Team 10 Final Paper
Spaecation: A Space Travel Companion Application

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ABSTRACT
The goal of this research is to develop and evaluate a companion mobile application for space vacationers. Interviews with potential users were conducted to gather important themes and a survey revealed the relative importance of each theme. Requirements were compiled based on important themes and paper and digital prototypes were developed to deliver on these. Finally, user evaluations were performed to gauge the complexity of completing tasks related to the requirements, and these results were used to iterate on the prototype's design. Our prototype makes space travel more feasible and easier than ever before.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords
Space; Travel; Vacation; Mobile Application; Companion Application; Future Technology

INTRODUCTION
As the usually steep costs of space missions fall through improved technology, reuse of expensive parts, and the rise of private spaceflight companies [21], it has become clear that interplanetary travel of both astronauts and civilians alike may soon become a reality. We believe it is important to prepare for the coming boom of space tourism by developing and testing a design for a space vacation guide.

Our technology is a mobile application that will act as a companion to travelers as they explore our solar system both inside and outside of the spacecraft. It acts as a guide as well as a method for seamlessly contacting a customer support team should the need arise. Our goal is to provide a worry-free experience from the time you launch to the moment you land back on Earth.

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RESEARCH PROBLEM AND MOTIVATION

Feasibility of Space Tourism
It has been around sixty years since human's first space exploration in 1961 [1], and research has been conducted about space travel since then. Researchers have been working on human health issues such as radiation protection in space, the impact of space travel on bone structure, and biochemical responses in space [14, 20, 16]. As we gain a better understanding of how to protect people in space, the possibility of civilian space travel has become a closer reality. In 2001, the first space tourist from Space Adventures was approved to visit the International Space Station (ISS) by NASA [2] spending approximately $20 million [17]. From 2001 to 2009, 7 space tourists visited the ISS brokered by Space Adventures [17]. NASA announced in June 2019 that space tourists will be allowed to visit the International Space Station from 2020 with a price of $35,000 per night [3]. Space tourism is now becoming a reality at a more affordable price.

Space Tourism Motivation
As early as the 1990's, research has been conducted in different countries around the world to collect data about the demand for space tourism [13]. A survey given in Japan showed that 80% of Japanese people younger than 60 would like to experience space travel [10]. In the same study, 61% of North Americans were interested in going to space and more than 10% stated that they would be willing to pay a year's salary for a chance to go to space [10]. The survey in the previous study was used in Germany to collect information about people's demand for space travel and the results showed that 43% of the population were willing to go to space [6].

Why a Mobile Application
From 1992 to 2019, the evolution of the smartphone has changed the way people live by providing more and more

possibilities [7, 19]. Now mobile devices are not only used for calls and texts, but also for reading, watching videos, and other applications. Around 800,000 mobile iPhone applications were on the AppStore and 650,000 on the Android Play Store in 2013 [15]. Also considering the fact that smartphones can easily be taken into space, we choose to design a mobile app to provide support during the whole space travel process, from launch to return.

Related Work

Given that this application will be used in the harsh environments of other planets, it is important to have a mode that delivers important functionality that can be accessed while in a spacesuit or otherwise unable to easily use the device. To accomplish this, we have considered several HCI methods of interfacing with users. One of the interaction methods we considered were voice commands which have proven useful in situations where hand dexterity is limited [11] which can be compared to the difficulty of precise tapping of buttons with the large gloves of a spacesuit. A list of voice commands could ensure that users have full control over the application, both on and off the ship. We did not implement voice commands in our interface due to the prototype's complexity but it is something we strongly considered and would try to add in the future.

If the user cannot use voice commands, there may be other constraints such as only being able to use one hand to interact with the device. There has been extensive research in using phones with one hand and how phone size and app design affects user experiences [22]. Because of this, our app needs to be easy to interface with if only a single hand is available.

Because this application will be acting as a guide for users on their journey, it is important that it contains a combination of automatic and manual selection mechanisms that fit the context in which they are being used [8]. For example, if a user were to land on a planet as part of their schedule, it would make sense to show only activities for that planet; this kind of automation could be achieved by tracking the user's location. Also, since we assume that the user has a set schedule that they will follow, we can make automatic selections based on this schedule. These are only two examples of how we could make this application have usable functionality as a guiding application but more will likely arise based on user wants and needs.

RESEARCH METHODS

In this section we explore the research methods and results for both the initial user research and the user evaluation of our digital prototype. The methods described in this section are all repeatable and allow for an iterative approach to testing a prototype.

Initial User Research Methods

To collect user wants and needs of our proposed technology, we conducted interviews and surveys to gather both qualitative and quantitative data from our friends and colleagues. First, we conducted semi-structured interviews using thirteen participants. The number of participants we were aiming to interview was twelve because that is the recommended minimum for discovering new themes from interview data [12]. The goal of these interviews was to collect general features and functions users would expect to see in our space vacation app. Considering this goal, we adapted five interview questions related to gathering user opinions [5].

At the beginning of each interview, we gave participants a detailed description of the space travel application so that they would not be confused about what we were proposing this technology would do. All thirteen participants were either undergraduate or graduate students from Clemson University. To collect the interview data, we took detailed notes of the participants' responses. Once all of the interviews were completed, we pulled out and separated major quotes and ideas from these responses. These separated ideas were grouped together by all members of our group based on common affinities, thus creating an affinity diagram [12]. From this diagram we were able to determine general themes of what the users of our application would be looking for; in other words, we were generally able to determine the users' wants and needs.

With the affinity diagram identifying common functionalities that interviewees expected, we created an eleven-question survey to measure the relative importance of each feature [18]. We also wanted to confirm the results of our qualitative data analysis by checking if the users gave importance to each of the features we highlighted, so a survey was distributed to the same participants that we interviewed. Nine questions focused on gauging the importance of various features using a five-point Likert scale ranging from 'Not Important' to 'Important'. The reason that we had nine questions instead of twelve (one for each theme) was that we combined some of the smaller related themes together since we were only trying to get an overview of what users were looking for.

We chose a five point scale to allow for an "indifferent" option in case a participant did not feel strongly either way about the feature [9]. We also asked two demographic questions (related to gender and age) to better understand our participants. For the number of questions we used the heuristic of having fewer survey questions than the number of participants, so since we were going to have thirteen responses we created nine survey questions.

Initial User Research Results

Twelve main themes were created based on the qualitative data from the thirteen interviews we conducted. It is important to note that there are thirteen themes in the diagram, but one of the themes is labeled 'Miscellaneous' and includes ideas from the interviews that we did not believe were very prevalent and also did not fit in with the other ideas. With the affinity diagram created, we were able to do a basic analysis of the qualitative data by looking for patterns apart from our main theme groupings. Different colors in the affinity diagram represent the responses that different members of our group separated from interviews. As shown in Figure 1, among the twelve themes users seemed to have the most to say about the

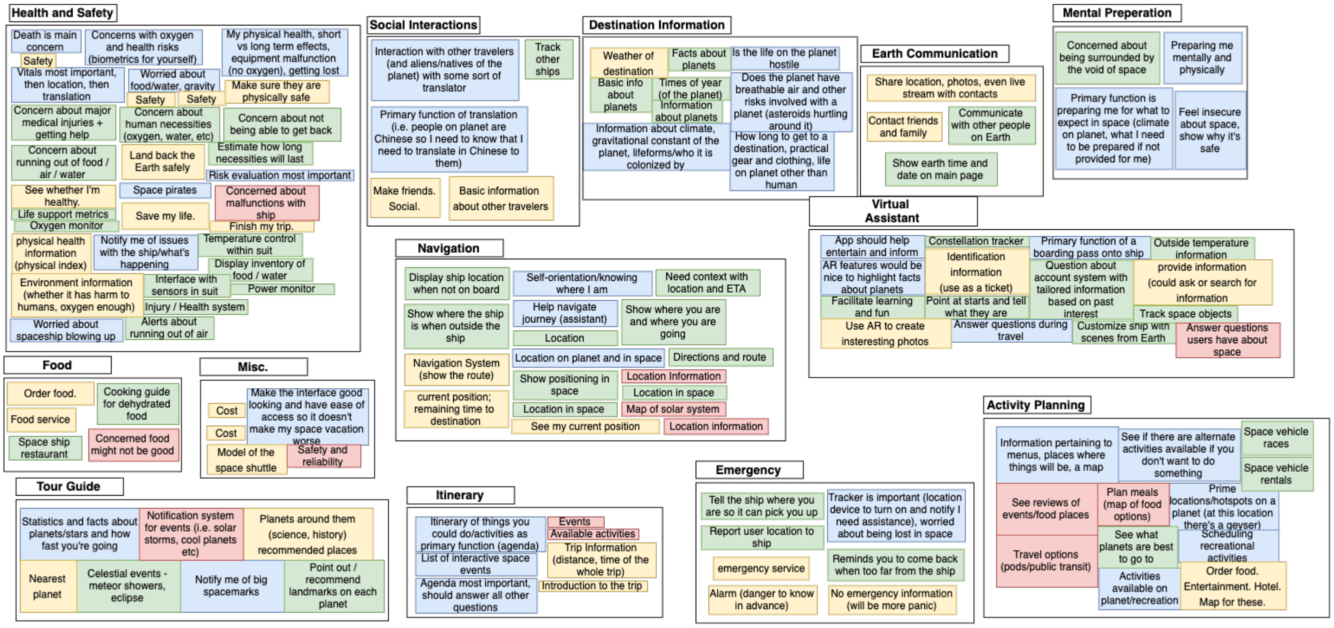

Figure 1. Affinity Diagram

'Biometrics' category, thereby suggesting that this category was the most important to them.

In the interviews, seven out of the thirteen participants mentioned that they were concerned about a 'lack of oxygen' or 'running out of air'. The second theme that participants seemed to mention often was related to 'Navigation' based on the number of comments in it. Most participants also expressed their expectations of seeing location information, including their current position, the location of the spaceship, the direction to their destination, etc. 'Virtual Assistant' was another general theme that users proposed as exemplified by the quote "If I can search for the information I need in the app, that would be helpful". The 'Tour Guide' theme includes functionality similar to a human tour guide, who would be able to tell the space tourists what attractions or landmarks are around them at any time so that the users can get the most out of their trip to space. Additionally, the themes of 'Social Interactions', 'Destination Information', 'Earth Communication', 'Emergency Services', 'Activity Planning', and 'Food' were mentioned throughout the interviews as well. However, we decided to discard some themes which would make our application overwhelmed. Considering these results, we want to make sure that the theme of 'Biometrics' is well supported throughout our space vacation application because it seems so important to our users. This matches our initial concept about creating such a mobile application; users will be less anxious during their trip if the application can help assure them that they are safe.

As mentioned in the previous section, we conducted a survey with the same thirteen participants who we conducted interviews with. The quantitative results of the survey responses were analyzed using Google Sheets. The reason why we did not use R or another advanced analysis tool for our data was because with such a small sample size we do not believe that we will have any significant results; but, we can still get a preliminary idea of what users are looking for. Also, we only did a simple analysis of this data for now so we did not deem it necessary to use more complicated software or techniques. We calculated the mean, median, and mode of the data and created a graph to visualize the data. These mean, median, and mode values were based on the results from the five-point Likert scale questions. The question with the highest average rating (a rating of 4.77) related to the category of 'Biometrics'. The question with the lowest average rating (a rating of 3.38) related to the theme of 'Virtual Assistant'. The three questions with the highest median values (of 5) were the questions relating to the themes of 'Biometrics','Emergency', and 'Location Information'. The question relating to the theme of 'Virtual Assistant' had the lowest median value which was 3. The mode values were generally not that interesting considering that most of the questions had a mode of 4 or 5, however, the questions related to the themes of 'Virtual Assistant' and 'Recommendations' (for food and activities) had modes of 3 and 3/4 respectively.

The findings from our interviews and survey support much of our original concept; however, there were some features participants believed to be important that were not included in our original idea for the project. Key features of our original concept included location information, biometric information, and a way to contact emergency services. The necessity of these features was confirmed through our survey as the highest-rated functionality related to the themes of 'Biometrics', 'Emergency', and 'Location Information'. Features not in our original plan but rated as important by our participants include factual information about surroundings, a notification system for real-time events, and information about available food and activities.

At a high level, these results show that users of a space vacation companion app want more than the bare necessities. In addition to the original core features, our participants expect the app to include content that will enrich their vacation experience through dining, entertainment, and recreational activities. As a result, the scope of our project expanded. Using the results from our user research, we adjusted our product design and plan to line up with what users expect from this tool. While we prioritized the functionality most important to users, we also provided other, vacation-enriching features that users want.

With 'Health and Safety' as one of our biggest and most important themes, we primarily focused on features such as a way to contact emergency services, displaying user health information, and other features that can assist users if anything goes wrong. The location and navigation functionality also continued to be a priority in our revised plan. New features in our design included factual information about planets and landmarks where applicable, notifications for note-worthy events such as the user's agenda and celestial events, and recreation recommendations.

User Evaluations Methods

For the digital prototype we created we completed 8 user evaluations which are within the 5-10 evaluations that are recommended for usability testing. The reason why we stopped after 8 evaluations is that we started to get the same recommendations for changes to our application from successive tests. To perform these evaluations, we first introduced the purpose of the application to each participant. We then informed the participants that they would be asked to perform a series of tasks and that their performance in each task was not a measurement of their own abilities but of the application. The participants were also informed that we would record how many clicks it took them to complete each task and how much time was spent on each task. Finally, participants were told that there would be a brief survey and interview administered after all of the tasks were completed.

We asked the participants to return to the home screen after each task was completed. Additionally, participants were asked to start on the home screen for the first task. We let the participants know when they had completed the task and that they should return to the home screen. We did not aid the participant in the completion of the task and the participant was asked to continue working on the task until it was completed. The tasks were designed to explore all of the potential functionality throughout our application.

The System Usability Scale (SUS) was administered to participants right after they completed the tasks so that the application would be fresh in their mind [1]. Once the survey was completed, we administered the semi-structured interview questions which were based on several usability questions [4].

The usability tasks performed by participants during the user evaluation were selected to address a core design requirement. After these tasks were defined, we established objective measurements to gauge the relative difficulty of each task. During the task completion, we collected both the total time to complete the task and the total number of clicks that the user made while completing the task. The time spent on a task allows us to gauge the relative complexity of the task and the number of clicks allows us to measure how efficiently users are able to complete tasks. For example, if the optimal path to complete a task requires 3 clicks and the user clicked 6 times to finish the task, we know that they had some difficulty in finding a solution to the task.

In total, we used 13 tasks to measure user interaction with the app. All tasks were created based on the functionalities and requirements designed earlier. Some of the requirements outlined in the requirements document were not included in the functionality of the digital prototype. The reason why certain requirements were excluded is that some are non-functional requirements. Also, we did a heuristic evaluation of our paper prototypes and found that some of the earlier requirements would not be useful or usable to the user. An example of one of these requirements is the elimination of ordering food which would make the application too broad and therefore confusing for the users.

The first task (check for any biometric and equipment status problems and report them) was one of the hardest for our users, taking an average of 11 clicks and 54.5 seconds for users to complete. The fifth task (finding earth on the map) was also difficult for our users, taking users an average of 12.3 clicks and 27.9 seconds to complete. Our most difficult task was the sixth task (figuring out speed), which took users an average of 23 clicks and 81.9 seconds to complete. Outside of these, task 7 and task 12 took users 26.5 seconds and 18.3 seconds, respectively.

User Evaluation Results

Survey

For our survey, we used the System Usability Scale [1]. Our survey consisted of 10 questions each evaluated on a 5-point Likert scale (0-4). Of our 8 responses, we took the average score for each question and took the sum for every question's average (30.75). We then multiplied this number by 2.5 per SUS guidelines and got a SUS score of 76.875 out of 100. The average SUS score, 68, indicates an average usability score; therefore, an app with a score above 68 is considered to have above-average usability. It's important to note that this is not a percentage and doesn't indicate what percentage of the app is usable.

Interview

Overall our users had good impressions of our app; however, they had issues with some features. One interviewee found the categories "confusing, like location and trip categories". Another user wanted the notifications removed from the home screen and the hamburger menu incorporated into the home screen.

Our users liked the UI design and the use of icons inside each menu. Users didn't like how the app was organized and how some of the names of the menus weren't helpful.

User Tasks	Averages Clicks	Time
1. Check for any biometric and equipment status problems	11.0	54.5
2. Contact emergency services and then cancel your request	4.8	14.3
3. Find out more details about rover racing	3.3	13.4
4. Figure out what time Halley's comet will go by	3.9	14.5
5. Find Earth on the map	12.3	27.9
6. Figure out your current speed	23.0	81.9
7. Find out how much gravity is on Saturn	7.1	26.5
8. Figure out how long ago you were notified about free pizza	0.4	3.1
9. Figure out how much longer your trip will last	2.1	6.5
10. Find where you can disable notifications	2.5	6.5
11. Figure out the two planets you're stopping at on your trip	2.0	5.8
12. Check units of measurement the app uses	4.9	18.3
13. Log out of the app	3.0	7.3

Table 1. Average Clicks and Time per Task

One user criticized the status menu and said that "the switch between the equipment and biometric status isn't clear". This user suggested "double-sided arrows" to better indicate the swap functionality between the equipment and biometric status pages.

Some other changes that our users recommended were to make some buttons more obvious such as our menu button in the top left. Another popular suggestion was to "move the dropdown menu onto the home page" instead of hiding all of the menu options behind a hamburger icon.

Overall users gave our app a rating of 7.875/10 (average) which confirms the general impression from users was that the app was pleasurable to use and they liked the design. However, users had some issues with the organization of the menus and navigation.

USERS

After we collected user wants and needs and identified our user requirements, each of us created a paper prototype for our Spaecation App. Then we combined the best features of our paper prototypes and built our initial digital prototype through Adobe XD.

User Profile

User profile and personas were created after user need collection. The user profile gave us an overview of the group of people that we are targeting with this application. It gave us an idea of the general audience whose wants and needs we have to consider in the design process apart from those who we collected user research from. Our user profile included the following information:

- Age: 18-80 years old
- Gender: Higher percentage of males than females
- Occupations: Any occupation, especially those related to space and other sciences
- Income: High income to pay for space travel
- Security Background: No criminal record and able to receive some sort of security clearance before traveling to space
- Residence: Across the United States
- Technology: Some computer experience; know how to use mobile phones and mobile apps
- Disabilities: People with normal vision who are able to move and function independently of others

Based on this profile we were able to create more specific personas that include more detail on specific types of users. The reason that we chose well-paying occupations for our user base is that even though space travel will likely become more common and affordable, based on previous research we found, it will still be quite expensive. Also, we previously cited papers about health and well-being in space in our research proposal paper. To ensure that the space vacationers don't have health issues while on their space vacations we set an age cap of 80 and specified that the users should be able to function independently so that they can survive in space.

Personas

We created four user personas as our typical users, all of which are enthusiastic about space travel. Detailed information about their background, finances, technology experience, what he/she's looking for, worries and fears and lifestyle are provided in the personas. The four personas are a young female, a young male, a middle-aged male, and an elderly female. The lifestyles, background information, finances, and technology experience of the personas are generally based on our user profile. They are created based on what kind of people we believe would use this application. What they are looking for and their worries and fears, however, are mostly based directly on the data we collected from our user research. Examples of how the personas connect to our research are detailed in the descriptions of each one below. The quotations used in the descriptions are directly taken from things that our users told us in interviews.

Here are two examples of our personas:

Joe is a persona based on a typical, middle-aged man. His primary motivation for this space travel application is to provide the best experience possible for him and his family because his work keeps him from seeing them as often as he would like to. Some of the things he is looking for includes a simple, intuitive application that is based on a user who asked for the interface to be "good looking and have ease of access so it doesn't make [their] space vacation worse." Also, he is looking for a solid way to plan things to do with his family because the "agenda is most important, should answer all *other questions." For his worries and fears, he is concerned with "mak[ing] sure they are physically safe" and getting "trip information".*

Gary is a persona based on plethora of data we collected relating to the existence of extraterrestrials. When we first conceived the idea of a space vacation companion application we did not consider the possibility of discovering or interacting with alien life forms; but, since the topic came up across multiple people that we interviewed, a persona based around this idea seemed like a good thing to have. Some of the comments from participants that led to this persona included "is the life on the planet hostile", "interaction with other travelers (and aliens/natives of the planet)", and "prime locations/hotspots on a planet". In addition, he is concerned about other travelers being government agents so he wants "basic information about other travelers".

Requirements

Requirements were identified using interview data from the user research we conducted. The requirement types are based on sorting the qualitative data in an affinity diagram. These requirements were further verified by post-interview surveys administered to all of the people interviewed. Based on the quantitative data from post-interview surveys, the average rating of 'Virtual Assistant' functionality was 3.38 out of 5, which is the lowest rating among nine functionalities. Considering that result, we decide to discard the 'Virtual Assistant' functionality.

In total, we established twenty-six requirements, twenty-three of which are functional requirements and three of which are non-functional. Additionally, objective tests were created for each requirement in order to test each requirement in our future evaluation.

The functional requirements were separated into 8 categories including emergency services, biometrics, location, attractions, notifications, food, activities, and trip information. Since we completed user testing after defining these requirements we ended up removing the application functionality related to food and therefore the requirements associated with it.

The functional requirements we ended up with are as follows:

- Allow the user to call emergency services at any time
- Provide other means of contacting emergency services
- Report the user's location to the ship
- Provide tracking information to emergency services
- Display the ship's oxygen, water, and power level
- Issue an alert if the oxygen, water, or power level falls below a critical threshold
- Report the status from sensors on the spacesuit
- Display information and hazards about outside the suit/ship
- Show the user's location in space
- Show the user's next destination

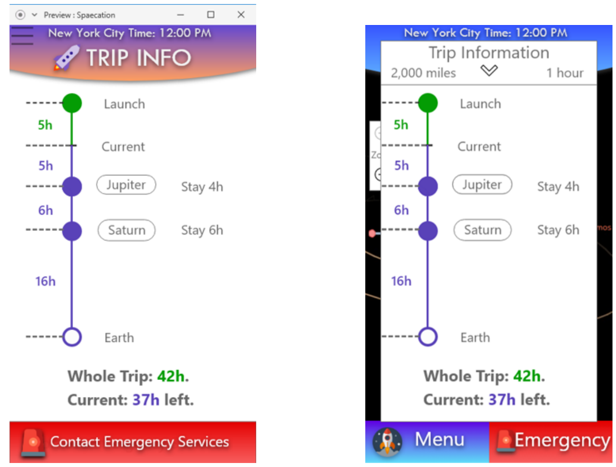

Figure 2. Previous Trip vs. Current Trip

- Show estimated time of arrival at the next destination
- Show the ship's location when not on board
- Show landmarks at the destination
- Show relevant information about the landmark
- Issue a notification alert when significant events are happening near the user
- Notify the user of upcoming agenda items
- List available activities at the next destination
- Allow users to schedule recreational activities
- Display a map of the destination with available restaurants/activities/events/landmarks
- Display time, weather, hazard, history, and preparatory information about the destination

The non-functional requirements we ended up with are as follows:

- The interface should be easy to use
- The app should make the user feel more safe in space
- The application should be mobile

ITERATIVE DESIGN PROCESS

Paper Prototype

Our paper prototypes were created based on our previous user research, which defined thirteen themes. However, not all the themes were included in the paper prototype because some themes are not important and they would make our application overwhelmed. Our paper prototypes had the following functionalities, which were confirmed to be important to users through surveys in user research, *biometrics status, location, trip information, activities, attractions, emergency service and settings*.

Figure 3. Previous Menu vs. Current Menu

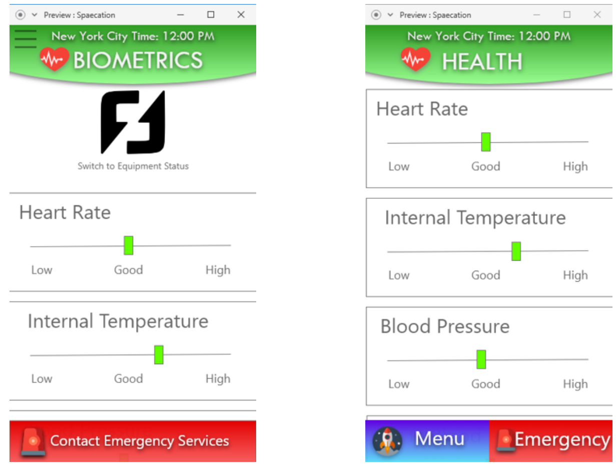

Figure 4. Previous Biometric Status vs. Current Health Status

Initial Digital Prototype

After we completed the design of our integrated paper prototype, we built a digital prototype in Adobe XD. According to our previous user needs collection, seven main categories were identified utilizing the user data analysis results. Once the users log in, they will see the home screen with agenda and local Earth time on the top of the screen. The menu was designed as a hamburger button on the top-left corner of all interface, as shown in Figure 2. Users can use hamburger button to go to any interface they are interested in.

Final Digital Prototype

Our initial digital prototype fulfilled the original motivation for designing a space companion system to help people during space travel. Through usability tests on our initial prototype, we found several problems users faced in using our system. We updated our prototype based on user evaluation findings. The following list is all the changes we made to our prototype:

1. Combine location and trip information.
   Reason: In our interviews, two participants said the significant change they want to make is to merge location and trip information. Users were confused about what information they could find under each category. As a result, we made trip information as a subsection of location category.

2. Change the hamburger menu.
   Reason: Five out of eight participants chose to change the hamburger menu when they were asked what significant change they want to make to this app. And two participants said different categories should be put on the home screen, "Instead of dropdown different categories, make that the home page and just have the home button on other pages" and "Move menu options to the home page instead of having to click the hamburger menu".

3. Change the name of 'biometrics' to 'health'.
   Reason: Participants were confused about the name of 'biometrics'. When they were doing the 'Figure out your current speed' task, they went to the biometrics category. Changing it from biometric to health will be more clear and less ambiguity.

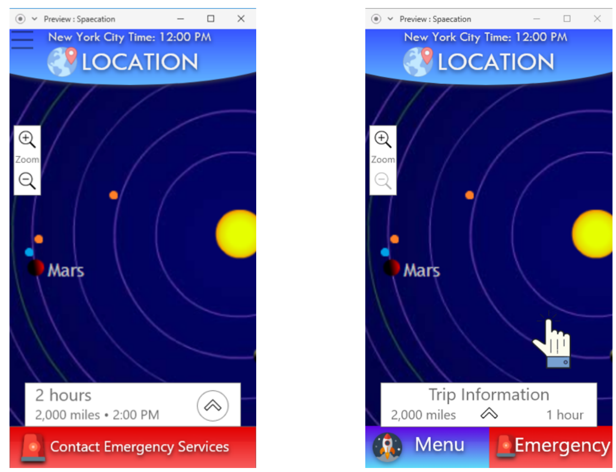

Figure 5. Interaction Direction To The Map

4. Separate heath and equipment status.
   Reason: Some participants had difficulty locating the equipment section during the "Check for any biometric and equipment status problems and report them" task, which indicates that the "Switch to Equipment Status" option in the "Status" screen is not clear. By separating the "Health" and "Equipment" sections, we can ensure that participants are able to find whichever status they are searching for.

5. Indicate that the map can be dragged.
   Reason: Many participants struggled on the task "Find Earth on the map" because they did not know that the zoomed-out map could be dragged to reveal more of the map.

Show an indication that the map can no longer be zoomed in or out.
Reason: Several participants had problems during the map interactions and mentioned in the interviews that they had problems knowing whether the map could be further zoomed in or out. For example, in trying to locate Earth on the map,

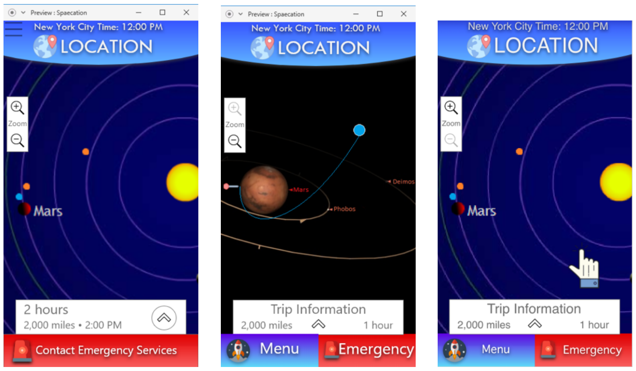

Figure 6. Zoom In & Out Visible buttons

some participants wanted to continue to zoom out, but it had already reached a maximum zoom out.

The final prototype has seven categories in total: *health status, equipment status, location and trip, activities, attractions, emergency service and settings*. As mentioned in the iteration of the digital prototype, we combined location and trip categories, and separated health (biometrics) status and equipment status. The final prototype fulfilled the requirements we created and will be able to provide users a more enjoyable user experience in their space travel.

CONCLUSIONS

The idea of a companion app for space vacations is not only feasible, but has shown what user's primary concerns are when faced with an unknown environment. The two main themes we found in our user research were ensuring user safety and awareness of where they are and what is around them. Once space travel becomes less expensive and more widely available, we firmly believe that such app will not only exist, but be essential to the space vacation experience.

Limitations

One limitation we faced in doing our user research is that our users could only answer questions hypothetically. Since none of them had actually been into space, they could only guess at what features would be most important to them.

We would also like to mention potential bias in our usability test results. Since we recruited friends and colleagues to test our system, it is likely there was bias due to convenience sampling. This bias could have lead to an increase in our overall usability score. We tried to minimize this through anonymous survey responses and by indicating that the application is only a prototype. Additionally, a majority of our users owned iPhones and may have expected similar functionality to other iOS devices. To reduce this bias we would need a more diverse sample of participants.

All of our testing was done in a normal environment, which isn't representative of where our app would actually be used. In future, we would conduct usability testing in an interstellar environment.

Implications

This research shows that a useful and usable mobile companion application can be developed to fulfill user needs during a space vacation. These needs include, among others, assurance of safety and ability to check statuses. The effective implementation of a space companion app will help users feel safer and enjoy their space vacation.

Our application also shows the capability of designing for future technology. Even though the implementation of the technology we rely on for this application is not fully realized yet, we can still design for the future. By doing so, we pave the way for other future thinkers who dream of going to space.

Future Work

Future work in this area could include an investigation into the app's efficacy in space. As mentioned in the limitations, we were unable to test if the app was just as usable in a real space setting as it was here on Earth in an ideal environment. Similarly, researchers could try to find if the app actually makes people feel more safe in a more dangerous environment like space.

Also, because we eliminated some functionality from our prototype to make the application less confusing, perhaps there is a way to reintegrate those features. Those features would mainly deal with food services available to user on their space vacation. Also, through more user research and usability testing it is likely that we could discover additional functionality that would be useful to users. These requirements may even stem from testing this application in space once it is available. It is not clear to us how interacting with this application in space will be different than here on Earth. Perhaps we will need to make adjustments if the users try to interact with the application while wearing spacesuits. Perhaps if the phone is floating in zero gravity it changes how users tap and swipe the application.

Mainly though, we need to consider how phones may change in the time it takes for space tourism to become a reality. Our application mirrors current phone applications and interactions in many ways, so those interactions will need to be updated based on the mobile technology available at the time of its launch. Even so, our design should still stand even if the interface changes.

Finally, we should mention the work that still remains in making civilian space travel a reality. This includes lowering the cost of space missions, an improvement in launch safety, and making travel to other planets more practical.

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