the modal, Nathan navigates to the *starzone* dashboard and begins to explore the application to determine if it would be the right fit for his class!

### Hierarchical Task Analysis

1. Navigate to *starzone* registration page
  - 1.1. Unlock laptop, phone or other device
  - 1.2. Open internet browser
  - 1.3. Type [www.starzone.com](http://www.starzone.com) into URL bar and press enter
  - 1.4. Click the “Create an account” button
2. Complete registration form
  - 2.1. Fill in registration form fields
    - 2.1.1. Type in “name” field

- 2.1.2. Type in “email” field
- 2.1.3. Type in “username” field
- 2.1.4. Type in “password” field
- 2.2. Click the ‘Register Now’ button
3. Update Content Preferences
  - 3.1. Under the ‘Content Preferences’ section, check off the topics you’re interested in
  - 3.2. Click the ‘Update Content Preferences’ button
  - 3.3. Read the confirmation alert and click “close” to dismiss it
  - 3.4. Navigate to *starzone* dashboard to see your changes in action

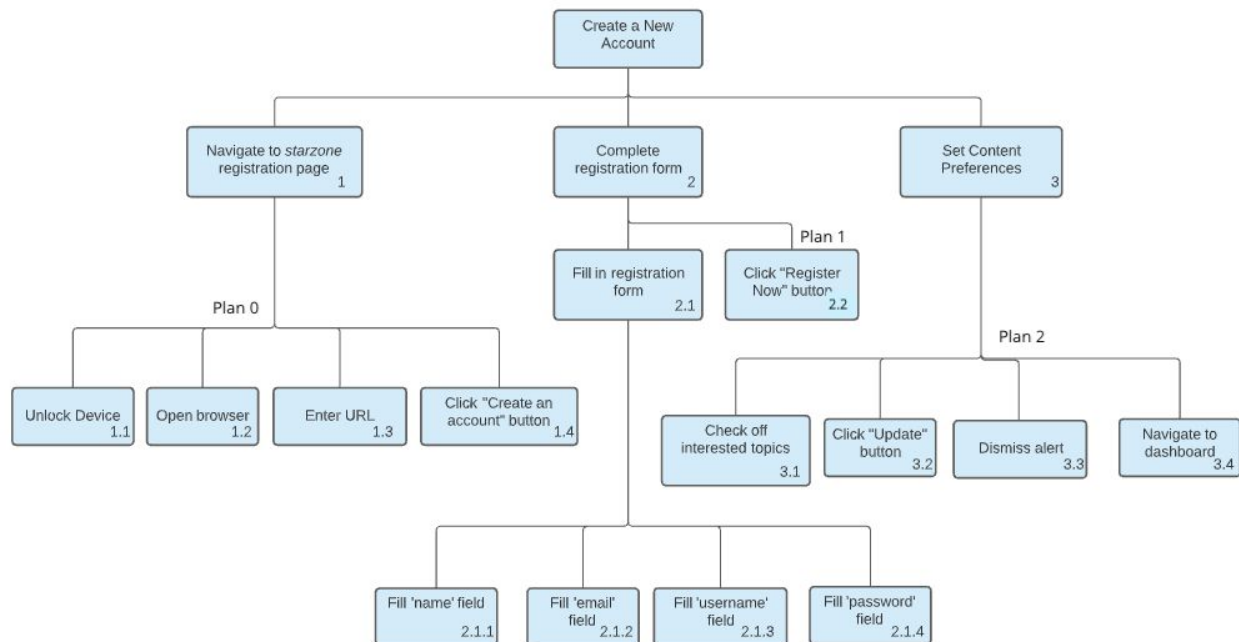
## Plans

**Plan 0:** if already on the *starzone* login page, do 1.4. Otherwise, start at 1.1.

**Plan 1:** do 2.2. If a validation error occurs, restart at 2.1.

**Plan 2:** do 3.1. If you don’t have any content preferences, skip to 3.4.

## Hierarchical Task Graph



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## 3.3 Scenario C: Star Search

### Scenario Description

Amanda is a 25 year old hobby astronomer. She has been a *starzone* user for many months now, and uses the dashboard often to keep up to date on celestial news and events in her region. Amanda is planning to go stargazing with her brother this weekend, and is doing some research about stars to prepare. She opens her computer and goes to [www.starzone.com](http://www.starzone.com), where she enters her username and password to login to her existing *starzone* account. After being greeted by her dashboard, Amanda uses the sidebar to navigate to the “Star Searcher” page. On this page, she browses the default star directory which is sorted alphabetically by star name. Amanda is specifically curious to learn about a star called *Sirius*, which she was told is the brightest star in the night sky. She clicks the search bar and begins typing her search term (“Sirius”). As Amanda types, the star results begin to filter below the search bar. Seeing her desired result, Amanda clicks on the card and a modal appears containing the star info. She studies the photo of *Sirius* and reads about its nomenclature, history, coordinates and characteristics. Wanting to learn more, Amanda clicks on a link in the modal and is redirected to an external webpage with more details. Once she’s finished reading, Amanda navigates back to the *starzone* tab and clicks the “Close” button to dismiss the “Sirius” modal. Using the Star Searcher, Amanda repeats this process for a few more stars. Once she’s satisfied with her research, she logs out of her *starzone* account by clicking “Logout” in the *starzone* sidebar.

### Hierarchical Task Analysis

1. Login to *starzone*
  - 1.1. Navigate to *starzone* login page
    - 1.1.1. Unlock laptop, phone or other device
    - 1.1.2. Open internet browser
    - 1.1.3. Type [www.starzone.com](http://www.starzone.com) into URL bar and press enter
  - 1.2. Complete login form
    - 1.2.1. Enter your username in the ‘username’ field
    - 1.2.2. Enter your password in the ‘password’ field
    - 1.2.3. Click the ‘login’ button
2. Search for a star
  - 2.1. Click “Star Searcher” in sidebar to navigate to Star Searcher page
  - 2.2. Perform search



- 2.2.1. Click the search bar
- 2.2.2. Begin typing search term and see results begin to appear
- 2.2.3. Finish typing search term
- 2.2.4. Click your desired result
- 2.3. Read the required information about the star on the modal popup
- 2.4. Click the modal title to read more about the star from an external site
- 2.5. Click "Close" button to close modal
3. Logout of *starzone*
  - 3.1. Navigate back to your *starzone* tab
  - 3.2. Click 'Logout'

## Plans

**Plan 0:** if already logged into *starzone*, do 2. Otherwise, do 1.

**Plan 1:** if already on the Star Searcher page, do 2.2. Otherwise, do 2.1.

**Plan 2:** do 2.1. If your star is shown already, skip to 2.3.

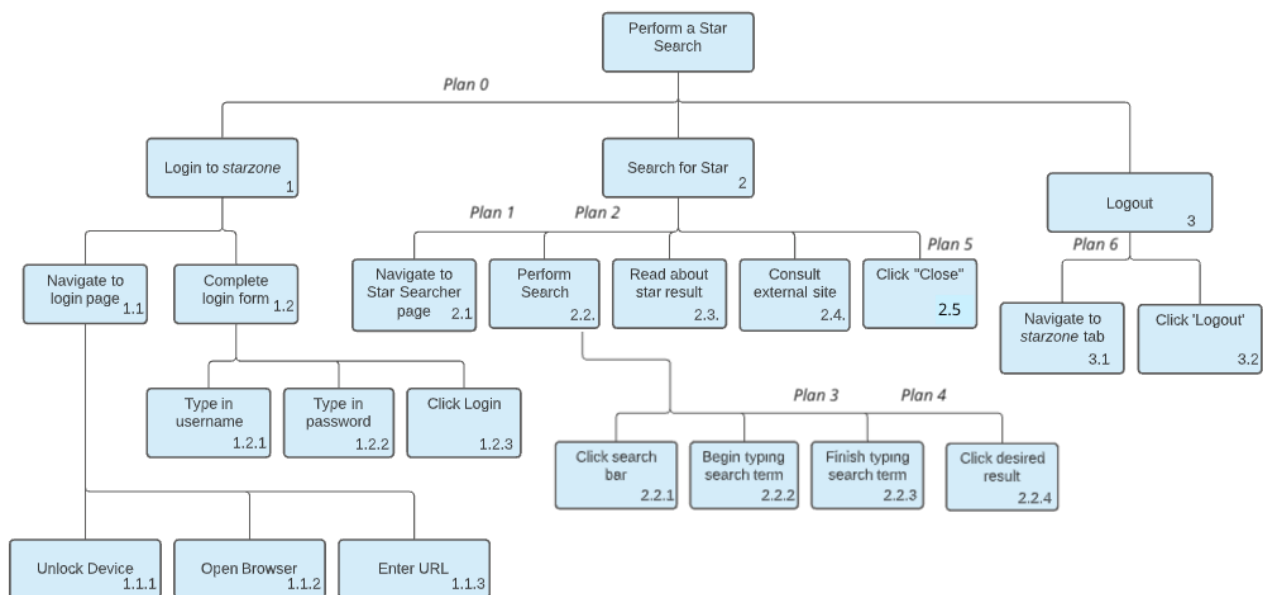
**Plan 3:** do 2.2.2. If your star appears early, skip to 2.3.

**Plan 4:** do 2.2.3. If no star results appear, skip to 3.

**Plan 5:** do 2.5. If you need to search for another star, restart at 2.2.

**Plan 6:** if already on the *starzone* tab, do 3.2.. Otherwise, do 3.1.

## Hierarchical Task Graph



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## 4. Prototyping

### 4.1 Prototyping Process

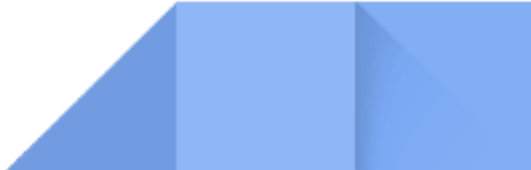
I probably spent the bulk of my time on this project doing prototyping. I feel this process was essential to me wrapping my head around the design and getting feedback through design evaluation and user testing.

I performed two different types of prototyping for *starzone*: low-fidelity (paper prototype and storyboards) and high-fidelity (wireframe). In between each prototype, I evaluated the design iteration and performed some user testing which is further described in Section 5. Throughout this entire process, I was thinking continuously about my design, perceptual and layout considerations which are discussed in Section 6.

I began by creating some basic user interface sketches by hand on scrap paper. These sketches, based on my scenarios, showed my original *starzone* vision. I drew a number of sketches which aren't included in this report because they were very rough drafts which I didn't end up keeping; they were simply a stepping stone to creating my first paper prototype. After figuring out how I generally wanted the application to look, I combed through my three Hierarchical Task Analyses and drew corresponding screens and features to go with each task. These sketches, which together make up my low-fidelity paper prototype, can be viewed in Section 4.2. I organized the sketches into storyboards and indicated the flow between each screen.

After making changes based on feedback from some basic user testing with the paper prototype, I moved on to building my Figma wireframe which is presented in Section 4.3. This wireframe is high-fidelity; it is built digitally and contains colour, photos, and "real" example data. This was my final prototype before I started to implement *starzone*, taking all the prototype feedback into consideration.

I hope this section gives you an idea of the prototyping process for designing *starzone*!

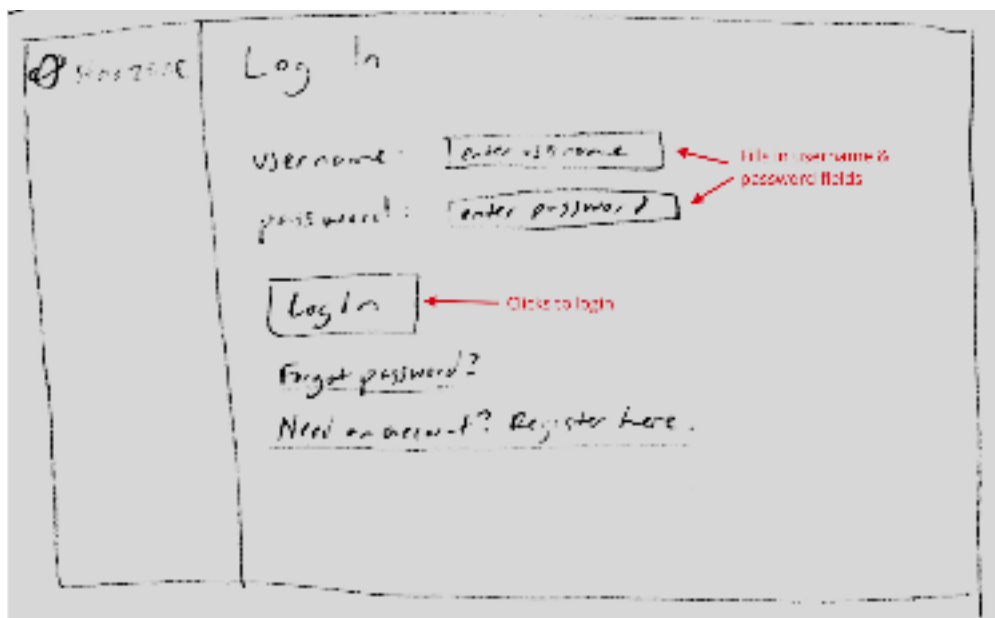


## 4.2 Low-Fidelity Prototype

Below, I have created 3 sequences of storyboards which correspond to the three scenarios introduced in Section 3. As these storyboards are a low-fidelity paper prototype, they are very rough and don't include some more detailed design aspects like colour. The sketches mostly focus on the general layout of components, the information to be collected and displayed to the user, and the flow of navigation between screens. By creating low-fidelity sketches, I was able to focus purely on the user experience when interacting with *starzone* and not become distracted by smaller design details, which were decided on later in the design process.

### Storyboard A: Check Upcoming Celestial Events

1. When a user goes to [www.starzone.com](http://www.starzone.com), they are greeted by this login page. Since they have an existing account, the user fills in their username/password and clicks "Log In".



2. Once logged in successfully, the user is greeted by their *starzone* dashboard. Notice the "Celestial Event Alert" section in the top right; this is where any upcoming events appear, tailored to the user's preferences. The user sees an event they're interested in and clicks

Hand-drawn wireframe of a mobile app interface for a space-themed application. The interface is divided into three main sections: a left sidebar, a top header, and a main content area.

**Left Sidebar:**

- Starzone
- Dash (highlighted in yellow)
- Star Search
- Settings
- Log Out

**Top Header:**

- News Feed

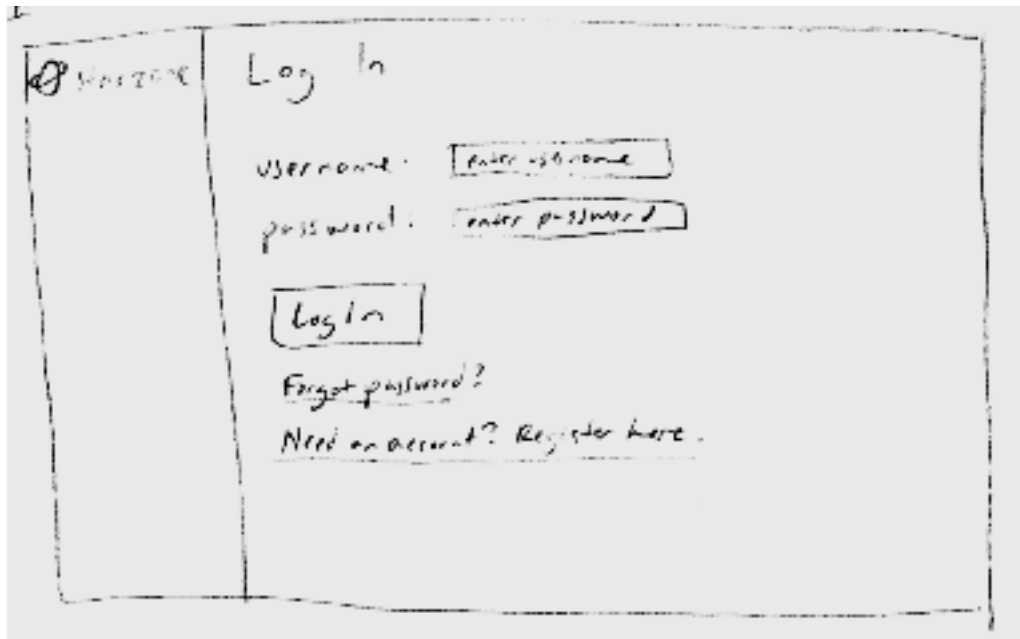
**Main Content Area:**

- News Feed (continued):
  - New title! by spacejunkies
  - Space is cool by NASA internally is
- Celestial Event Alert (highlighted in yellow):
  - Dec 04 Meteor Shower
  - Dec 06 Solar Eclipse
- Astronomer's Forecast:
  - 9 Guelph
  - Bar chart showing weather conditions: wind, sun, cloud, light.
  - Temperature: 10°C

Just some fake interesting events to be reflected to other users to be in a new way

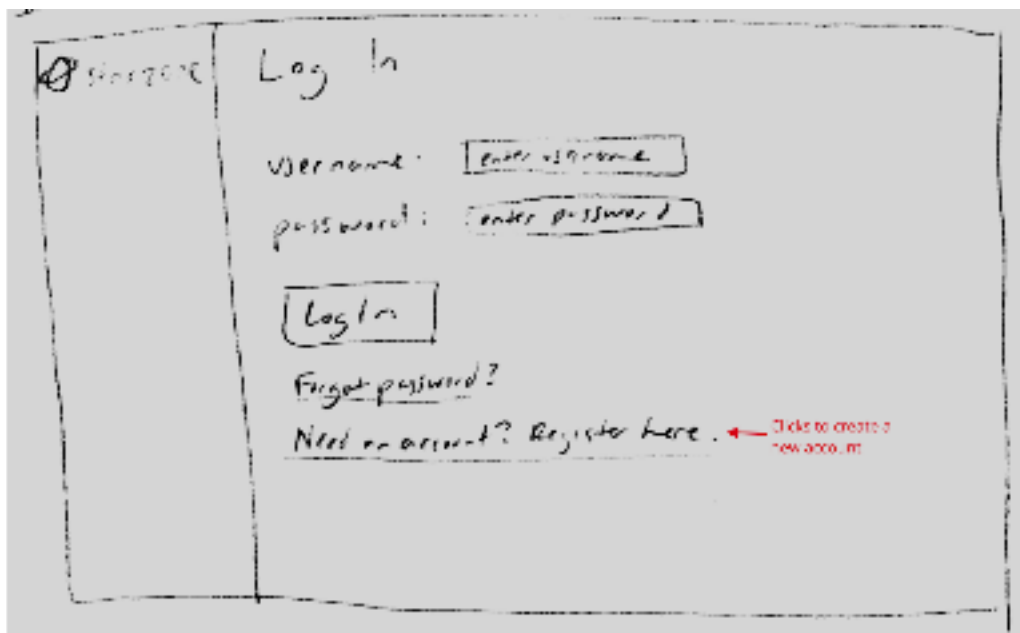
- 
- Storage
- Dash
- Star Search
- Settings
- Log Out
- 2x click = log out
- ### News Feed
- News title! by Space bla-bla
- Space is cool! by NYT it really is!
- ### Celestial Event Alert
- Dec 04 Meteor Shower
- Dec 06 Solar Eclipse
- ### Astronomer's Forecast
- Region → Guelph → Area to add cloud cover forecast
- Cloud Cover: 14%
- Wind rain cloud light
- Region temperature → 10 °C

4. The user is logged out of their account and is redirected to the starzone login page.



### Storyboard B: Create a New Account

1. When a user goes to [www.starzone.com](http://www.starzone.com), they are greeted by this login page. Since they do not have an existing account, the user clicks "Register here".



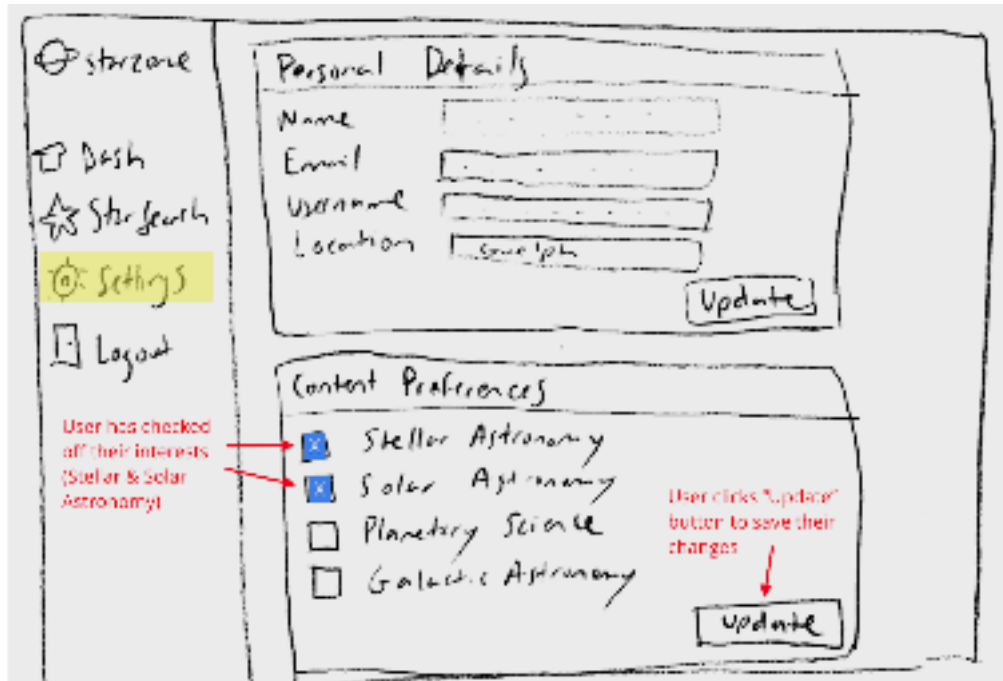
- The user is redirected to the "Sign Up" page to register for an account. The user fills in the Name, Email, Username and Password fields correctly then clicks "Register Now".

The sketch shows a web page titled "Sign Up" for "Starzone". It features four input fields labeled "name:", "email:", "username:", and "password:". Red arrows point from a note "User fills in their name, email, username and password" to each of these fields. Below the fields is a button labeled "Register Now" with a red arrow pointing to it from a note "Clicks to Register". At the bottom, there is a link "Have an account? Sign in here".

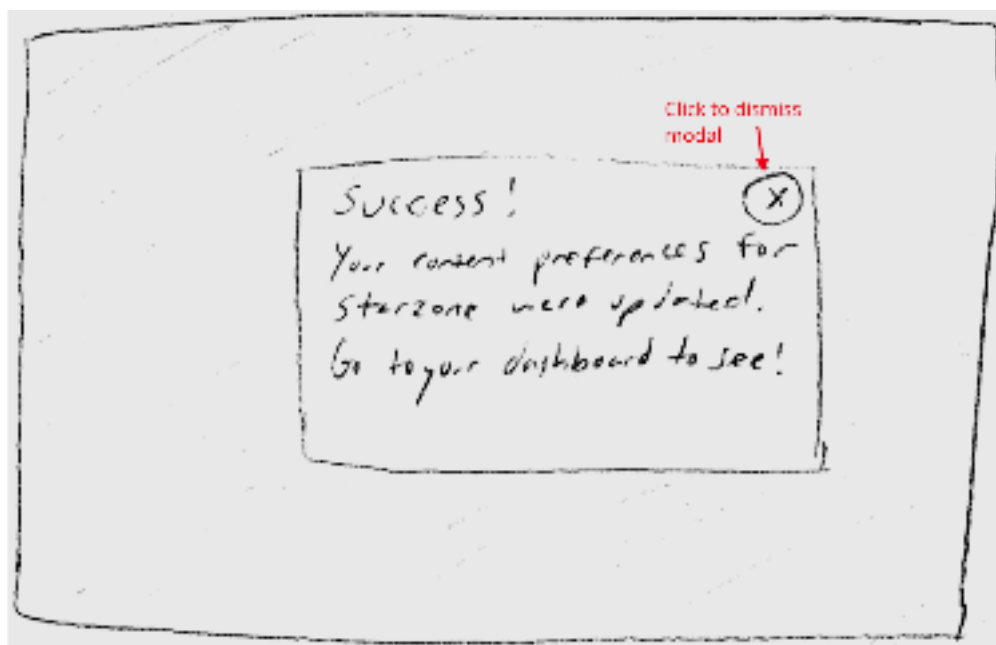
- Once successfully registered, the user is greeted by their Account Settings page. Here, they can view their personal details and set their content preferences in the bottom section. This user checks off "Stellar" and "Solar" Astronomy as their interests.

The sketch shows an "Account Settings" page for "Starzone". On the left is a sidebar with links: "Dash", "Star Search", "Settings" (highlighted in yellow and labeled "Current page"), and "Logout". The main content area is divided into two sections: "Personal Details" and "Content Preferences". The "Personal Details" section has fields for "Name", "Email", "Username", and "Location", with an "Update" button. The "Content Preferences" section has four checkboxes: "Stellar Astronomy", "Solar Astronomy", "Planetary Science", and "Galactic Astronomy". Red arrows point from a note "All unchecked (no content preferences set yet for new user)" to each of these checkboxes. There is an "Update" button at the bottom right of the "Content Preferences" section.

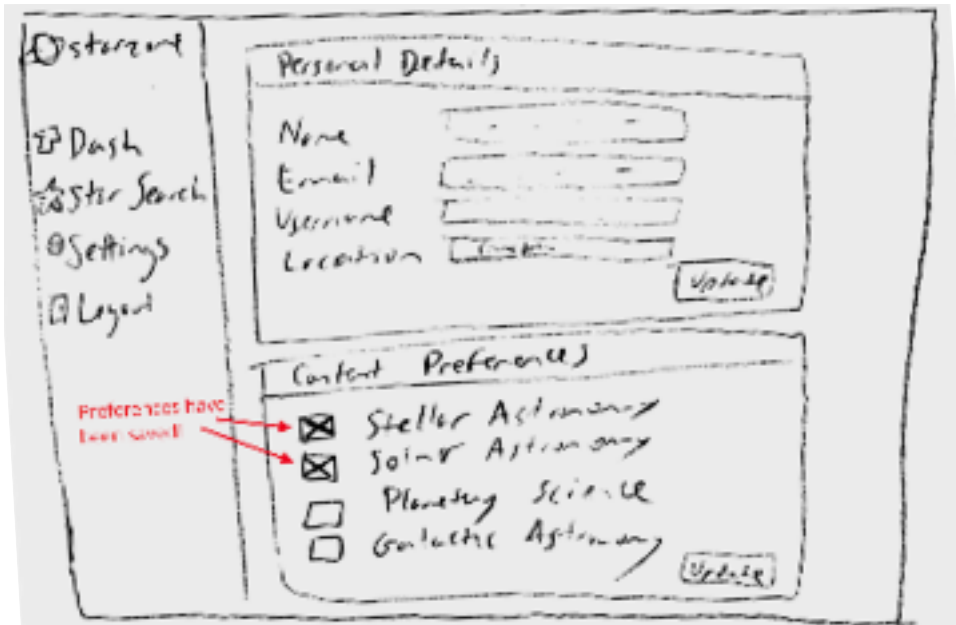
- The user clicks the "Update" button to save their new preferences.



- The user's preferences have been saved! A modal popup appears informing them of their success. The user clicks "X" to close the modal.

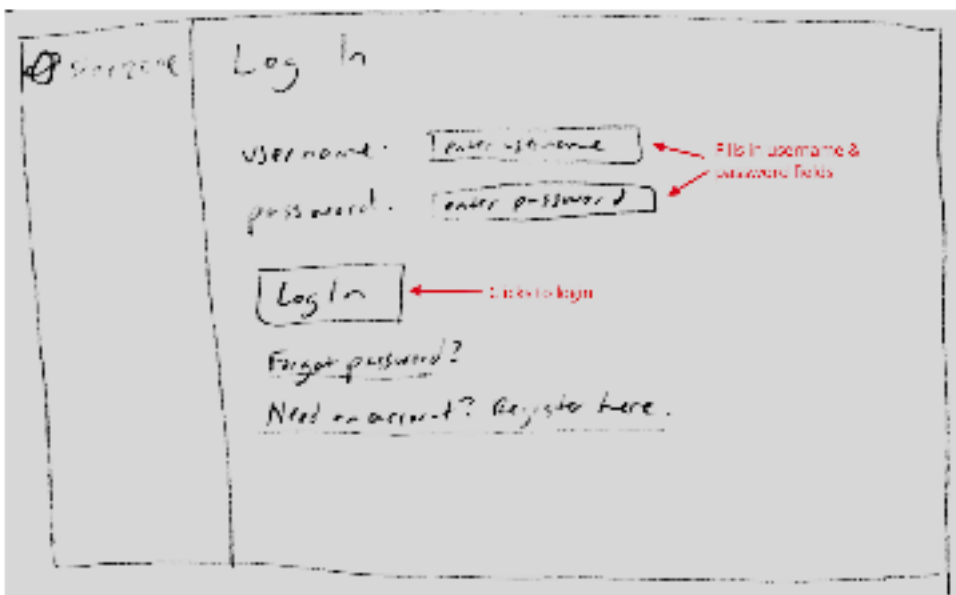


6. After dismissing the modal, the user is back on their Account Settings page. We can see that the user's preferences have been updated successfully. Their *starzone* dashboard content will now be customized according to these preferences!



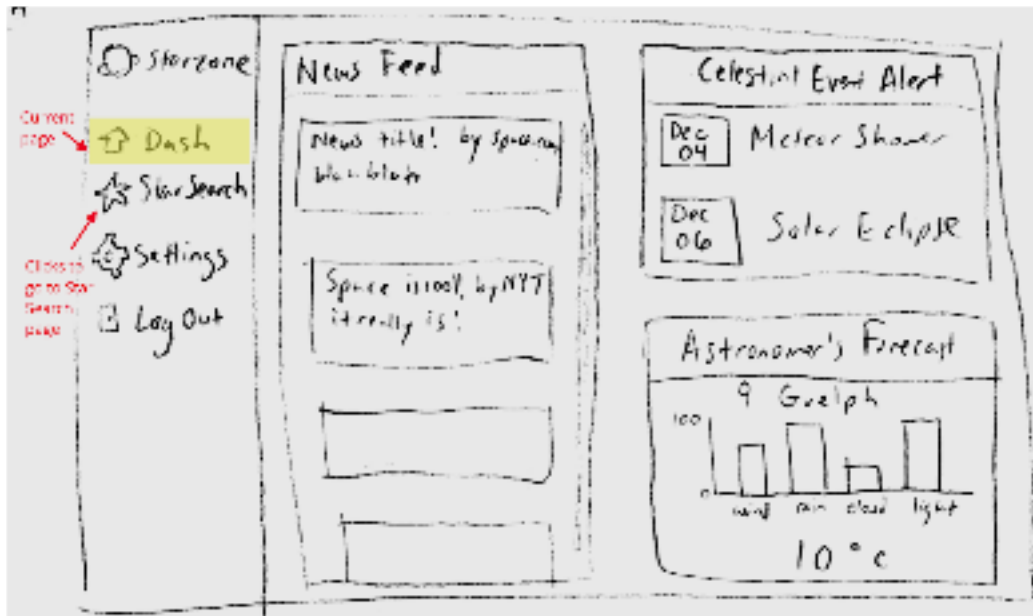
### Storyboard C: Star Search

1. When a user goes to [www.starzone.com](http://www.starzone.com), they are greeted by this login page. Since they have an existing account, the user fills in their username/password and clicks "Log In".

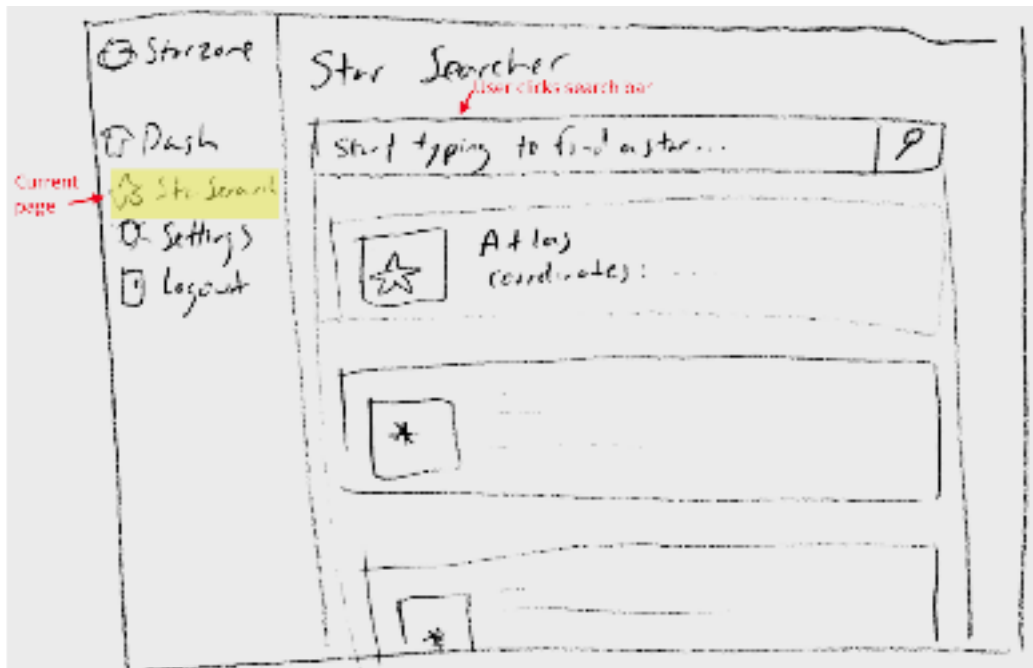




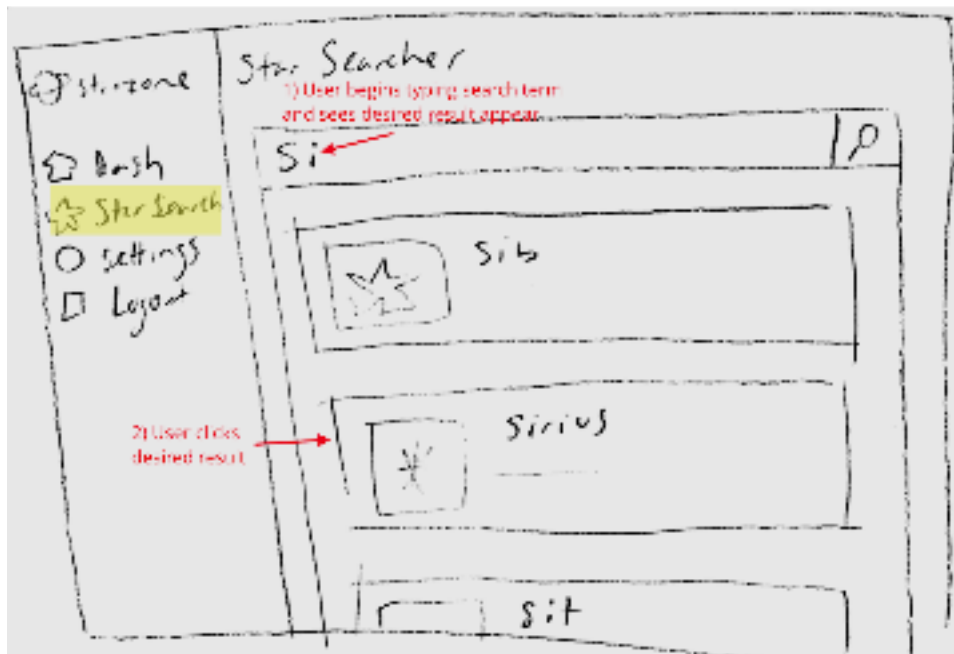
- Once logged in successfully, the user is greeted by their starzone dashboard. This user is interested in performing a Star Search, so they click "Star Search" on the left sidebar.



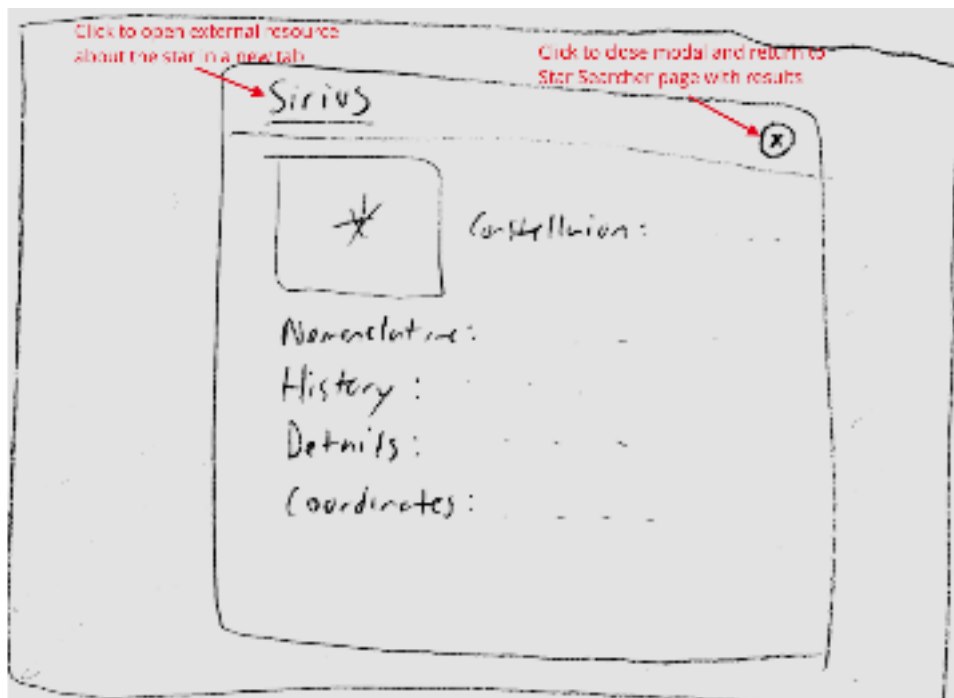
- The user is now on the "Star Search" page. Stars are shown alphabetically in a scrollable list. The user clicks the search bar to perform a search for a specific star.



4. The user begins typing their search term and notices the corresponding results being filtered under the search bar. They see their desired star result, *Sirius*, and click on it.



5. An information modal for the star pops up. It contains a photo and details about this star. The user may click navigate to a more detailed external page in a new tab.



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## 4.3 High-Fidelity Prototype

I built my high-fidelity wireframe using Figma. I have used Figma just once before, for Assignment 3 in this course, but I find it to be an excellent tool for wireframing.

Please click here to access my complete Figma wireframe prototype:

[figma.com/proto/xHv1Ktf3TRuVBTvDJdzluN/starzone\\_wireframe](https://figma.com/proto/xHv1Ktf3TRuVBTvDJdzluN/starzone_wireframe)

My wireframe is much more realistic and refined than my paper prototype, and pretty close to the final *starzone* product in some places. The wireframe has limited functionality to allow test users to navigate through the most important *starzone* features. The functionality of the wireframe covers all the same scenarios defined earlier in this report. I considered choosing just one or two scenarios, but I felt that all three were important pieces of functionality which needed to be properly designed before implementation. Below is the script which can be used to navigate through the entire prototype from the initial *starzone* login page.

### Steps to using Figma prototype:

1. [Open the prototype in Figma.](#)
2. Click the blue "Login!" button (assume the username/password fields are filled).
3. Explore your *starzone* dashboard!
  - a. Click the first article under "News Feed" to be redirected to a news source.
  - b. Click the first event under "Upcoming Celestial Events" to see an event page.
  - c. Please note that the cloud forecast graph functionality under "The Astronomer's Forecast" was not prototyped in the wireframe. I planned to use a JavaScript library called ApexCharts for this graph in my final implementation, so prototyping the graph design was not really necessary.
4. Once you're done exploring the dashboard, click "Star Search" on the sidebar navigation.
5. Click on the first star result example, "Atlas".
  - a. Note that the result filtering for the Star Searcher functionality was not prototyped in the wireframe due to its complexity. Instead, I described to test users how, as they type, the search results would be filtered below the search bar.
6. An information modal appears. Read the information about the Atlas star.

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7. Once you're finished reading, click "X" to dismiss the modal.
  8. Log out of your *starzone* account.
    - a. On the sidebar navigation, click "Account".
    - b. Click "Logout".
  9. Now, instead of logging in, we will create a new *starzone* account. From the login page, click the yellow "Need an account? Register here!" link.
  10. Click the blue "Register!" button (assume the registration form fields are filled correctly)
  11. You are now viewing your Account Settings page. Read through your personal details.
    - a. Please note that there is no functionality for updating personal details in the wireframe, however this functionality is present in the final implementation.
  12. Under the "Content Preferences" section at the bottom, click on "Stellar Astronomy" to specify it as an interest. The checkbox should fill as you make your selection.
  13. Click "Save Preferences" to save your changed *starzone* content preferences.
  14. Read the confirmation modal, then dismiss it using the "X" button.
  15. See that your preferences have now been altered on the "Account Settings" page!

Through viewing my prototypes, I hope you have a better idea of my design process for *starzone*. To read about how I used these prototypes to evaluate my design iterations through user testing and feedback, please continue to Section 6!

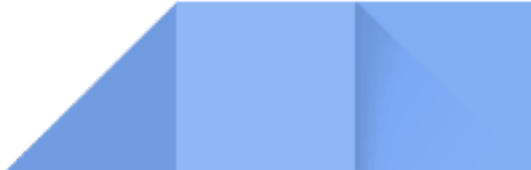
## 5. Design Decisions

### 5.1 Perceptual Considerations

Below is an overview of the perceptual considerations I took into account when designing and prototyping *starzone*. These design choices were largely considered from the very start of the design process, as early as my project proposal submission in October.

#### Colour Variables

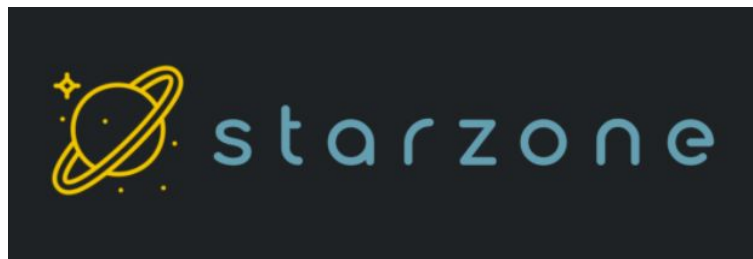
I wanted *starzone* to be beautiful and visually appealing. To match the outer-space theme, my colours are mostly greyscale and dark navy blue. I wanted the interface to be beautiful and



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approachable while still giving off the vibes of a professional tool, and I think the colour scheme helps achieve this. The dark-mode colour theme is actually essential for the usefulness of the application; astronomers usually work outside at night. When seeing in the dark, your eyes are extremely sensitive to any source of light pollution. If an astronomer wants to check something on *starzone* while at work, they would need the application to have a dark screen instead of a bright white background like most applications have.

As an example of my colour palette, please see the logo I designed below:



I believe my final implementation makes good use of colour. The menu on the left of my website uses coloured effects to indicate which page the user is on, or which menu item is being hovered on. Colour is used in the menu and throughout the entire application to improve the clarity and usability. To balance the darkness of the colours and draw the users' attention, I included yellow colour accents for links, error messages, and certain headers. This colour provides good contrast between the original light text, the dark grey background, and itself. Accented elements indicate important functionality, but do not distract from the content of the page. For example the logo, menu items, link hovers are all in yellow.

To ensure my application is still usable for the 8% of colourblind people in the world, I made sure to not convey any essential information through colour. For example, the polar area chart under "The Astronomer's Forecast" has a built-in colour-based legend system from the JavaScript library I used to implement it. However, I also enabled a hover-legend so that if a user can't differentiate between the colours, they can hover to read which metric each area of the graph represents and their user experience will not be compromised. I used high contrast text so that even if a user can't fully see colour, they can still read all the information on the site. Most of my website uses light grayscale text against a dark grey background, which is one of the best colour combinations for legibility according to my research.

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## Emotional Variables

My chosen colour palette is a big influence in the use of emotional variables in my prototype. The main colour throughout *starzone* is shades of greys. The colour grey is solid and stable, creating a sense of calm and composure. I hope that navigating *starzone* is not a stressful experience, and choosing a calming colour that doesn't evoke too many strong emotions helps to keep the user focused on the content. The accent colour, a golden yellow (#E1AD01), evokes a feeling of fun and is very uplifting and motivating. The color yellow relates to acquired knowledge; it resonates with the left or logic side of the brain, stimulating our mental faculties. This is very fitting, as the core purpose of *starzone* is to learn.

That being said, I recognize that colour may be interpreted differently in different cultures. For example, red in many countries can evoke feelings of danger, evil, and anger. However, in China, red means joy and celebration. Due to the subjective nature of colour interpretation based on culture, I decided to use a minimal amount of specific colours to avoid evoking strong negative emotional responses or different biases in users. *starzone* is available worldwide for use, so I had to be careful with considering this perceptual factor.

Another way I tried to play on emotional variables is through my font choice. I chose a modern, rounded sans-serif font for the headers and text across the site. This makes the information very easily readable and conveys a friendly yet trustworthy sentiment without distracting from the functionality.

Lastly, moving away from colour, the clear layout of information across *starzone* has the impact of not emotionally overwhelming the user. In line with my primary usability objectives, my goal is that using *starzone* is a rewarding, simple and motivating experience. I structured the site with clarity in mind, including only essential information and splitting it into consumable and well-labelled columns, chunks and fields with photos and icons for emphasis where appropriate.

## Gestalt Principles



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While browsing my *starzone* user interface design, you can see that it interacts with many of the different Gestalt Principles discussed in this course. This makes the interface more usable, on top of being aesthetically pleasing. I outline my reasoning for this observation below:

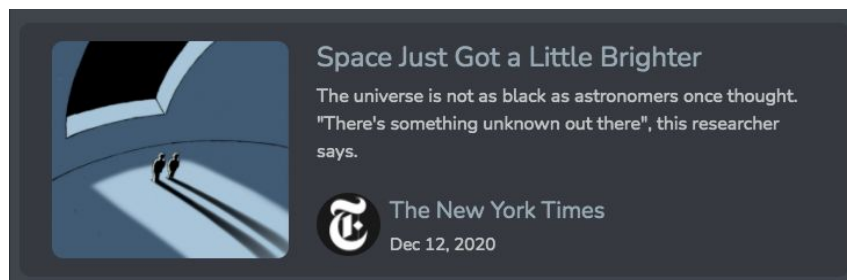
- **Law of Balance and Symmetry**: this law states that “a visual object appears incomplete if it is not balanced or symmetrical”. In order to follow this, I made components of my design symmetrical as often as possible. For example, on the *starzone* dashboard under the “Astronomer’s Forecast”, all the content is centred including the legend, whose five items are split symmetrically down the middle. In addition, note that all clustered images across the application are the same size and shape; for example, the “Starzone News Feed” section is a good example of using the Law of Balance.



- **Law of Proximity**: this law states that “items placed near each other will be perceived as a group”. To follow this Gestalt Principle, I ensured to place related items close together. I used colour blocking and whitespace to strongly distinguish between different information clusters. For example, the “Upcoming Celestial Events” section below is a very simple design. However, it works and makes sense because I used proximity to relate each event date to its corresponding description.



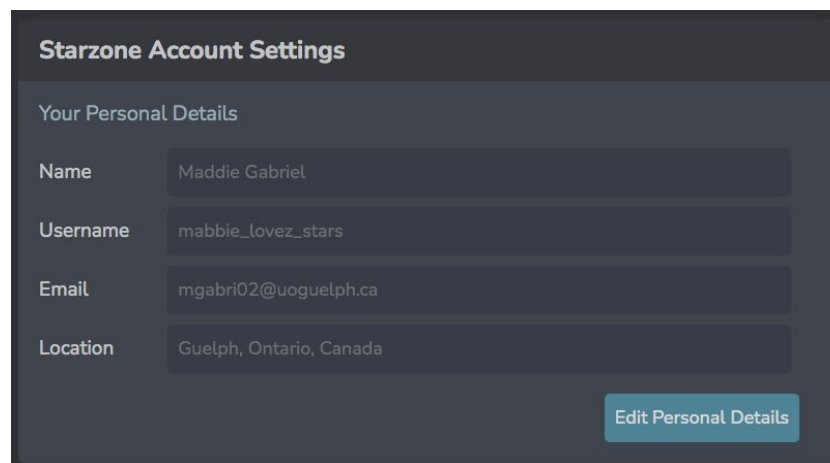
In addition, the Law of Proximity is used in the information displayed about each news article in the *starzone* news feed. The fact that all the information is clustered into a single area near the article thumbnail makes it easily perceived as a group.



- Law of Pragnanz: this important law states that "a structure that is perceived from the image is seen as simply as possible". To make sure I followed this law, I started my design prototyping process by hand drawing the way I wanted *starzone* to be structured in order to fit in all the required information and components in a simple, desirable structure. I did this before making my high fidelity prototype and adding real text, images, animations and colour. This resulted in a stripped down set of containers (rows and columns) with no detail, which I played around with until I was happy with the structural shell of my design. Using the Bootstrap framework, it was easy to bring my skeleton layout to life and resulted in a design which I feel follows the Law of Pragnanz well.



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- Law of Similarity: this law states that “similar objects will be counted as a group and can be used to draw a user’s attention”. I relied heavily on this principle in my design, using similar features to demonstrate related items. For example, when registering for a new account or updating your personal details, the form fields are all exactly the same. This indicates a relationship to the user between the fields; it should be clear from this similarity that the fields are for the same purpose.

A screenshot of a web form titled "Starzone Account Settings". Below the title is a section header "Your Personal Details". The form contains four rows, each with a label and a text input field: "Name" with "Maddie Gabriel", "Username" with "mabbie\_lovez\_stars", "Email" with "mgabri02@uoguelph.ca", and "Location" with "Guelph, Ontario, Canada". All input fields have a light blue border and a light blue background. At the bottom right of the form is a blue button with white text that says "Edit Personal Details".

Starzone Account Settings	
Your Personal Details	
Name	Maddie Gabriel
Username	mabbie_lovez_stars
Email	mgabri02@uoguelph.ca
Location	Guelph, Ontario, Canada
<a href="#">Edit Personal Details</a>	

## Attention

I used a few different tricks to draw the user’s attention to the right parts of the interface when cognitively interacting with *starzone*. First of all, as soon as the user logs into the website, personalized dashboard content based on their preferences and location appears in the *starzone* news feed. I added this feature to the landing page because I wanted to draw the user in, making them more likely to become a *starzone* user.

I tried to keep my application very simple/elegant and avoid clutter so the user doesn’t ever have too much conflicting information. There are only a few menu items, and the *Star Search* search bar is simple and clear. My use of bold headers and bright yellow colour accents is helpful in drawing the user’s attention to the important information and functionality on each page. The use of arrows for dropdowns in the sidebar menu and popup modals for seeing more content in the *Star Search* results helps keep the interface simple, so the user can expand content intuitively as needed but is not overwhelmed all at once.

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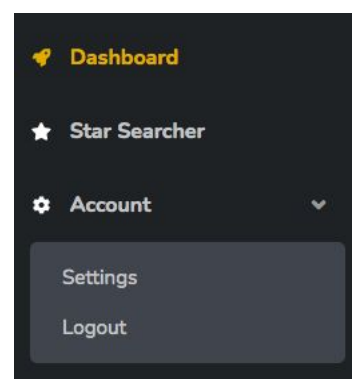
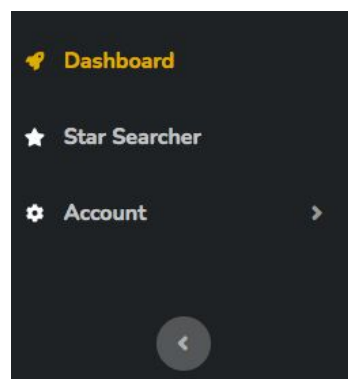
The overall structure of *starzone* aims to appeal to different users' potential goals. Whether they're on *starzone* just to lose some time browsing their newsfeed, to search for a specific star, or check out upcoming events - it's very clear from the homepage where to find all this information. All functionality on the site is just one click away, no matter where you are; there isn't a mess of nested pages and information. This holds the users attention and also aligns with my primary usability objective of efficiency,

When a user hovers over each link in the navigation or the news feed, the information becomes salient as it turns yellow. Similarly, when a user hovers over each event in the "Upcoming Celestial Events" section, the background colour changes to a darker grey. This use of colour across *starzone* serves to draw the user's attention to the fact that clicking on that element will take them to a new place in the application.

## Memory

I made adjustments in my design to account for the limitations and capabilities of human memory. First off, I made the website very simple and limited the amount of information to only the essentials; this means that the user won't have trouble navigating *starzone* to find the information they need, regardless of it's their first or tenth visit.

I relied heavily on images, shapes and icons in the design, since humans are generally better at remembering images than words. For example, by using dropdown arrows and meaningful icons in the sidebar navigation, I hope the user will recognize the indication to perform a certain action, and not have to recall it through memory.



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The left sidebar navigation menu lays out everything on the site within one click, meaning the user doesn't need to remember where to find certain information or how to accomplish certain goals using the design - everything they need is right there, so they can simply skim the options and proceed as directed if they forgot how to reach a certain action. Also, when searching for a star or when updating their settings including content preferences and personal details, short instructional sentences are displayed to prompt the user as to what each section is for.

Lastly, throughout *starzone* I utilized chunking of content to help increase the amount of information that my user can remember in the short term. For example, the menu is chunked into three small elements one to two words each. Any instructional phrases are kept to a short sentence instead of a long explanatory paragraph. Each Star Searcher result modal is chunked into multiple cards of related information, rather than being one large wall of text. For example, the result below has four different sections. This means the user won't be overwhelmed and is more likely to remember the information they need to successfully navigate *starzone*.





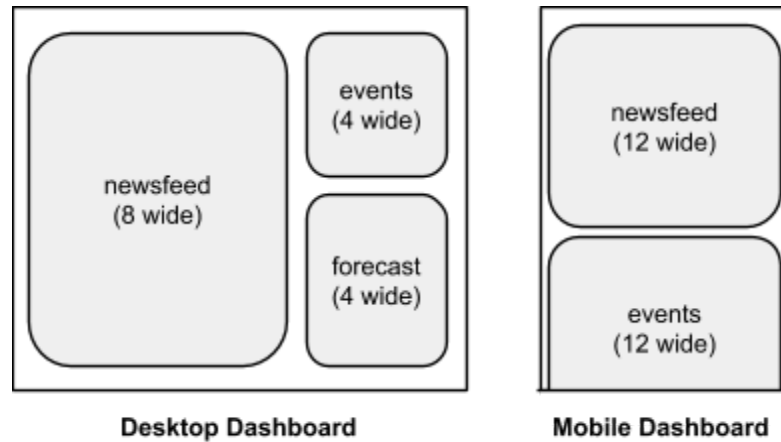
## 5.2 Layout Considerations

My main goal in designing *starzone*'s layout, especially the main dashboard, was simplicity and usability. Each dashboard component, containing related clustered information, is of consistent design but is clearly separated by grid borders, whitespace, and blocks of colour.

The ideal layout for the *starzone* dashboard is a two-column grid-based dashboard, as shown in the figure below. However, as the application is completely responsive, the dashboard components are visually structured across the page in dynamic layouts depending on the user's browser window size. This layout consideration was easy to achieve using Bootstrap. This responsiveness means that users can use *starzone* on their mobile device without

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compromising their user experience; this is important because astronomers often work outdoors without access to a computer.



There are many other layout considerations I made while designing *starzone*. The font, image and form field sizes are all implemented in a way that they scale along with the page. This means that, whether the user is on a cell phone or a television-sized monitor, *starzone* should be equally usable and provide a good user experience.

A strong layout is proven to enhance user experience by improving efficiency through proper grouping and positioning of elements, and also by increasing learnability through the use of a consistent design. I hope I achieved a solid layout design for my *starzone* interface!

## 5.3 Event, Input & Error Handling Design

### Event Handling

*starzone* handles a few different types of input events, but most event interactions which occur between the user and the system are mouse-button events and keyboard events. Keyboard events occur at nearly each place there is user input collected within *starzone*, which is further detailed in the next section. Mouse-button events occur across each component of *starzone*. I carefully considered the responses of the system to mouse events such as hovering and

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clicking. My goal in considering event handling was for the user to always be aware of what their next action would result in through the use of hover color and cursor changes.

Space Just Got a Little Brighter

*Default Article Title*

Space Just Got a Little Brighter

*Hovered Article Title*

## **Input Handling**

User Input occurs in multiple places in *starzone*, namely: the Login page, the Register page, the Account Settings page, and the Star Searcher. Input is received through well-formatted text boxes and checkbox inputs which include input validation. I decided to keep the input methods simple and consistent to make it easy on the user; consistency in design leads to ease of use. All input fields have clear labels and/or placeholder text, so the user isn't ever confused about how to interact with the system; this has the effect of minimizing user memory load.

In accordance with the affordance principle, all "Submit" type buttons are obvious in function to the user through appropriate text labels, colour, and distinct button shape. Additionally, following the constraint principle, all buttons are greyed out/unclickable until all required fields are completed. For example, until a change is made to the checkboxes under the "Content Preferences" window, the "Update Content Preferences" button is greyed out and disabled. Also, if the user has not yet filled in their password when logging in, the "Login" button is disabled.

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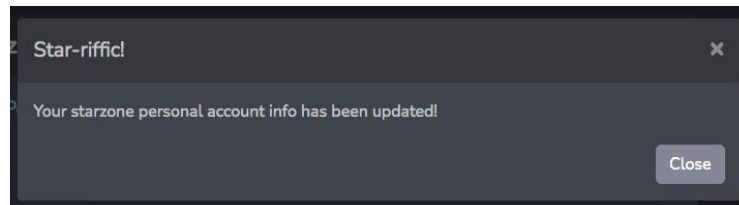
The image shows two states of a login form. The left state shows a successful login attempt with the username 'maddie\_g\_luvz\_starz' and a password field containing 'pass|word'. A green message 'looks good!' is displayed above the password field. Below the password field is a red error message 'please enter your password.' and a green 'log in' button. At the bottom, there is a link 'new to starzone? register here!'. The right state shows the same form with the username 'maddie\_g\_luvz\_stars' and a password field filled with 12 dots. The 'log in' button is green, and the 'New to starzone? Register here!' link is at the bottom.

Lastly, if a user is viewing their personal details but not editing them, the fields are inactive to indicate that they cannot be updated until the user clicks “Edit Personal Details”. Once they click that button, the fields change colour and a “Save” button appears.

The image shows two states of the 'Starzone Account Settings' page. The left state shows the 'Your Personal Details' section with fields for Name, Username, Email, and Location. The fields are inactive (greyed out). A green 'Edit Personal Details' button is at the bottom right. The right state shows the same page after clicking the 'Edit Personal Details' button. The fields are now active (white with grey borders). A green 'Save' button has appeared at the bottom right.

## Output Handling

In terms of output, I always considered giving the user an appropriate response to their input. For example, when a user edits their personal details, the following confirmation modal is outputted to let them know that their changes have been saved successfully. There are similar confirmation modals used across the application for consistency of design. The goal here is to keep the user informed of the status of their actions so they don't become confused or frustrated by their interaction with the system.



Additionally, when using the Star Searcher to perform a search, the results appear directly below the search bar as the users type. An example of this design is shown in the “Sirius” star search example in Section 5.1. This additional output consideration made in the design process means that users know exactly where their search results are, without having to even click a button.

## Error Handling

The *starzone* interface performs proper input validation and error handling on all user input to help users diagnose and recover from errors and ensure that *starzone* is easy to interact with. As the user types, if they enter an invalid value, a meaningful error message appears below the field informing them of their specific error so they can try again. Alternatively, if the field is filled correctly, the interface informs the user too. No button is activated until the user has correctly filled in each required field. Please see the image below for an example using the Register page.

A registration form with input fields and error messages. The form is dark-themed. It contains the following fields and messages:

- First name: "maddie gabriel" (looks good!)
- Last name: "invalidemail" (please enter a valid email.)
- Username: "maddie\_g\_luvz\_stars" (looks good!)
- Password: "ooooo" (looks good!)
- Confirm Password: "o" (passwords must match.)
- Location Access: "On" (allow starzone location access?)
- Register Button: "register"



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I have detailed the input error handling performed by the system below:

- *Login Form*
  - *Username*: user must enter an existing username to login.
  - *Password*: user must enter the correct password to login.
  - Currently, because login details are not stored, the user just needs to enter some username and some password to be able to log in. This error handling would be extended in the full *starzone* implementation.
- *Register Form*
  - *Name*: user must enter name to register.
  - *Email*: user must enter the valid email address to register. It must be greater than 5 characters and match the following regular expression:  
`/^([a-zA-Z0-9_+-.]+\@)(([a-zA-Z0-9-]+\.)+([a-zA-Z0-9]{2,4})+)$/`
  - *Username*: user must enter a valid username to register. The username must be at least 1 character and can contain any alphanumeric characters.
  - *Password*: user must enter a valid password to register. The password must be at least 1 character and can contain any alphanumeric characters.
  - *Confirm Password*: user must confirm their password to register. The confirmed password must match the previous 'password' field.
- *Account Settings*: same restrictions as the "Register" form.
- *Star Search*: no search restrictions.

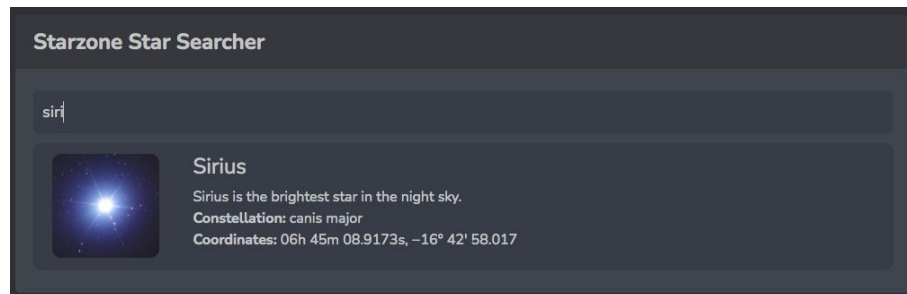
## 5.4 Additional Design Considerations

There are a few other design decisions I made which should be noted.

I employed the visibility principle by only showing the user the essential information they need to make their next step at any given time; I didn't want to over-clutter the page and overwhelm the user. As users click on components, more information can be revealed. For example, the Star Searcher result card only includes a small amount of information about the star: its name, photo, constellation and coordinates. This is enough information for the user to decide if the

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star is their desired result, but is not an overwhelming amount of content to consume. Clicking on that result will open a popup modal with the complete star profile which, while still chunked appropriately into sections and lists, contains a lot more information.



Additionally, here appropriate throughout the application, I used images, icons and graphics to increase visual appeal and draw the user's attention while conveying information in a novel way. For example, the "Astronomer's Forecast" section of the dashboard makes good use of a unique but informative graph as well as an icon to represent the weather rather than more words.

Lastly, I included mapping elements in the *starzone* user interface like scroll bars in the newsfeed and star searcher, as well as different cursors over clickable elements to prompt the user as to what their next action should be. This design consideration also aligns with the affordance principle.

## 6. Design Evaluation

In this section, I will describe the steps I took to evaluate my design. I will also explain further ways in which I would evaluate my *starzone* design, given more time and resources.

### 6.1 User Testing

Although I was able to perform some minimal user testing throughout my *starzone* design process, I would have liked to perform much more formal user testing given more time and resources.

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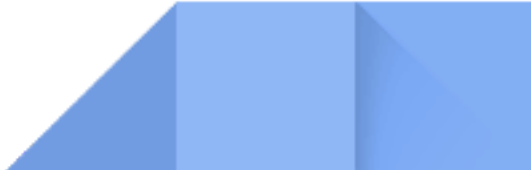
After building my low-fidelity paper prototype and storyboards, I decided to perform some light user testing. I asked my roommate (a physics undergraduate student) to go through my paper prototype and provide feedback. My roommate does fit the description of one of my primary user groups. I gave him goal tasks which align with the three scenarios presented in this report, and observed him attempting to complete those tasks. I gave very little direction or assistance and I took notes of any challenging areas encountered. At the end of the user testing session, I asked him to provide feedback and took the following notes:

### **Feedback on Low-Fidelity Prototype**

- Add a 'confirm password' field to the registration form.
- Change the organization of links on the sidebar navigation menu to group similar items ("Account Settings" and "Logout") and reduce clutter, since these items are the least interacted with.
- Change the layout of the login and register pages to have no sidebar, since it doesn't seem necessary at that point in the application.
- Through observing the users, I decided the 'forgot password' functionality is out of scope for this project. It is not interesting enough to include in the design report, since it would be very similar to the login/register design process.
- Refine the news feed article item layout, and include a photo to entice the user.
- Add an event description in the "Celestial Events" section.

Following this, I built my wireframe while taking the user testing feedback into account. Once my figma wireframe was complete, I asked my roommate to perform the same set of tasks and provide new feedback. I also asked my little brother, a fellow hobby astronomer, to go through my wireframe and complete the same tasks. These are the notes from the user testing sessions for the high-fidelity *starzone* prototype:

### **Feedback on High-Fidelity Prototype**

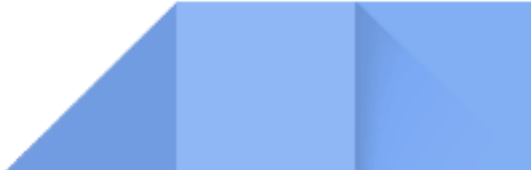
- The colour scheme should be changed to a dark theme across the entire site. Whites, light blues and light greys should become blacks, dark greys and navy blues. This is because the contrast between the dark sidebar and light page content is too jarring, making things difficult to read.
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- I realized that many users may use *starzone* outside while stargazing to check their dashboard or to use the star searcher. This means the interface must be dark enough that it doesn't corrupt their eyes or environment with too much light. Additionally, I got feedback from a test user that this colour scheme would fit better with the aesthetic of the application and I definitely agree.
  - A loading page could be added to improve the professionalism of the application.
  - The cloud forecast could probably be better represented as some sort of radar chart, rather than a bar chart. In the end, I settled on a polar area chart.
  - There should be boxes of some kind around each news item in the news feed to improve the distinction between each item.
  - More realistic sample data and images could be used to improve the interface experience.
  - The search icon for the Star Searcher is unnecessary since the search auto-filters. Having it there is confusing, so it should be removed.
  - Changed various wording across the site for consistency of writing style and tone.

## 6.2 Further User Testing

All this being said, given more time and resources, I would do much more in-depth user testing. I would choose a typical group of *starzone* users to test. This would include a small group of 5 - 10 people from the primary and secondary user groups defined in Section 1. I would be sure to perform user testing on a diverse representative population of users who are screened to ensure different demographics, technical backgrounds, levels of experience with astronomy, educational backgrounds, and even personalities.

Before performing any user testing, I would need to determine my budget for the design evaluation. This is an important consideration when designing a user testing process, as it dictates how much money the designer can spend on equipment and how much time they can sink into the process. I would also need to elect some evaluators to lead the formal user testing sessions. On top of this, before starting I would develop an ethics plan. This would include an informed consent form for user testing participants to review and sign before being able to



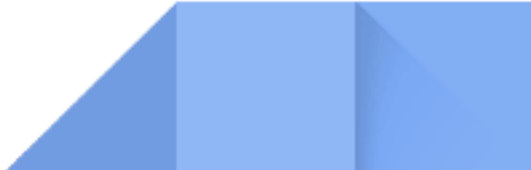
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participate. This form would outline the rights and responsibilities of the participants to make sure they are aware of what they're consenting to.

The actual user testing session would be similar to the casual user testing I performed with my brother and roommate. The evaluators would ask the test users to perform some typical *starzone* tasks in a controlled environment. These tasks could be based on the scenarios defined in this report. For example, I could ask the user to create a new *starzone* account and use it to perform a star search. These tasks would be maximum 15 minutes each and would be controlled, allowing each user to have a similar experience. It's important to replicate test conditions for every user to receive accurate, unbiased results which can be compared after the sessions to measure certain metrics and analyze results. I would hope to secure a usability lab or another controlled space for the duration of all user testing sessions.

The goal of my user testing is to determine how well users can perform the given *starzone* tasks; overall, their success or failure is an indication of the level of usability of the system. This success factor is measured by the speed of task completion as well as the number of errors made. This is the type of data collection I would perform during each user testing session. I would compare the results afterwards to identify trends.

After all this, as the developer, I would use the results of my user testing process to make informed designed decisions to improve the usability of the *starzone* system. Based on the users' observed actions I might add new shortcuts, make certain functionality simpler or more reachable, or add any missing functionality. Through user testing and observation, I would be able to determine if there are any problem areas in the interface which cause confusion for the user and prevent them from reaching their goal in an efficient and effective manner. Based on the success or failure of the test users, I could adjust *starzone* to make it even more usable. This analysis and design iteration process is similar to what I did based on the casual user testing feedback for my low and high-fidelity *starzone* prototypes; however, my user testing results were simply qualitative notes which I recorded while observing the users. It would be nice to collect and analyze qualitative user testing data in order to better evaluate my design and, in turn, improve it.



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## 6.3 Questions for Experts

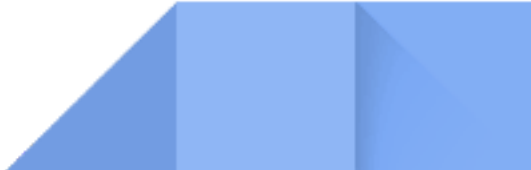
There are many aspects of the *starzone* design for which I would perform heuristic evaluation in order to consult experts for feedback. This evaluation technique would allow me to gather opinions and advice from experts who know more about certain aspects of the technology or target users than I do. Using their knowledge of the technology and user base, experts could produce crit-reports which evaluate the usability of my *starzone* design. I would use this technique for evaluation if my budget was too small to perform user testing, since user testing often becomes expensive due to the time spent and general costs.

I believe it would be worthwhile to get an expert opinion on the news feed column for *starzone*. I would consult somebody with experience in designing social media news feeds which are easy to interface with. I would be looking for usability tips to make this section more intriguing and keep users coming back for more. I would also consult an expert in search interfaces to create a more advanced search interface for the *starzone* Star Searcher page. Currently, it is only possible to search for a star by its name. I would like to build an advanced search option for *starzone* such that users could filter and sort the star results by constellation, star magnitude, coordinates and more. As this would be a complex piece of functionality, I would like to gather expert feedback.

Lastly, I also might consult an expert in the area of astronomy or teaching astronomy. I personally am a beginner hobby astronomer and I certainly don't claim to be any kind of expert. This is why it would be extremely useful and interesting to perform a heuristic evaluation to gain the perspective of a professional astronomer. While I wouldn't consult them for strict usability feedback in terms of the user interface, I would gladly gather feedback about the astronomer tools provided and take suggestions for additional useful features.

## 6.4 Feedback Questionnaire

After performing the user testing process described in Section 6.1, I would use a feedback questionnaire to gather user feedback. This survey would be given to each user who completed user testing, as soon as possible after they complete their user testing session so the information is fresh in their mind. The questions on the questionnaire would be used to



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determine how satisfied the users are, how enjoyable their experience was, how easy they found it to learn to use the interface, and more. I would also gather comments on the aesthetics of the system, and any other relevant comments. The questions cover all three question types: factual, opinion and attitude.

I have designed the following sample questionnaire through Google Forms which you can view by clicking this link: <https://forms.gle/fLZV66mkqoYWxJAq6>.

## 7. Conclusion

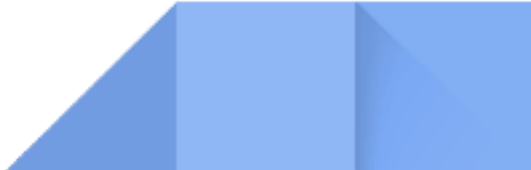
I have really enjoyed completing this term project for CIS\*4300. It has been amazing to experience the design process first-hand, and I have definitely learned a lot along the way. From the very first project proposal to now, I'm quite proud of what I've been able to learn and achieve through this project, especially during a rather strange and difficult semester. Overall, I had a lot of fun designing and building *starzone* - and I hope you had just as much fun using it!

### 7.1 Challenges Faced

Part of the fun of this term project was the challenge - nothing easy is worth doing! The first challenge I faced was coming up with an appropriate idea for my proposal. I went through many unoriginal ideas before looking at my own life to identify an area of need; from there, I was inspired by the idea of *starzone*. Another challenge in the early design phases was that, as mentioned earlier, I am a beginner hobby astronomer. This means that, while I can provide some insights into user needs, I don't have much of the necessary background knowledge which could be useful when designing an application like *starzone*.

Additionally, it was difficult to perform proper user testing and design evaluation on my *starzone* prototypes. This is due to a lack of resources and time, as well as this being seemingly out of the scope of this project. I did my best by performing basic user testing on my roommate and brother, but I know I could do much more in-depth user testing given the opportunity.

The biggest challenge I face in terms of implementing *starzone* was, funnily enough, deciding on the colour scheme. After switching from a light to dark theme, I struggled with changing my



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colours and finding the appropriate shades of grey which go well together but still provide enough contrast to not impede usability. In the end, I ended up colour picking hex codes from everyday dark-themed applications I use in my own life (like Spotify, Github and Discord). Using these colour hex codes as inspiration, I came up with the final *starzone* colour palette you see in my implementation. Another tricky area of implementation was making *starzone* completely responsive. Although this functionality is built into Bootstrap, I don't have much experience with making responsive web applications, so I struggled with some of the code.

## 7.2 Limitations & Improvements

There are definitely some limitations present in both the design and implementation of *starzone*.

First of all, the user interface obviously lacks real data. In the future, I would like to actually implement the whole *starzone* system. This would obviously bring up additional complexities in design and coding to be addressed.

In terms of the dashboard design, I feel there is room for more features. Perhaps a future design iteration of *starzone* could include a weekly cloud forecast instead of only a daily one, so users could plan to attend celestial events further into the future. I would like to incorporate an event calendar for the user, so they could "RSVP" to celestial events. The events would appear in the user's celestial calendar and they could invite friends with *starzone* accounts. Another potential feature for the future could be an astronomer forum; beginner astronomers could connect with others in their region or get advice from more senior astronomers. This would introduce some social communication aspects into the application, which we know gets people hooked.

While it turned out better than I expected, I feel the star searcher functionality has good room for expansion. Currently, it is only possible to search for a star by its name. I would like to build an advanced search option for *starzone* such that users could filter and sort the star results by constellation, star magnitude, coordinates and more. My *starzone* implementation could have a better responsive layout design for some screen sizes. Although it is responsive, it looks a little wonky at certain specific screen sizes. Given more time, I could easily fix this.

Overall, I feel that my current *starzone* design is a solid base which could be easily scaled and extended for future iterations!





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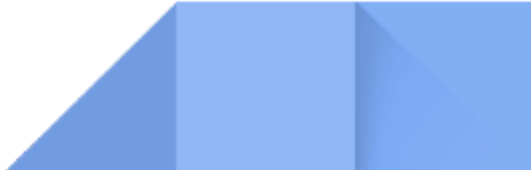
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- On the dashboard, I used this short HTML/CSS code snippet I found online for the layout of the news card items under the "starzone news feed". I customized the design and removed some unnecessary elements.

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- I pulled small HTML code snippets from the Bootstrap docs for two components: the "Star Searcher" search bar and the "Star Searcher" modal popups. Please note that I customized the JavaScript and built my own results section for the Star Searcher.

StartBootstrap (2020) Bootstrap SB UI Kit open source stylesheet (Version 4.1.3) [Style Sheet]. <https://github.com/startbootstrap/startbootstrap-sb-admin-2>.

- I use the SB UI Kit CSS file often for easy padding, margins and cards. It pairs with Bootstrap and extends some of the functionality. It also provides a nice sidebar with toggle functionality, which I customized and used for starzone. The CSS file can be found under `css/sb-ui-kit.css`.

