Alistana Fitness & Nutritional Tracker (AFNT)

Application

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Digital Systems Project



# Abstract

This research aims to address the global health challenge of high obesity rates by developing a secure fitness and nutritional tracker to assist individuals in achieving their health goals. The prevalence of obesity, particularly in developed countries, has led to widespread health and economic implications. This study seeks to raise awareness about the significance of good health, emphasizing the positive mental effects associated with fitness.

The primary objective is to create an accessible software solution that encourages health-conscious behaviour and to increase awareness about the benefits of exercising regularly which can help minimize the healthcare burden and lower the risks of diseases and illness. The relevance of this research is underscored by the urgent need to combat the obesity pandemic and understand its far-reaching consequences on both society and the economy.

The anticipated outcomes include fostering a global culture of health consciousness, where individuals comprehend the profound benefits of good health. The research also endeavours to produce an easy-to-use program, empowering users to navigate their fitness journey effectively. By promoting higher fitness levels, the research aspires to contribute to a healthier population, subsequently mitigating the risks of diseases and alleviating the strain on healthcare systems. This project serves as a comprehensive test of software development and planning skills, aimed at making a substantial impact on public health and well-being.

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# Introduction

Currently, one of the biggest challenges the world is facing is a global obesity pandemic, which has become an especially acute problem in the developed world. According to The Guardian, around 38% of the global population, approximately 2.4 billion people, are currently categorized as overweight or obese. Without the widespread adoption of measures such as taxing and limiting the promotion of unhealthy foods, this trend is expected to persist. By 2035, it is predicted that the percentage of clinically obese individuals will rise from one in seven to one in four, with more than half of the total population being obese or overweight (Campbell, 2023). Having said that, the rapid increase of obesity rates will lead to higher chances of diseases and illnesses, which will have a greater burden on the healthcare sector and the overall productivity of the economy (‘Obesity Consequences’, 2012).

The key contributors of obesity and overweightness can be summarized to the consumption of high-calorie, fatty foods that are easily accessible, combined with a lack of physical activity (Wright and Aronne, 2012). This research will focus on ways to tackle this complex problem.

The main goal of this research is to develop the Alistana Fitness & Nutrition Tracker (AFNT) program, a free and inclusive application promoting health-conscious behaviour. AFNT aims to raise awareness about the benefits of regular exercise and a balanced diet, reducing healthcare burdens and lowering disease risks, including obesity. The application empowers users to track workouts, nutrition, and body progress securely, ensuring compatibility with mobile and desktop devices.

Maintaining good health and fitness is crucial as it benefits not just physical well-being but mental health as well. Engaging in regular exercise and fitness activities can elevate self-confidence, enhance attractiveness, and foster a health-conscious lifestyle, encompassing balanced nutrition and proper sleep. This holistic approach to well-being not only boosts productivity but also alleviates the financial burden on individuals and the healthcare system at large. By embodying a healthy lifestyle, individuals can inspire others to pursue their fitness goals, thereby fostering a community that values and prioritizes health and well-being.

The project is structured in four phases: Phase 1 involves setting up a Database Management System (DBMS) with Central (CDB) and Local (LDB) databases (Phase 1.5). User data is stored locally, accessible only to the user, while CDB stores predefined workouts, meals, and user login credentials for secure login. Phase 2 introduces the Admin Management Website (AM) responsible for maintaining CDB and pushing updates to AFNT. Phase 3 focuses on developing the AFNT application, allowing users to monitor workouts, meals, and body data. Phase 4 extends Phase 3 by introducing the Arduino Watch, capable of monitoring health metrics and seamlessly transferring data to the AFNT application via Bluetooth or a wired connection.

The outcome:

The report consists of 8 chapters. Chapter 2 provides a critical review of the AFNT Project. Chapter 3 delves into detailed requirements and objectives for the DBMS, AFNT Application, AM Website, and Arduino Watch. Chapter 4 focuses on the Agile methodology used in AFNT development, while Chapter 5 explores AFNT's design architecture. Chapter 6 covers the project's implementation, with Chapter 7 dedicated to its evaluation. Finally, Chapter 8 concludes the report and outlines further work.

# Literature Review

## Technological Advancements and Human Lifestyle

Throughout human history, technological advancements have played a pivotal role in making daily activities more efficient and less labour-intensive. From the invention of tools by Homo habilis to the industrial revolution, innovations like the wheel, carts, and various modes of transportation have transformed the way people live and work (Woessner *et al.*, 2021). The Industrial Revolution further enhanced productivity and ushered in an era of electronic and telecommunications revolution, introducing household appliances that reduced manual labour. Simultaneously, advancements in medicine, spanning over two millennia, have significantly contributed to improved healthcare and increased life expectancy. The twentieth century witnessed breakthroughs such as vaccines, early disease diagnosis, and treatment innovations, resulting in a substantial rise in life expectancy to around 80 years.

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Figure 1: Life Expectancy 10,000 BC - Today (Cato Institute)

However, alongside these benefits, technological proliferation has resulted in a significant decline in incidental physical activity. Everyday activities like active transport and manual labour have been replaced or reduced by technological solutions. The advent of the internet, especially accessible through mobile devices, has further contributed to increased sedentary behaviour, with established associations between internet usage during leisure time and obesity. The overall reduction in physical activity, coupled with a surge in sedentary behaviours, has become a significant factor in the obesity epidemic. Despite technology's positive impact on healthcare and life expectancy, addressing the challenges posed by reduced physical activity remains crucial for promoting overall well-being (Woessner et al., 2021).

Another significant contributor to the rapid increase in obesity rates is the heightened caloric intake, particularly from sweetened beverages, as emphasized by Caballero (2007). These dietary changes, marked by increased consumption of energy-dense foods and a shift away from healthier options, play a substantial role in the current health crisis. The availability of low-cost, easily accessible, and energy-dense food items, combined with changes in dietary patterns, emerges as a prominent factor in the rising rates of obesity. Addressing dietary choices and promoting healthier eating habits are critical components of strategies aimed at combating the obesity epidemic (Caballero, 2007).

Fortunately, technology's ascent has spawned innovative tools for achieving a healthier lifestyle, including mobile phones, smartwatches, and a variety of health and fitness technologies. This market encompasses meditation and workout apps, wearables, connected home gym equipment, Wi-Fi-enabled bathroom scales, and more, offering solutions for weight loss, stress reduction, improved sleep, enhanced immunity, elevated mood, and better nutrition (Moscaritolo, 2024). Additionally, the COVID-19 pandemic accelerated the adoption of health and fitness apps, enabling individuals to maintain their well-being from the comfort of their homes. The iOS app market, as analysed by Pankush Kalgotra, Raja, and Sharda (2022), exceeded growth expectations by 29.9%, highlighting the increasing demand for health and fitness-related apps during and after the pandemic.

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Figure 2: Fitness App Annual Users 2015-2021

## Benefits of an Active Lifestyle

Engaging in regular exercise not only contributes to improved mental well-being, reducing feelings of anxiety and depression, as highlighted by the Mental Health Foundation (2015), but it also plays a pivotal role in weight management by aiding in the burning of excess calories and enhancing metabolism, according to Mayo Clinic (2023). Additionally, exercise has been shown to enhance brain function, safeguarding memory, and thinking skills, thereby promoting overall cognitive health (Godman, 2014). Beyond mental and cognitive benefits, regular physical activity significantly enhances sleep quality, facilitating quicker sleep onset and deeper sleep experiences ('How Can Exercise Affect Sleep? | Sleep Foundation', 2013). Moreover, exercise positively influences the immune system by promoting optimal circulation and facilitating the efficient movement of immune system cells and substances throughout the body ('How to boost your immune system - Harvard Health', 2014). This multifaceted impact underscores the holistic benefits of incorporating regular exercise into one's lifestyle.

## Evolution of Health and Fitness Tracking

Nowadays, the pursuit of a healthy lifestyle has become increasingly intertwined with advancements in technology. Health and fitness tracking, facilitated by a myriad of innovative technologies, has emerged as a transformative force in the way individuals approach their well-being. This introduction delves into the pervasive influence of fitness-tracking technologies, shedding light on their prevalence and inherent relevance in our daily lives.

The ubiquity of smartphones, smartwatches, and various wearable devices has empowered individuals to take charge of their health through continuous monitoring and data-driven insights. These technologies have transcended traditional approaches to fitness, ushering in an era where personalized well-being is just a tap or click away.

The prevalence of fitness tracking technologies is evident in the exponential rise of health-conscious individuals leveraging these tools to monitor various aspects of their physical activity, nutrition, and overall health. From step counters to sophisticated heart rate monitors, these devices have become integral to the health routines of millions.

Beyond the sheer popularity, the relevance of fitness-tracking technologies lies in their ability to foster awareness and accountability. By providing real-time feedback and actionable data, these tools empower individuals to make informed decisions about their health. The shift towards preventive health measures has gained momentum, with people embracing technology as a proactive means to achieve and maintain their fitness goals.

As we navigate the evolving landscape of health and fitness, this literature review will delve deeper into the evolution of fitness tracking, the significance of health awareness, and the integration of wearable devices and mobile applications. Through a comprehensive exploration, this report aims to unravel the multifaceted impact of these technologies, setting the stage for a detailed examination of the AFNT project and its unique contributions to this dynamic field.

## Types of Fitness Tracker Apps

## Effectiveness of Fitness Tracker Apps

**How am I going to carry out search for information?**

Using Google, YouTube, reading through API docs, watching UWE lectures, and using other learning materials provided by UWE.

**What is the current state-of-the-art-technology?**

**Wearable Technology**: Advanced fitness trackers and smartwatches like the Fitbit and Apple Watch are equipped with sensors that monitor various health metrics such as heart rate, sleep patterns, and physical activity. These devices can use GPS technology for tracking outdoor activities and can even measure skin temperature and blood oxygen levels (‘Fitbit Official Site for Activity Trackers & More’, 2023).

**Machine Learning and AI**: My Fitness Pal uses a mobile app that uses Machine learning (ML) algorithms are increasingly being used in fitness and health applications to provide personalized workout and nutrition recommendations. By analysing users' workout history, biometric data, and other relevant information, the application can adapt and provide more effective and tailored recommendations (‘Calorie Tracker & BMR Calculator to Reach Your Goals | MyFitnessPal’, 2023).

**Natural Language Processing (NLP)**: Apple’s Siri and Google Assistant use NLP technology is used to interpret and respond to voice commands, which can be useful in the hands-free operation of fitness apps during workouts.

**Computer Vision**: This technology can be used in workout apps to ensure users are performing exercises with proper form. By analyzing video data, computer vision algorithms can provide real-time feedback on exercise forms and techniques.

**Internet of Things (IoT)**: Peloton is a company that offers the integration of fitness equipment with IoT technology that allows for real-time tracking of workouts and synchronization of data with health and fitness apps (‘Peloton® | Workouts Streamed Live & On-Demand’, 2023).

**How have other people tried to solve it?**

**Fitness Trackers and Smartwatches**: Companies like Fitbit, Garmin, and Apple have developed fitness trackers and smartwatches that monitor various health metrics such as heart rate, sleep patterns, and physical activity. These devices often have accompanying mobile apps that provide detailed analytics and insights.

**Fitness Apps**: There are numerous fitness apps available for smartphones, such as MyFitnessPal, Strava, and Nike Training Club. These apps offer workout tracking, personalized workout plans, nutrition tracking, and community features.

**Connected Fitness Equipment**: Companies like Peloton and NordicTrack offer connected fitness equipment, such as exercise bikes and treadmills, that can sync with fitness apps and provide real-time workout tracking. These devices often have built-in screens that display workouts and provide interactive features.

**Online Fitness Platforms**: Platforms like Beachbody On Demand and Daily Burn provide on-demand workout videos, personalized workout plans, and community support. Users can stream workouts on their devices and track their progress through the platform.

**Health Monitoring Devices**: Devices like blood pressure monitors, glucose meters, and oximeters can sync with health and fitness apps to provide a more comprehensive view of a user's health.

**What am I claiming about this project? (Claim/Hypothesis/Assertion)**

**What are my project goals and objectives?**

## Ethical Considerations

**Legal problems**

Data privacy and Security: The application will be storing personal information and health-related information. It is crucial that data is stored and transmitted safely and securely. The application should also comply with the General Data Protection Regulation (GDPR).

Medical and Health Advice: The program will also be providing medical and workout-related advice. So, it is important to ensure that the advice is accurate, evidence-based and provided by qualified professionals. Providing incorrect or harmful advice could have serious consequences for the users.

Intellectual property: It is important to have the right to use third-party content, such as videos and images, or exercise routines, this may require licences or permissions.

Accessibility: The program must be accessible to users with disabilities. Making it easier for disabled users to use the application. The website phase of the project must follow Web Content Accessibility Guidelines (WCAG).

## Development Research Plan

### Technical Knowledge

### Domain Knowledge

### Requirements Gathering

### Technologies Used

### Success Criteria

The implementation of a comprehensive workout tracking and health monitoring system, including personalized workout plans, nutritional tracking, and health advice, will lead to improved physical fitness, increased adherence to exercise routines, and enhanced overall well-being among users.

# Requirements

# Methodology

# Design

# Implementation

# Project Evaluation

# Further Work and Conclusions

# Glossary

# Table of Abbreviations

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# Appendix A: First Appendix