POLITECNICO DI TORINO

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A CROSS-PLATFORM MOBILE APPLICATION SUPPORTING A HEALTHIER LIFESTYLE

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Introduction

The work that is being presented in the next pages is based on two main arguments: the importance of following a healthy lifestyle and how technology can help in achieving this goal. Infact, our project work along with my colleagues concerned the implementation of an application suited for achieving a good lifestyle. The application, composed both by a frontend part and a backend one, allow the users to track their data regarding nutrition, as well as physical activity, sleep and emotional state. These data can be either inserted manually or collected through a wearable device. The application still requires the user to insert his basics information, such as username, weight and height. They are then all available in the application, where the user can eventually change them. The application also integrates a gamification approach through a specific section of the app, that allow the users to learn and deepen their knowledge about the topic, granting a form of reward when users complete a specific task. Finally, the application also involves the usage of recommendation as a way to provide suggestion about health and lifestyle to the user and improve his healthy journey. The thesys is then structured in 5 chapters: the first one deepen the health and well being topic, considering the guidelines that literature has found over the years of studying the topic. It then focuses on how technology can help us in achieving a better lifestyle, by considering which are the main software and hardware tools that can be used, such as smartphone application and wearable devices that allow to collect data and share them with application to create a more complete picture of the user's health. The second chapter moves into more tecnical aspects, by considering the technology stack that has been used to develop the application, starting from the used programming languages and automation tools, moving then to the IDE (Integrated Development Environment) and to the backend related aspect. The third chapter then talks about the overall implementation of the application, by focusing on my particular contribution. The fourth chapter talks about the performance analisys of the application, by considering the different testing devices that have been used to test the application performances. Finally, the fifth chapter concludes the work by considering the results that have been achieved and the future work that can be done to improve the application.

1 Health and Well Being

Health is one of the most important, if not the most important aspect of a person's life. For this reason, over the years, different organisations have established guidelines on how to stay healthy, thus increasing people's life expectancy and quality of life. Among these, the most widely worldwide recognized is the World Health Organization (WHO) [1] that provides several guidelines not only in term of physical activity, covering also other health aspects.

As far as concerns the physical activity, the WHO estimates that 1 in 3 adults and 4 in 5 adolescents do not do enough physical activity, with adolescents girls less active than adolescents boys and with inactivity levels that increases after 60 years of age. This level is expected to rise due to country economic development (more use of technology, change of cultural values and more sedentary behaviour). This trend sadly keep going in the wrong direction, despite the fact that physical activity has countless benefits, like reducing the risk of heart disease, cancer, diabetes, hypertension and depression.

- Children and Adolescents:

  - **Regular physical activity** enhances fitness, cardiometabolic health, bone strength, cognitive and mental health while reducing body fat.
  - **Sedentary behavior** leads to increased adiposity, poorer cardiometabolic health, behavioral issues, and reduced sleep duration.

- Adults and Older Adults:

  - **Active adults** experience lower body fat, risks of all-cause mortality, cardiovascular diseases, hypertension, specific cancers, and type-2 diabetes. They also enjoy improved mental health, cognitive function, and sleep quality.
  - **Sedentary lifestyles** are associated with higher mortality rates and increased incidences of chronic diseases like cardiovascular issues and cancer.

- Pregnant and Post-Partum Women:

  - **Engaging in physical activity** decreases the risks of pre-eclampsia, gestational hypertension, gestational diabetes, excessive weight gain, newborn complications, and postpartum depression, while having no negative effects on birth weight or stillbirth risk.

<div align="center">

Active vs Sedentary lifestyle[2].

</div>

Food is also crucial in order to be healtier. Having a healthy diet helps to prevent several diseases (like heart disease, diabetes and cancer) and also malnutrition in all its forms. However, care has to be taken in choosing the right food sources that have good quality and avoid processed foods. Eating noble foods like fruits, vegetables, legumes, nuts, and whole grains, while limiting the intake of salt, sugar, and fats, is the key to a healthy diet. For all these reasons, both physical activity and diet are strongly promoted by the WHO through his global action plan, by calling international partners, private sector and also civil society to take action in order to support them.

1.1 Guidelines

1.1.1 Physical Activity Guidelines

As far as concerns the physical activity, the WHO gives some recommendation based on the age group [3]:

- 5-17 years:

  - Should do at least 60 minutes of physical activity with moderate/vigorous-intensity daily (of course more than 60 minutes provides additional benefits), as well as bone-strengthening and muscle-strengthening activities.

- 18-64 years:

  - Should do at least 150 minutes of physical activity with moderate-intensity in a week or at least 75 minutes of physical activity with vigorous-intensity in a week or an equivalent combination of both (increasing moderate-intensity will provide additional benefits), but also muscle-strengthening activities by involving major muscle groups.

- 65 years and above:

  - Should do at least 150 minutes of physical activity with moderate-intensity in a week or at least 75 minutes of physical activity with vigorous-intensity in a week or an equivalent combination of both (increasing moderate-intensity will provide additional benefits), recruiting major muscle groups with muscle-strengthening activities but also including exercises to enhance balance and prevent falls in case of poor mobility.

1.1.2 Healthy Diet Guidelines

Regarding having an healthy diet, also here the WHO gives some guidelines, emphasizing that a good diet includes legumes, fruit, vegetables, animal sources foods (like meat, fish, eggs, and milk), cereals (like wheat and barley) and also tubers (like potato and yam). It also gives some further recommendations[4]:

- Babies and young children breastfeeding:

  - Breastfeeding promotes healthy growth, as well as having long-term benefit, like reducing the risk of developing nonncommunicable diseases, overweight, obesity. From birth until 6 month of life is important to feed the baby only with breastmilk, while from 6 month to 2 years of age is important to introduce also additional complementary foods, while still breastfeeding.

- Eat lots of vegetables and fruit:

  - These foods are rich in vitamins, minerals, dietary fiber, antioxidants and plant protein, which help to prevent heart disease, stroke, diabetes, obesity and some cancers.

- Eat less fat:

  - Fats and oils are concentrated source of energy, so it is important to limit them, especially saturated and industrially-produced trans-fat that can increase the risk of stroke and heart disease. To avoid gaining weight in an unhealthy way because of them, care has to be taken in using unsaturated vegetable oils (like olive oil) instead of animal fats or oils high in saturated fats (like butter or palm) and in any case fat consumption should not exceed 30% of total energy intake.

- Limit sugars:

  - Sugar consumption should be the 10% of total energy intake. This should be achieved by limiting soft drinks, soda and other drinks high in sugars (fruit juices or yogurt drinks) and also by avoiding the consumption of processed foods high in sugars (like cookies, cakes, chocolate). Better to choose fresh fruits instead of them.

1.2   Technology Role in Health

Having clear in mind the importance of an healthy lifestyle and a good dieting, it is also important the role that technology can have in this. Even though it is still possible to achieve a good lifestyle without technology, it has to be said that using technology sure makes it easier across several aspects. Several researches in this aspect have been performed by the National Institutes of Health (NIH) [5], an american health organization driven by the U.S. Department of Health and Human Services. The NIH found notable improvement in diet and activity habits with usage of mobile technology.
They took 204 adult people that met these constraints:

- Being obese or at least overweight.

- Having a diet high in saturated fat and low in fruits and vegetables.

- Perform a small amount if daily physical activity.

- Having lots of sedentary time.

then they divided these people into four groups, where each one had a specific diet. Furthermore, a mobile device was given to them and they had to enter their diet and activity data into the device for a 20-week follow-up period. Coaches would then receive the data during this period to monitor these people, as well as contacting them in order to provide encouragement and support towards an healthy change. The results found overall improvements in all four groups, emphasizing how technology can improve a fitness journey, also as a means to provide support and motivation [6].
Another aspect in which technology surely can help is about measurements: during physical activity and dieting, several aspects require measurements: the amount of calories burned, the heart rate during physical activity, the amount of calories taken, as well as the types of food consumed, their macronutrients (carbohydrates, proteins and fats) and so on. In this aspect, technology can provide several tools to help, like smartphone applications or wearable devices.
In the first place, technology helps in easing the process of performing measurements and gather these data (both for physical activity and dieting) that can be boring to do repetitively for us humans. In the second place, technology can provide a more accurate measurement of these data, more difficult to achieve manually. Related to this aspect, a study of the NIH showed how physical activity measurements taken by devices proved to be more punctual compared to the one taken manually with a diary [7].

1.2.1 Smartphone Applications

Moving to the technological tools that can be employed, smartphones surely are one of the most used devices and they allow to exploit several aspects related both to dieting and physical activity. Also here a study of the NIH [8] showed that users were more stimulated into following a healthy diet, particularly liking applications that were quick and easy to administer, and those that increase awareness of food intake and weight management. Even though work has to be made to increase food awareness, the study recognizes the importance of smartphone applications in this aspect. Dually another study has been done also on physical activity [9], showing that smartphone apps can be efficacious in promoting physical activity. Also in this case users tend to prefer applications that are user-friendly, thanks to their capability of automatically track physical activity (e.g., steps taken), track progress toward physical activity goals, as well as be flexible enough to be used with different types of physical activity. Countless of these smartphone applications are available to support an healthy lifestyle. They are cross-platform, so they can be used on both Android and iOS devices, in order to reach the largest audience possible. Here are some of the most popular applications, where for each the main features and the feature that distinguishes the application from other on the market are listed:

App Name	Features (Distinguishing Features In Bold)
MyFitnessPal	Food logging with a large database, barcode scanning, calorie and macro tracking, personalized insights, exercise logging, and integration with other apps. **Share and View Your Diary with Others.**
Fitbit	Step tracking, heart rate monitoring, sleep analysis, GPS tracking, food logging, and activity reminders. **Comprehensive health metrics tracking, including stress levels and Active Zone Minutes.**

Google Fit	Step counting, activity tracking, heart points, integration with health apps, and customizable fitness goals. **Collaborates with the American Heart Association and WHO for heart health insights.**
Nike Training Club	Guided workout programs, personalized fitness plans, workout tracking. **Free access to a variety of workouts, from yoga to high-intensity interval training.**
Strava	GPS tracking for running, cycling, performance metrics, social sharing, and route planning. **Community-focused with support for sharing routes and competing with others.**
Noom	Weight loss coaching, food logging, biometric tracking, and habit-building tools. **Focus on the psychological aspects of diet and health for long-term results.**
JEFIT	Exercise logging, workout planning, personalized workout, and performance tracking. **Training optimization with advanced analytics.**
Cronometer	Nutrition tracking, biometrics tracking, diary and diary groups, and micronutrient breakdown. **Advanced nutrient tracking suitable for specific diets.**
Lifesum	Food tracking, calorie counting, diet plans, water tracking, and nutrient breakdown. **Visual and user-friendly meal planning tailored to dietary preferences.**
Yazio	Calorie counting, meal planning, recipes, nutrition tracking, and progress reports. **Extensive recipe database and meal planning features.**

Table 1: Overview of popular diet and fitness apps with distinguishing features highlighted

1.2.2 Wearable Devices

Considering the Wearable Devices, even though they are less used compared to smartphones, their usage is growing more and more.Furthermore they are a good tool in order to track physical activity and dieting. Their main advantage is that they can be worn on the body, like a watch or a bracelet, but they are equipped with sensors allowing to collect data about the body, like the heart rate, the number of steps taken, the calories burned, the quality of sleep, and so on. They can also be connected to a smartphone in order to share these data with it, so that the user can have a more detailed view of his health status. Given their diffusion, applications have been introducing a way to connect to these devices, in order to exploit their data. This has been done by carefully considering their diffusion [10].
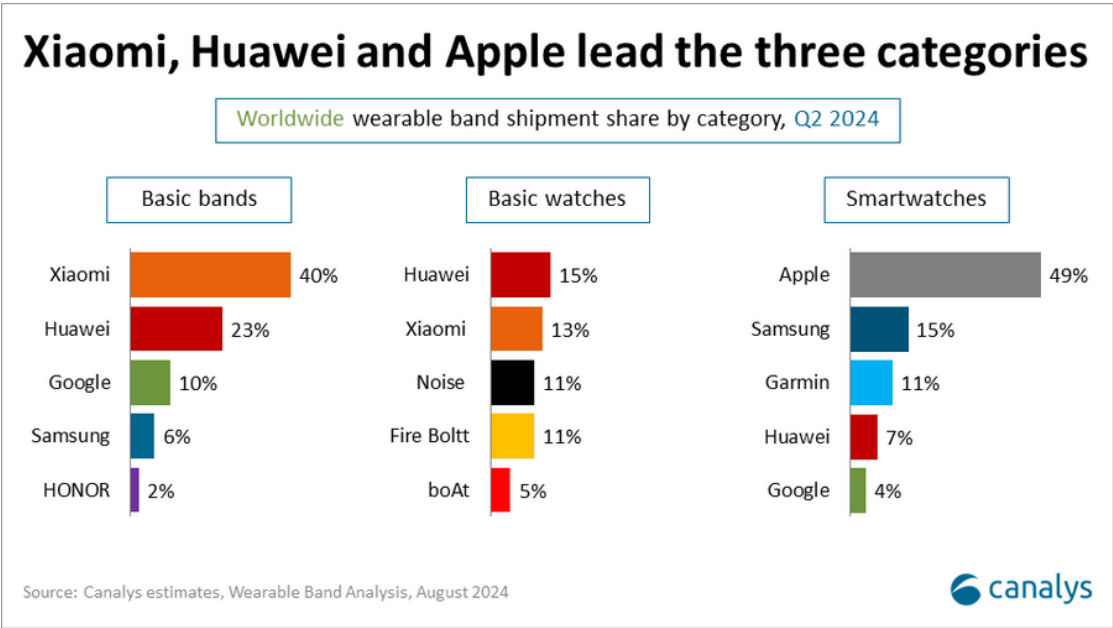

Figure 1: Wearable diffusion by major brands [10].

2   System Design and Technological Stack

2.1   System Requirements

2.2   System Design

2.3   Technological Stack

3   Results

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