Context-Aware Clothing Recommendation

DESIGN DOCUMENT

Team 34

Client/Advisers
Goce Trajcevski

Team Members/Roles
Ethan Wieczorek - Lead Developer
Nickolaus Eaton - Hardware/FW Project Manager
Will Parr - Communications/Meeting Facilitator
Nicus Hicks - Head of Report Development
Christian Ehlen - Lead Quality Assurance Engineer
Tyler Witte - Software Project Manager

Team Email
sdmay19-34@iastate.edu

Team Website

https://sdmay19-34.sd.ece.iastate.edu/

Table of Contents

List of figures/tables/symbols/definitions (This should be the similar to the project plan)

1 Introduction

1.1 Acknowledgement

Professor Goce Trajcevski will be assisting in the technical advice and equipment retrieval for this project.

1.2 Problem and Project Statement

It's very common to see people wearing clothes that are simply inappropriate for the weather, just because they were unaware of the day's forecast. The problem is simple, it's just too easy to get dressed while unaware of what you should actually be putting on. Our goal is to implement a system that suggests clothing fitting the weather and events that you have planned for the day.

This project aims at providing a comprehensive solution for a clothes recommendation system. The main idea is to couple data from multiple sources and integrate it in a manner that will enable the users to select outfit and/or plan which clothes to pack for an expected trip. As a motivational example-scenario: upon detecting that the user has woken up (e.g., Fitbit), a trigger is fire that connects to a Weather Channel API. Given the weather prediction and the tasks and places that the user has entered in the calendar for that particular day, an app will provide a recommendation for selecting the items from the closet to be worn/carried for the day. In addition, in case of a multiple options, the hangers in the closet will provide another source for selection.

Extending this example would correspond to two kinds of scenarios: (1) a user needs to plan a business trip in multiple places and different geo/climate zones and providing a recommendation for which clothes to pack; (2) an abrupt change in certain parameters (e.g., weather; change of meeting place) necessitates obtaining another clothing item (e.g., a sweater or an umbrella) -- in which case the system should recommend a nearest store or a store requiring smallest deviation from a planned route.

1.3 Operational Environment

This product will mostly be used on smartphones with some users potentially using a web version of the application. Operating environments will not really affect our application any more than the normal operating environments of the user's smartphone.

If we do end up moving to include a hardware aspect of the project, our hardware aspect will consist of a single screen hooked up to a computing device (a screen with a raspberry pi, or a cheap android tablet, etc.) that will live in a singular location in or around the user's closet. The operating conditions of the closet will be easily manageable for any computing device we decide upon as the device will be stationary and in a dark, dry location.

1.4 Intended Users and Uses

Our first primary intended user is those who travel frequently for business. These individuals may be traveling to different countries in the duration of just one or two days. Our application is intended to allow these users not to worry about checking the weather, but rather just have it done for them. Our application will also take their schedule into account as well, so that it will give smart predictions based on the weather at that time of day and also where they will be.

Another primary user are those who live in an area where there is easy access to public transportation. These individuals may have a longer commute and may not be able to go home during the day. Therefore, our application needs to be able to give recommendations for an entire day based on the weather.

Our secondary user is those who would like to make their day more efficient. These individuals would like to have an outfit prediction based on the weather, and may not have a busy schedule. Picking out an outfit takes time, and our application will make their day more efficient.

1.5 Assumptions and Limitations

Assumptions:

- System will run on a single-user basis, so should be able to run on many concurrent systems.
- That the user will be able to have internet connection a majority of their time, and always when they are getting ready for the day.

Limitations:

- The system will need to be connected to the internet in order function.
- Users will need a smartphone or tablet in order to run the end product.
- The integrated development environment won't be available to us on school computers so work will take place off campus

1.6 Expected End Product and Deliverables

The current planned deliverable is the android, iOS, and web application. The application will have the ability to do all available functions across all 3 versions of the application. The client will be able to first input all of their owned pieces of clothing and catalog them in their digital “closet.” The user will then set a daily time they would like to be initially told an outfit for the day (this will normally be the same time as their alarm). The user can also request an outfit update at any point of the day inside the application. The application will provide an outfit based on the current and possible weather for the day at the specified time every day. The application will also periodically check in throughout the day to see if the weather predictions have changed and suggest items like snow boots, raincoats, and umbrellas. The application will notify the user if any updates that require a sudden change in attire do occur.

The application will reach the alpha stage by December 2018. The alpha stage will consist of an initial product we will use to retrieve feedback from testers and potential users. The beta stage will be when we have finalized the product and are looking for improvements will be reached by May 2019, and the finalized application will be released three weeks before the end of the Spring 2019 semester.

2. Specifications and Analysis

2.1 Proposed Design

After discussion and research, we decided to use React Native for our implementation of this project. We came to the decision on this framework because it allows us to develop for both Android and iOS simultaneously. For our external APIs, we chose DarkSky for weather data because it is well supported and has libraries that streamlines its implementation and use within React Native. For the project database, we chose to go with Google’s Firebase Real-Time Database because it is lightweight and is compatible with React Native. Firebase services also offer Google Authentication, so instead of us handling all the accounts that would need to be created for the use of the app, we can use this authentication service and have the users sign into the app using their own google account.

Functional Requirements:

- Log in and out
- View available clothing
- Select clothing to be worn that day
- Add/Remove clothing from wardrobe
- Refresh wardrobe when wardrobe is low or out

Non-Functional Requirements:

- **Scalability** - The database of the application must be scalable to ensure many users will be able to access the application and their wardrobes.

- **Availability** - The application needs to be available 24/7 for when the users require context updates for their wardrobe.
- **Reliability** - Application must be able to recover loss of database and preserve user accounts and wardrobes.
- **Maintainability-** Database must be maintained to ensure proper updates via the weather and calendar.
- **Security** - Database must be secure to protect information about the users and their clothing.
- **Data Integrity** - The clothing items stored in the database should only be able to be modified by the users or an administrator.
- **Usability** - Will be accessible by all users and administrators, so all users can receive updates for clothing recommendations. Users will connect to the application via a mobile device and recommended clothing will be displayed as the weather and calendar are checked.
- **Performance -** The application should generate a recommendation based off the weather and calendar events in less than 3 seconds.

2.2 Design Analysis

So far we have determined the login page, as well as the weather api and display we will be using.

Login Page: For the login page we had a few different designs we were deciding between. Option 1 was a basic username/password login page. Option 2 was an email/password login page. Option 3 was a firebase enabled login through google.

We chose the firebase enable google login because of a few key strengths. The login authentication is handled entirely by google and we don't need to authenticate usernames or emails with hashed passwords. This adds a layer of security because our database doesn't actually store any password hashes so there's no security vulnerability if our database is compromised.

Weather API: We are using the Dark Sky weather API. The dark sky api provides us with an easy call to make for all of the weather information necessary for daily use. More importantly, our application is allowed to make 1000 requests to dark sky for free every day. Beyond the base 1000 requests the price per request is considerably low. Out of all of the APIs we researched this is the best price per request we found for our use. There are no limitations to dark sky that we have found.

3 Testing and Implementation

For this project, the testing is simple but critical. Since the app we are creating will ideally be used by countless people at the same time, it's important that we ensure the resulting app is tested for successful user interface implementation and simultaneous activity.

We will need to ensure items can be added and removed from a user's profile, depend on the weather, and take events into account. Additionally, we need to make sure multiple users simultaneously accessing the system receive timely and accurate responses from the database.

Over the course of our testing process, hands down the best way to do it is to simply operate the software on each of our devices. For load tests, we can generate a number of requests from a few locations, ensuring the feedback is accurate and reliable.

3.1 Interface Specifications

Our system runs primarily on smartphones and tablets. In every case, it's important that the application has a familiar, if not identical, appearance and interface. Additionally, we will port the app to a web app, to allow users to use a computer instead. This will be extremely beneficial for adding multiple pieces of clothing.

3.2 Hardware and software

As of now, there are no major plans for the development of hardware peripherals. However, due to the nature of the project, we will be making use of tablets and smartphones to interact with the application we develop.

3.3 Functional Testing

Tentative Test Cases:

1. Application collects weather data.

   Test Case:

   For this FR, we want ensure that the application correctly retrieves information from the weather reporting service we decide to use.

   Test Steps:

   a. Manually collect weather data.
   b. Check weather data collected by app against manually collected data.

2. Reasonable recommendations are given.

   Test Case:

   For this FR, we want to ensure that the system can give the needed recommendations and that the recommendations are reasonable and correct.

   Test Steps:

   a. Give program sample wardrobe.
   b. Ensure that the system runs.

3. User data is saved correctly and retrievable.
   Test Case:
   For this FR, we want to make sure that user information is correctly stored in the database and retrieved from the database.
   Test Steps:
   a. Upload user information.
   b. Load and edit user information through the application.
   c. Check that the information was correctly saved.

4. Clothing is correctly categorized and displayed.
   Test Case:
   For this FR, we want to ensure that when a user inputs clothing into the system, it is put into the correct place in the databases and can be accessed again.
   Test Steps:
   a. Input clothing items through the application.
   b. Check the databases to ensure that the items were categorized correctly.

5. Application runs on Android and iOS.
   Test Case:
   For this FR, we want to ensure that the application runs on both Android and iOS at comparable qualities.
   Test Steps:
   a. Start the application on an Android and iOS device.
   b. Run all previous tests for both systems.

3.4 Non-Functional Testing

Performance

- The user should receive a recommendation based on the weather in under 3 seconds.
  - Test Case:
    - The user will logout and login making sure that nothing will be saved in the cache, and then request a recommendation for their clothing. This should render on their phone in under 3 seconds.
- The user should be able to be authenticated in less than 1 seconds.
  - Test Case:
    - When a user has logged out of the application or is creating a new account, the authentication service should authenticate them less than 1 second and be displayed in the database.

Security

- Users will not have access to administrative functions
  - Test Case:

        - Create a new user account within the database and test whether or not their privileges are escalated enough to make any malicious changes within the application and the database.

Usability

- Efficiency of New Clothes
    - Test Case:
        - When the user is adding new items of clothes, they should be able to do this in an efficient manner. The user should be able to select what temperature range this should be worn at and the category of the article of clothing on average under 5 seconds based on user experience with technology. The user in the future may be able to add their clothing from a csv file making the web interface extremely efficient.
- Performance Tracking
    - Test Case:
        - Any process that takes more than 2 seconds should display a window saying “Please Wait” this allows the user to not overload the application, but also understand that the app is working and that it is not user error.

Compatibility

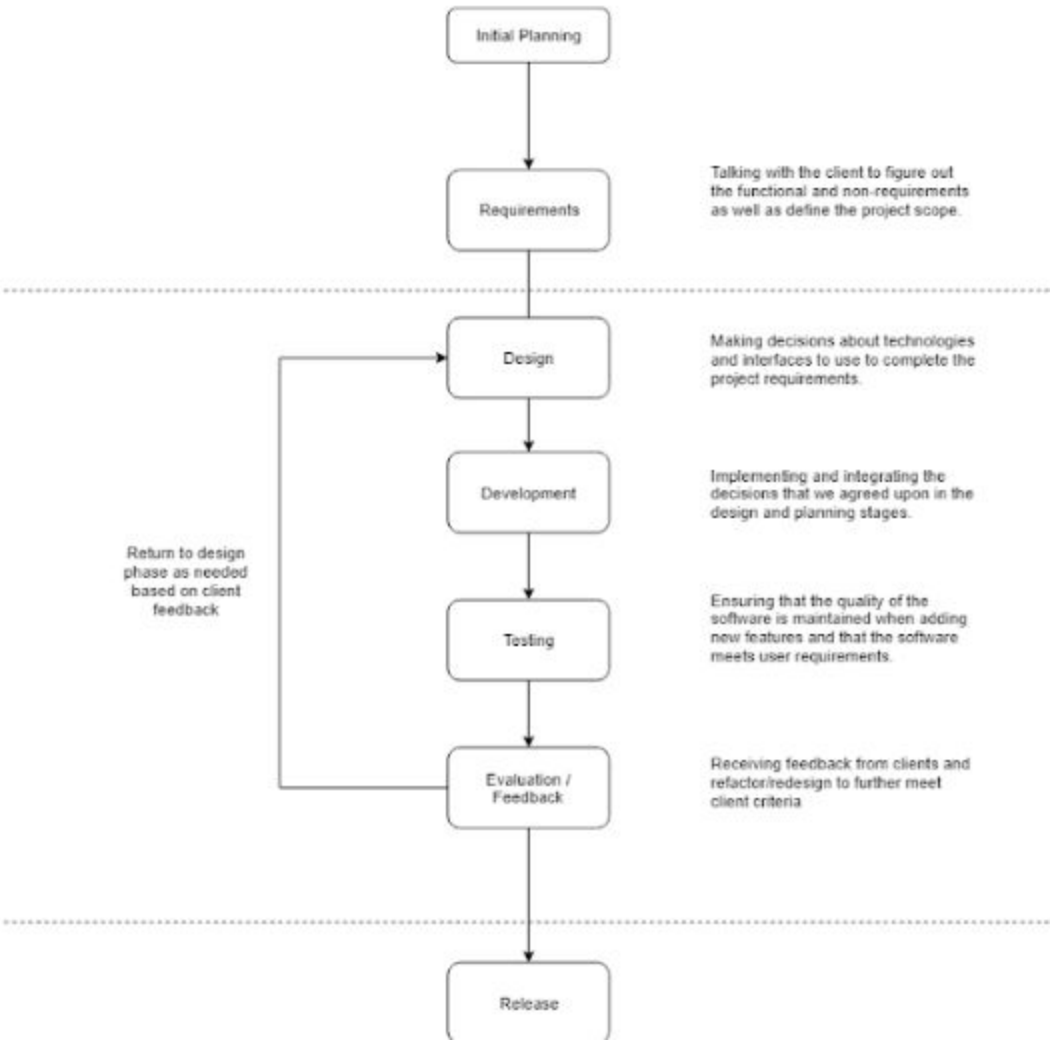
- External APIs
    - Test Case:
        - Test various ways the APIs are used for the application and how they can be plugged into the environment. This way the application can get the best use out of these APIs.

3.5 Process

Before any actual development we made sure that our requirements and scope were correct by pitching our idea to our client. If the client was satisfied by the product and felt that it met all of their requirements, we could move on to development.

We first began development testing by testing the overall functionality of the mobile app and its interaction with the database. Once the mobile app is working and displays the placeholders for all of the screens without any major issues, we are moving to the testing of displaying the data. If the data is displayed correctly and tests well with users we will move to the web interface of the application. We plan on moving to porting the mobile app to having a web interface as well for large wardrobe inputs. This will need to correctly be stored in the database and reflect what the user has entered from the web interface. Once this is a stable feature, we will move on to adding external devices.

Moving on, we will likely be moving to adding IoT devices such as smart hangers for more accurate recommendations for the user that will take into account colors, style, and thickness. This will enable the user to have far more accurate predictions for their requested days.



As shown in the diagram above, we will continually be testing new features and receiving feedback from our client. Our testing process will take place throughout the entire development lifecycle allowing us to pivot if we need to refine requirements. By continually designing and testing, it allows us to take steps back and view where the project should be headed and not get tunnel vision on the development side of new features.

3.6 Results

There have been no system tests performed at this time, as basic implementation is still in process. However, we have successfully retrieved information in experiments.

4 Closing Material

4.1 Conclusion

Our context-aware clothing recommendation system will benefit our users with smart suggestions on what to wear; rain or shine, hot or cold, formal or casual. The intent of the system is to provide a user with day to day updates on what to wear as well as a function to help a user pack for a trip. The system will intelligently select qualifying items the user should wear or pack based on the user's calendar and the upcoming weather.

Thus far, we have begun implementing a design for a universal-type react native application that is to be functional on both android and ios devices. Our implementation has reached the early app development stages and is has a functional react dashboard with a weather API call. Our goal is to complete additional calendar api calls and to complete a functional user interface so that we can begin to add clothing to the database.

Our best plan of action is to continue with the application development in sprints. If we successfully complete each development cycle, we expect to have a working prototype of the application within the next couple weeks.

4.2 References

Npm, (2018). React-google-calendar-api. [online] Available at: https://www.npmjs.com/package/react-google-calendar-api [Accessed 12 Oct. 2018].

npm. (2018). *react-native-weather*. [online] Available at: https://www.npmjs.com/package/react-native-weather [Accessed 12 Oct. 2018].

4.3 Appendices

Iowa State University and Senior Design Team 34 do not discriminate on the basis of genetic information, pregnancy, physical or mental disability, race, ethnicity, sex, color, religion, national origin, age, marital status, sexual orientation, gender identity, or status as a U.S Veteran.