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SU AYAK İZİ

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Abstract

Water scarcity is a pressing global concern, that calls for innovative approaches to encourage sustainable water consumption. This thesis introduces "Su Ayak İzi," a mobile application that is intended for precise tracking and evaluation of water consumption of individuals. "Su Ayak İzi" determines user routines of water usage by asking related questions during registration process. This leads to measuring water use in terms of volume and frequency across a range of activities that people do in their daily life, such as showering, laundry, dishwashing, and handwashing. The collected data establishes a comprehensive profile, enabling users to visualize, understand and evaluate their consumption patterns, then behave accordingly.

However, the impact of "Su Ayak İzi" not only goes beyond tracking the water usage but also aligns with a broader objective in accordance with the United Nations' Sustainable Development Goals, specifically focusing on the aim of "clean water and sanitation". The application aims to promote a collective awareness among users, encouraging a dedication to sustainable water usage for the improvement of our environment and future generations.

This thesis presents how this mobile application, "Su Ayak İzi", was designed, built, and tested to obtain its strength/effectiveness in encouraging water-conscious behaviors of humans. Considering the precise analysis and user feedback, this study contributes insights into the potential impact of technology in advancing sustainable practices, particularly in the matter of water consumption.

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i.e.	Id est (Latin: this means)
e.g.	Exempli gratia (Latin: for example)
SDG	Sustainable Development Goal

1 Introduction

Water, the essence of life, appears at the top of global sustainability challenges, due to increasing populations and climate uncertainties, which intensify concerns about its limited availability. In this context, "Su Ayak İzi" emerges as an innovative mobile application designed to effectively and purposefully help people to manage their consumption of water by monitoring and analyzing it in a simple way. The fundamental concepts, societal significance, and the justification for using a mobile application as the medium for monitoring and assessing individual water usage. It highlights the need to utilize smartphones, which are constantly present in everyday life, to enable effortless input of data and user engagement.

The creation of "Su Ayak İzi" relies on rigorous collecting of user data, acknowledging that water usage is not merely a numeric measure but a nuanced representation of individual habits. The registration process, characterized by specific inquiries, acts as an entry point to the complexities of daily water-related activities/tasks. The application systematically records several aspects of water usage, including the timing of showers and the frequencies at which household appliances like washing machines and dishwashers are used, to capture each user's water footprint. Using a mobile app as the main way to track water use was decided after thinking about how important technological devices are to modern life. With these gadgets becoming more and more a part of our daily lives, using a mobile app makes entering data easier for users. Smartphones make the app easier to find and use, and they also make it easy for users to add water tracking to their daily lives, which helps them enter data consistently and correctly.

"Su Ayak İzi" overcomes the traditional function of a tracking app, aiming to serve as a catalyst for both individual and community modifications in behavior. The application analyzes acquired usage data, (some of the data will be collected time-based, whilst others collected as liter-based), to create a customized consumption profile. This profile offers users valuable insights into their water usage patterns. By providing straightforward visual representations and immediate feedback, the mobile application serves as a medium for making well-informed decisions, enabling users to improve responsibility for their ecological footprint. In short, supporting to create a community of individuals who are passionate about protecting our water resources for the benefit of future generations was the kick-off point of this project.

2 Literature Review

The Earth's water is running out day by day. As Gall, N.(2015) [4] stated, "Half of today's giant cities face mounting difficulties in securing and managing water resources for their growing populations. As in ancient times, water supply is emerging as a challenge to civilizations both rich and poor." Pearce, F.(2007) [6] explains the significance of the situation with the following sentences in her article: "Some of world's largest rivers now trickle into sand miles from the ocean, exhausted by human need. Water is the new oil -except we can live without oil; there are no alternatives to fresh water."

In this context, people need to be conscious about water consumption for the survival, cleanliness, and accessibility of water, which is a basic need for the continuation of life. Since water is not only consumed for drinking, taking a shower, cleaning, or watering the garden; water is consumed in every step people take, in every piece of clothing they wear, in every agricultural product they consume, and in every product they buy, regardless of the material.

A few examples can be used to concretize the amount of water spent and to reveal the criticality of the situation. According to the studies, 4.3 trillion cubic meters of freshwater is used every year. This amount is the equivalent of over 50 Olympic swimming pools being consumed every second. At the same time, this amount is equivalent to all people in the world drinking more than 4 glasses of water every minute.

These amounts mentioned only refer to direct freshwater use, so this is just the tip of the iceberg. At this point, the concept of "virtual water" comes into play. As mentioned before, water consumption occurs through the products people use, the food they eat, and the clothes they wear. This type of non-direct, indirect-consumed water is called "virtual water." Related to this, Harvey, F.(2018) [12] who is an environment correspondent, stated, "How do you fit 130 liters of water in a single cup? The answer: fill it with coffee." and he mentions that currently, 844 million people (equating to approximately one-ninth of the planet's population) lack access to clean, potable, and affordable water within half an hour of their homes, and every year almost 300,000 children under the age of five die of diarrhea due to the lack of access to clean water, resulting in contaminated water consumption and inadequate sanitation. Furthermore, it is crucial to enhance public knowledge regarding the significance of water preservation and the repercussions of these acts on the environment and future generations.

Through collaborative efforts and proactive initiatives, it can be effectively guarantee sufficient access to uncontaminated water for all individuals and safeguard the conservation of this planet's natural resources for future generations.

3 Related Works

In this manner, many studies have been conducted to track and measure virtual water consumption. For instance, Reckitt Benckiser home and hygiene products company, known for its finish detergent brand, asks very general questions about people's water consumption routine, just like a carbon footprint meter, within the scope of a project called "Yarının Suyu" and provides them with approximate individual water consumption data. However, although this data is a measurement based on the person's indirect consumption, this measurement is a one-time measurement that can be accessed only once, if the user enters that website. At this point, this study is insufficient to monitor personal water use on a daily and regular basis.

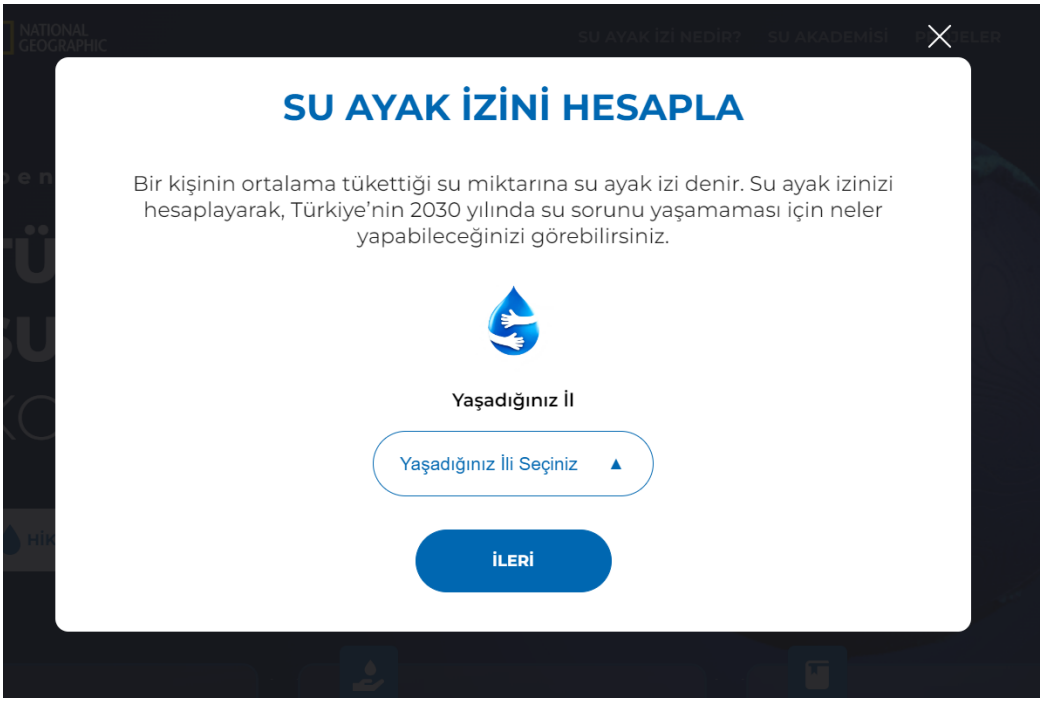

Figure 1: A sample screen of "Yarının Suyu" project.

Figure 2: A sample screen of "Yarının Suyu" project.

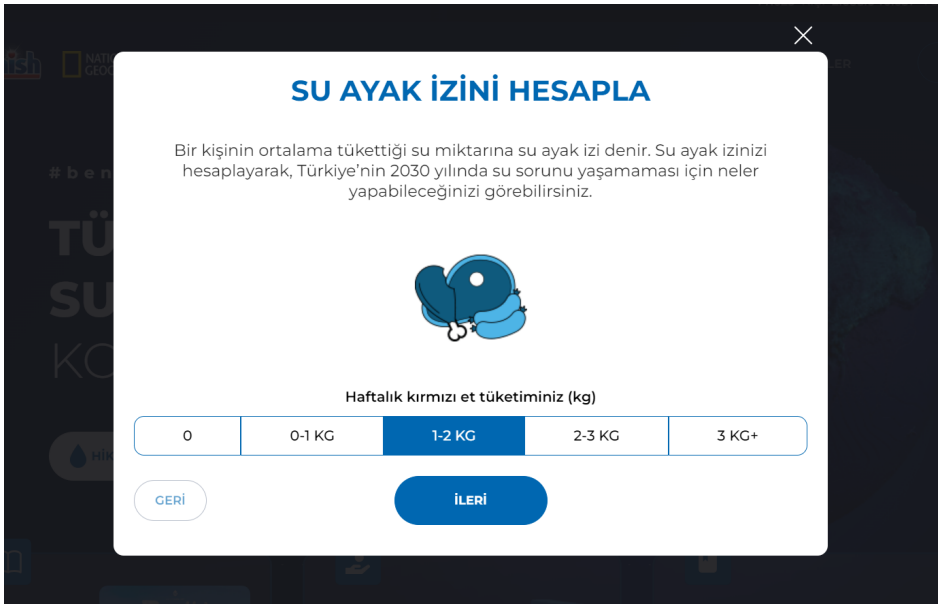

Figure 3: A sample screen of "Yarının Suyu" project.

[redacted]

Su ayak İzin 5322 lt/gün

Figure 4: According to "Yarının Suyu" calculations, sample usage data.

As can be seen from the screenshots taken from the website of the "Yarının Suyu" project, the calculation here is only a one-off and only shows annual summary data. It does not offer users a daily tracking opportunity.

In addition, there are many applications offered under the title "hydration reminder" to remind people about water consumption, but the only function of most of such applications is to remind people to drink water. and therefore such apps are out of context when compared to the "Su Ayak İzi" project.

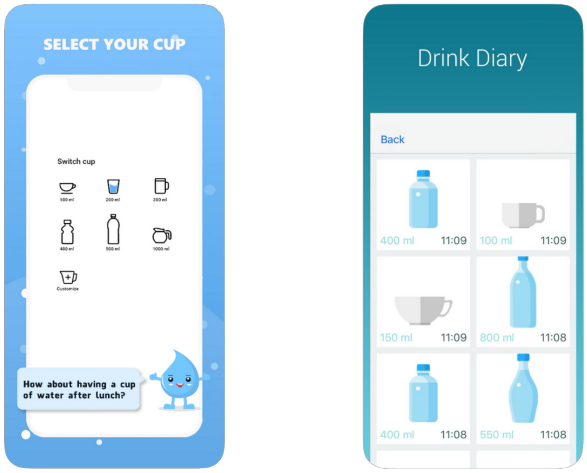

Figure 5: Water reminder applications in the market.

In this context, many of the technological breakthroughs aimed at tracking water consumption and raising consumption awareness are less effective and superficial in comparison to the "Su Ayak İzi" mobile application, which offers daily and regular monitoring. Lastly, even though some actions are taken, the world still needs rigorous break-throughs. As Tortajada, C. (2018) [9] mentioned, "Innovative proposals that would improve management of water resources in general and of water sup- ply, sanitation and wastewater management in particular did not emerge, with the consequent negative

health and environmental impacts for billions of people globally." Right here, at this point, it becomes clear that the need for a project such as "Su Ayak İzi" arises.

4 Methodology

The "Su Ayak İzi" mobile application is a user-friendly platform for monitoring individual water consumption. It gathers unique user data on water-intensive activities, prioritizes privacy, and incorporates features like easy-to-navigate interfaces, reminders, and gamification. The project aligns with Sustainable Development Goal 6 and aims to promote clean water and sanitation.
The initiative is closely aligned with Sustainable Development Goal 6, which specifically aims to ensure universal access to clean water and sanitation while promoting sustainable management of these resources. "Su Ayak İzi" contributes to global sustainability goals by advocating for individual-level adoption of clean water and sanitation practices.
The development approach has been characterized by a dedication to resolving obstacles such as data accuracy and user involvement. We have made ongoing design enhancements by incorporating user feedback and conducting iterative testing to improve the overall user experience and ensure the accuracy of water use data. Incorporating user feedback loops creates a dynamic communication route between developers and users, enabling continuous upgrades and customization of functionality to match changing user requirements.

The design of "Su Ayak İzi" incorporates a comprehensive technique that combines technological advancements, user involvement strategies, and a commitment to sustainability pledges. Utilizing cutting-edge technology guarantees the precision and dependability of water usage data, while user engagement tactics stress the active participation of users in the conservation process. Moreover, the incorporation of sustainability commitments motivates users to adopt water-conserving behaviors, promoting a feeling of ecological accountability and collaborative effort.
To summarize, "Su Ayak İzi" serves as a holistic remedy that not only tackles personal water usage but also makes a significant contribution to the worldwide endeavor of sustainable water management. The application acts as a catalyst for promoting positive change in water saving practices by including novel features, user-centric design, and adherence to international sustainability objectives.

4.1 Tools and Technologies

While developing Su Ayak İzi mobile application following tools are used for designing, coding, versioning and testing:
For tools and technologies, Google Store is selected for the Android platform over IOS Google Store is selected because it is faster to release applications and cheaper compared to IOS. Also, more people use Android so this can lead to quickly connecting with people.
From different options such as Flutter, IntelliJ, AIDE, Android Studio, and more, Android Studio is selected by the teammates, As a team we already knew how to use Android Studio and we're currently taking an Android Studio class, are the main reasons for this decision.
For the application language, Java language is selected, because for our education life, we used Java language. Also, Kotlin was the next option but because it is the lighter version of Java and it would take time to learn, Java was the agreed decision.
Canva and Figma for our UI/UX design are used because they're free tools for usage, have a user-friendly interface and there are free non-copyrighted icons, fonts, and crafts, from the community.

Figure 6: Used Tools and Technologies

MySQL or SQLite for our database is currently being used for this application. These databases are already known by us and SQLite is a lightweight design of MySQL also it is already implemented in Android Studio. which means we do not need to download or re-learn anything. But if this project gets bigger and we need more space or can not handle our data, we are planning to use MondoDB's Realm database which provides free cloud service for our data which would take the stress from the server, also it's an open source project that supports Java.
For the backend and for the server side, the Node.js tool is planned to be used. Other options were Django or Laravel but we already knew Node.js and it's a free open-source server-side application
And lastly, for testing the application, JUnit which is the only framework will be used. It is a free testing framework that supports Java language and it is preferably used for Android applications.

4.2 UML Diagram

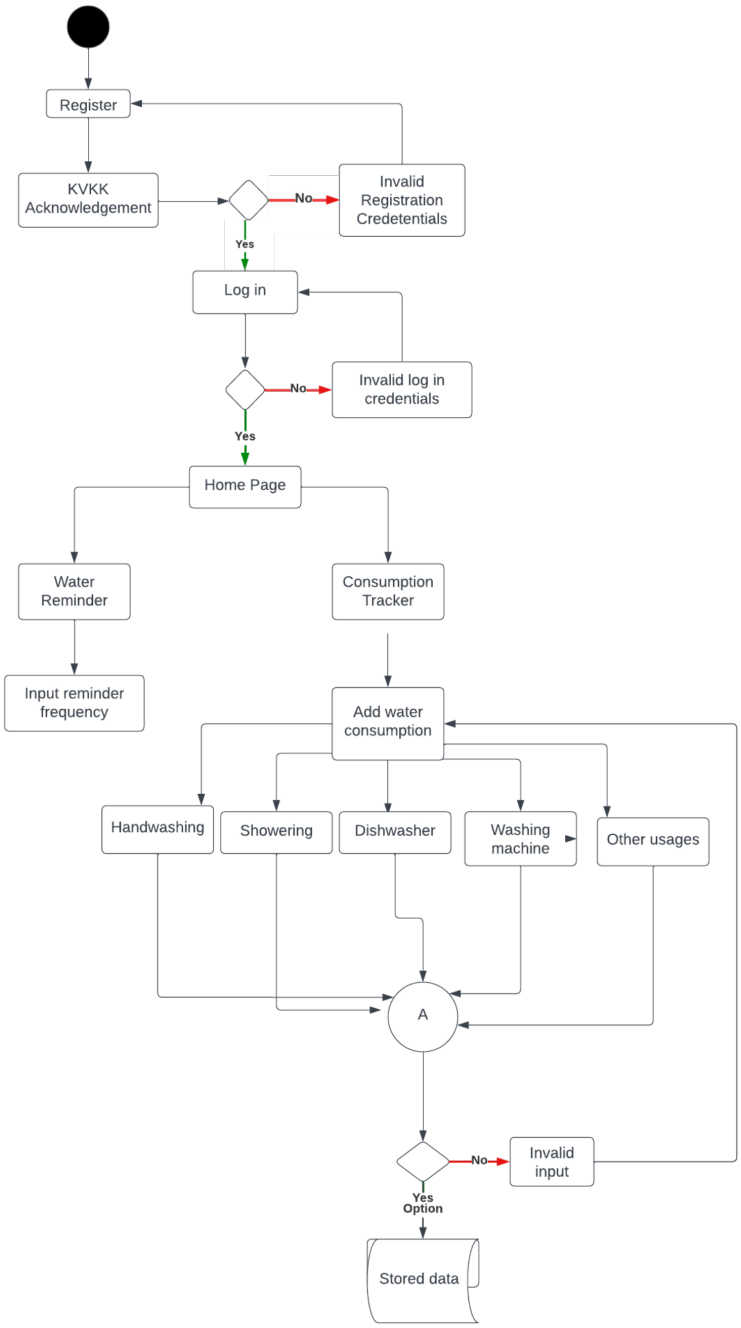

Figure 7: UML Diagram

Explanation of the UML diagram (Figure 6):

During registration process, users need to read and accept the KVKK acknowledgement. If this condition is not met, registration can not be done, then invalid login credentials is show up and a warning appears to check the KVKK acknowledgement.
If the condition is met then user can reach the login page, same process is valid for this step, too.
When the login process is successful, the screen is navigated to Home Page. Here, two different functionality appears which are "Water Reminder" and "Consumption Tracker".
For "Water Reminder" section, users can input reminder frequency, and they get notification accordingly.
When the other main functionality, "Consumption Tracker", is choosen, users can add water consumption data for the slots handwashing, showering, dishwasher, washing machine, and other usages.
If the related input is not invalid, then the data given will be stored. If it is an invalid input, (not a number) then the invalid input credentials will be applied.

5 Design

In this section the detailed design processes of this project such as prototypes, features, diagrams, project constraints, project tasks/duration information will be included.
While carrying out this project, since it is aimed to raise social and collective awareness about water consumption, determining the user group to which the product/project will be presented is important, at least for the beginning and for the recognition of the project. When it comes to developing behavioral awareness, children will be the most fundamental link in this chain. Because children, with their young and fresh minds, are more directional in developing such consciousness. Although the final product is suitable for the general user base, since it is about raising awareness, young minds, that is, children, will act more competently and urgently in this regard, and the design of the application will be continued by appealing to that age group.

5.1 Prototypes

Figure 8: Splash Screen and Home Page Demos

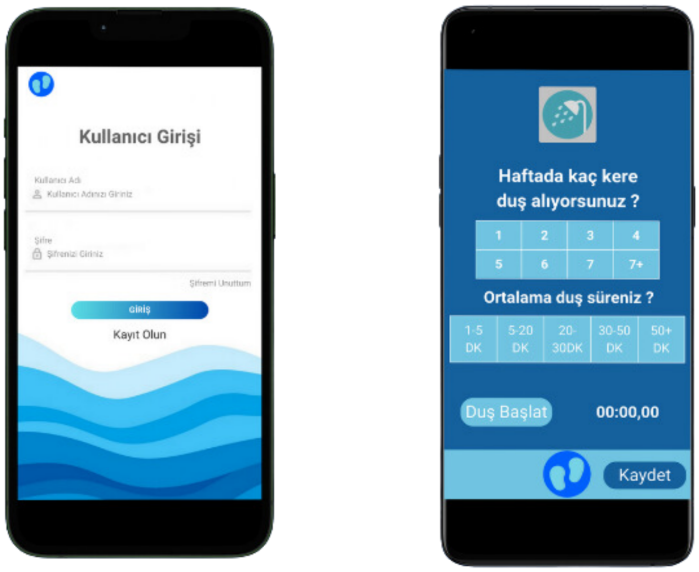

Figure 9: Splash Screen and Home Page Demos

In this section (Prototypes) There exist that the screenshots of Splash Screen, Home Page, Login Page and the showering measurement functions of the application. When you first enter the application, the splash screen (in Figure 7) will open, and then if you are not logged in, you will see the login screen. If the user is already logged in, it will display the Home Page. From here, it will be possible to save water usage data in the relevant fields by using buttons such as showering, dishwasher, washing machine. As seen in the figure related to Showering (Figure 8), the user will be able to measure the time spent in the shower.
In the screenshot about showering, information about the user's routine is obtained by asking the user questions about the frequency of showering and average shower duration. According to this data, a default usage entry is made in the user's water consumption field. Another function is to measure the time spent in the shower with the help of a counter that the user can easily start.

5.2 Features

Tracking Consumption Routine Individually:
The "Su Ayak İzi" mobile application is capable of monitoring and analyzing the water usage patterns of individual users. The application furnishes individuals with customized comprehension of their water consumption trends. This characteristic functions as a foundational element in fostering self-awareness and promoting conscientious water usage practices.
Compared Consumption Data of Users:
By comparing water usage data between users, it presents the difference between users and individuals are encouraged to consume less water.
Measuring Water Usage Time-Based and Liter-Based:
Since combining the application with a hardware product will increase the cost, some measurements are made time-based, while others are liter-based, in order to facilitate the process of producing the final product. While data on showering and hand washing will be taken on a time-based basis, the water consumed during use of the washing machine and dishwasher will be measured on a liter-based basis.
Water Reminder:
Since it is also significant for human beings to drink enough water, the application will include water reminder configuration. It will send notifications/alerts according to the frequency determined by the user.

5.3 How the data is obtained?

The usage consumption data provided for the application is obtained from:

1. During user registration:
   The information about users daily usage pattern, routine or frequency of water is asked during user registration process.

2. Time-based measurement:
   Time-based measuring for showering and handwashing is choosen as a parameter since the duration of the most people is wastefully.

3. Measurement for home devices:
   Average usage amounts for machine brands, liter-based, will be used since it is a fixed usage for every house, every person.

4. Among users:
   Compared user data configuration is to create a common sense of thriftiness by showing summarized usage data.

5. Other:
   Other consumption data, users' manual inputs which can not be calculated by application so that it involves to input manually.

5.4 Risks and Constraints

1. **Technical Infrastructure:**
   Challenge: Establishing and maintaining a robust technical infrastructure, including servers for data storage and processing, may pose challenges, especially as the user base expands.
   Mitigation: Leveraging cloud services, adopting scalable architecture, and regularly assessing the infrastructure's capacity can address potential bottlenecks.

2. **Data Accuracy and Reliability:**
   Challenge: The accuracy of water consumption data relies heavily on user input. Inaccurate or inconsistent data entry by users could compromise the reliability of the insights derived from the application.
   Mitigation: Implementing validation checks, user prompts, and periodic reminders can help encourage accurate data entry. Additionally, incorporating machine learning algorithms for anomaly detection may enhance data quality.

3. **Privacy and Security Concerns:**
   Challenge: KVKK policies, collecting and storing personal water consumption data raises privacy and security concerns.
   Mitigation: Implementing robust data encryption, secure storage practices, and transparent privacy policies.

4. **Target Audience Concerns:**
   As per the scope of the project, the target audience will be kept in general scope since the area it serves is to raise public awareness about water consumption. In this context, since children will also be a part of this target audience, the application's interface and content should be designed to be suitable for children.

5. **Budget and Time Planning:**
   Since the project team consists of students, the budget channeled for this project is limited and this determines the range of motion. Moreover, since there exist a time limitation for this project to accomplish, each and every scenario needs to be considered during the process. The possible scenarios such as constraints, requirements, timeline of

the project will be mentioned in this report

6. **Visibility of the Application and Search for Marketing Resources:**
   One of the most important ways to increase the functionality of this project is to ensure that the project, that is, the application, reaches many active users. For this reason, the marketing/PR activities of the application should be carried out meticulously and the necessary resource planning should be made for this. Partnerships with white goods companies that try to draw attention to economical water consumption will be a good start in this regard.

7. **Ease of use in product design:**
   Since the application will be offered to people from every age, the UI/UX design of this application is required to be handy for each and every user.

5.5 Project Timeline

The starting point of this project's timeline is determined as the project topic decision with this project team's academic advisor. Project timeline and expected task/duration tables are given.

	Work Package Description	Expected Duration	Responsible
1	UX development – process of researching, considering designing, the best possible experience for users.	1 week	Barış Akgün
2	Storyboarding, Wireframing – straightforward plan of the application, basic sketches of each panel and the activity.	1 week	Zeynep Hüma Özkul
3	Prototyping and UI Design – This process also includes combining the UX with branding and style guides.	2 weeks	Zeynep Hüma Özkul
4	Development – after the UX and UI stages are almost complete	4 weeks	Mehmet Emin Palabıyık, Barış Akgün
5	Testing and quality assurance	2 weeks	Zeynep Hüma Özkul
6	Regression Testing – ensuring that all the components work seamlessly when they are brought together.	2 weeks	Barış Akgün
7	Beta Testing – offering a small group of users to spot any errors or issues.	1 week	Mehmet Emin Palabıyık
8	Product Launch and Maintenance	1 week	Zeynep Hüma Özkul

Figure 10: Work package - expected duration table for development part of this project

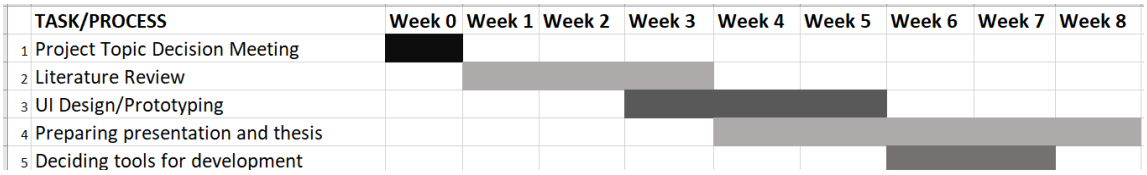

Figure 11: Task/Process table related to the design and research part of this project (1st semester, week 0-8)

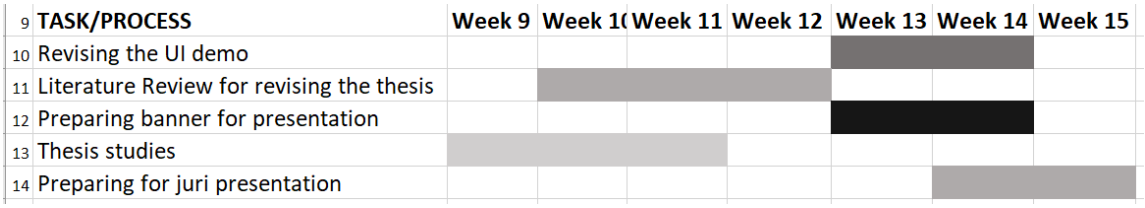

Figure 12: Task/Process table related to the design and research part of this project (1st semester, week 9-15)

6 Future Works

This project basically focuses on manual tracking of personal water usage. This can be combined with smart home technologies (IoT) to provide data tracking in a more automated manner. For example, the production of a device that can be integrated into the fixtures used at home, measuring the amount of flowing water and adding usage data to the mobile application instantly via the cloud with its built-in wifi-module that is, a hardware product, can be included in this project. Embedded systems can be used to improve data quality and automate data analysis processes, that is, for data management. By tracking the monthly water bill, related interpreted data and a warning system can be added. With this system, improvement suggestions can be made to reduce the high amounts of water bills paid by users. It can also be combined with configurations to monitor and control the consumption of other energy sources by expanding the scope of the project.Moreover, some gamification strategies can be applied for both children and adults. For grown-ups, a scoreboard which stimulates the usage consumption data of the related user can be integrated. For children, an internal "Save the fish" game can be included, which they can save the fishes by being a conscious consumer, relatively.In this manner, all plans regarding the project should be restructured and action should be taken according to the new project scope.

7 Conclusion

Looking at the literature reviews and other resource and market researches, the water shortage, which was a crisis for the world and vitality in the past, still continues to be a threat to vitality today. At this point, unless the conscious consumption philosophy that forms the fundamentals of consumption behavior is instilled in people, this problem will increase and reach a more dangerous level. While not everyone in the world has equal or fair access to scarce resources, developing public awareness about the consumption of these limited resources is essential for humanity to continue its existence on earth safely and prosperously. As can be seen from the United Nations' Sustainable Development Goals, clean water and sanitation principle (Sustainable Development Goal - 6) is essential for the survival of life on earth.
In this context, there is a significant need for every new step to be taken to raise awareness about the use of scarce resources - and specifically about the consumption of water resources in this academic study. In this direction, this project, which was set out to provide people with a conscious consumption behavior, starting from the youngest minds of the society to the oldest, aims to shape their behavior by providing users with a personalized experience, providing comparative tracking of water usage data.
All water consumption data received from users is compiled and interpreted to serve a relevant purpose. With this interpreted data obtained, a comparable usage summary is presented to individuals. Users who view and examine their individual water consumption in detail on a daily, weekly, monthly and annual basis are expected to shape their consumption behavior over time. With the implementation of this project, which is planned to take action and take steps for this purpose before water, which is the cornerstone of the ecological system, decreases to the level of scarcity in the world, it will contribute to the development of a more sensitive, intelligent and environmentally friendly behavior in today's consumer societies.

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