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Independent Project Proposal

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BEng Electrical and Electronic Engineering Year 3

2024 / 2025

Independent Project ACCA6020

Contents

Introduction	3
Background to the Research	4
Key Developments in Biomedical and Wearable Health Technology	4
Trends Shaping Wearable Health Monitoring Technology	5
Research Problem Statement	6
Aim and Objectives.....	7
Research Methodology	8
Project Planning	9
References.....	10

Introduction

The project which has been chosen is a wearable health monitoring device, which measures heart rate, temperature and other such variables using various sensors and displays this information on a lcd display screen for the user to examine.

The reason this project has been chosen is because of the steady increase in popularity of wearable health monitoring devices, mainly wrist-worn devices, over recent years, and the usefulness of such devices to the average person, as it can be difficult to track an individual's health without the use of clinical technologies. Physical health is without a doubt one of the most important things in life, and physical health can often be overlooked by individuals who don't have access to real-time data in order to keep track of their physical health, therefore the development of a wearable health monitoring device is relevant and pertinent for a project.

Background to the Research

The field of this project would be biomedical engineering technology, as there are similar integrations of sensors, data analytics and wireless communication which is used to create devices which monitor different metrics of health in real time. The field of Biomedical Engineering has seen many transformative advances in recent years, such as developments in IoT infrastructure, the miniaturisation of electronic components, and the application of artificial intelligence for data analysis [1]. These advancements enable more continuous monitoring of physical health of individuals in terms of things like heart rate, blood oxygen levels, and respiratory rates, providing people with better access to data on their own physical health.

Key Developments in Biomedical and Wearable Health Technology

Below are some key developments which are relevant to wearable health monitoring devices:

- Miniaturisation of electronic components

One key advancement in technology which has helped wearable health technology is the miniaturisation of electronic components such as sensors, as this is what allows the devices to be more compact and able to be worn without being cumbersome. Recent developments in photoplethysmography (PPG) sensors, which measure heart rate by detecting blood flow changes in the skin, and electrocardiogram (ECG) sensors, which capture electrical activity in the heart, have allowed for non-invasive, continuous monitoring of health data, and make the devices capable of providing this data extremely accurately without needing the use of larger equipment [2].

- Integration with IoT and Cloud Infrastructure

Biomedical engineering and wearable health monitoring devices increasingly rely on IoT and cloud technology to process and store large amounts of health data [3]. By transmitting data to cloud platforms, these devices enable long-term data analysis and integration with healthcare systems, which support remote monitoring and telemedicine applications. IoT also enables seamless communication between multiple different devices, which can be instrumental in collecting comprehensive data.

- Data Analytics and Machine Learning in Health Monitoring

The continuous stream of data from healthcare devices, and in this case wearable devices, has led to the integration of data analytics and machine learning in recent years to identify things such as trends and anomalies in the data on a widespread scale and the aforementioned data can also be used for making predictions of early signs of irregular health concerns and heart problems, which may otherwise go unnoticed in standard monitoring setups [4]. The incorporation of these technologies allows wearable health monitoring devices to move beyond basic data tracking to actively contribute to preventive and predictive healthcare for individuals.

- Focus on Personalized Healthcare

A growing emphasis on preventive and personalized healthcare has driven the adoption of wearable health monitoring devices to enable individuals to manage their health proactively. By providing continuous data, these devices support early detection and management of chronic conditions like cardiovascular disease, which are major global health concerns easily overlooked until too late. For

this reason, wearable devices have a significant impact on healthcare by reducing the burden on healthcare systems and intervening or preventing a possibly poor outcome [5].

Trends Shaping Wearable Health Monitoring Technology

Below are some of the trends which help to prove the significance of a wearable health monitoring device as a project:

- Rise of Chronic Diseases

With the increasing prevalence of chronic illnesses, there is a strong demand for wearable devices that enable real-time monitoring and management of these conditions without the need to go to a medical facility, making them crucial for both patients and healthcare providers.

- Consumer Demand for Self-Monitoring

With greater health awareness, consumers are increasingly adopting wearable technology to monitor their own health metrics. This trend is reinforced by tech giants like Apple with the Apple Watch and the Fitbit also, which continuously innovate their wearable devices capable of offering deeper insights into users' health.

Research Problem Statement

Despite the progress in wearable health monitoring devices, there are still limitations in things such as the accuracy of the data, the battery life of these devices, and data security. Given these limitations, there is an increasing need to enhance the reliability and accuracy of wearable health monitoring devices, particularly for high-motion environments, and to integrate robust security measures that protect sensitive health data without compromising device performance. This project seeks to address these gaps by focusing on the development of a wearable device that provides reliable heart rate monitoring with improved sensor accuracy and enhanced data security protocols.

Aim and Objectives

The aim of this project is to create a wearable health monitoring device which can provide precise and accurate data on an individual's health to themselves and promote the importance of taking care of one's health.

The key objectives to achieve in this project are as follows:

- To design a wearable device that measures heart rate, body temperature, and possibly even steps using a variety of sensors.
- To develop an intuitive interface for real-time data monitoring and analysis, likely using an lcd display screen.
- To analyse the data to predict potential health concerns accurately.
- To prioritize power efficiency, aiming for a battery life suitable for daily use.

Research Methodology

The research approach which will be used when conducting research will mostly be a mix of both deductive and inductive approaches, although the approach most used will be deductive, as there is a wealth of existing literature for the topic which the project comes under.

The research methodology which will be used will likely be quantitative, as the project has many numerical values and parameters to be researched, and the research will depict hard data for the most part.

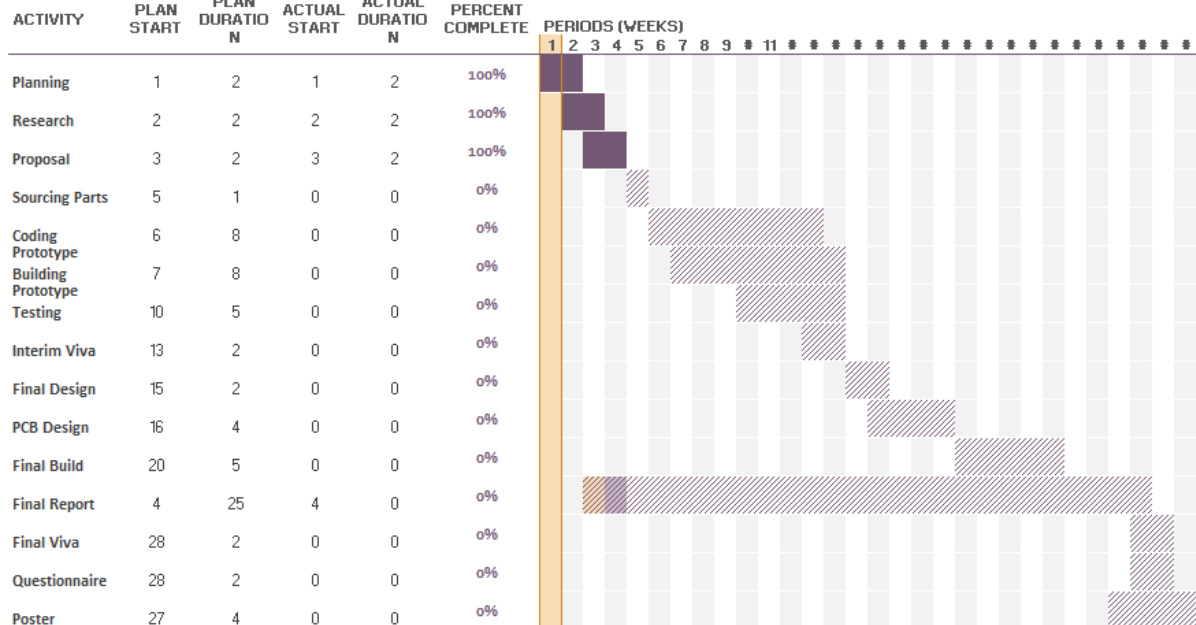
The research strategy conducted will be a case study, as the project being created will have extensive research conducted into every part of the topic in order to create a device which can accurately complete the objectives of the project.

Project Planning

A Gantt Chart has been created to give an accurate representation of the project plan, showing when and in what order each task will be carried out across the span of the whole project. The Gantt Chart can be seen below:

Wearable Health Monitoring Device Project

Select a period to highlight at right. A legend describing the charting: **Period Highlight:** 1  Plan Duration  Actual Start  % Complete  Actual (beyond plan)  % Compl



The Gantt Chart depicts the project timeline, with each step of the project split into different stages to better manage the project. Some tasks will be running alongside each other such as the coding and prototype building because there will likely be many adjustments made during the span of the project while other steps are being undertaken. Things like the final project report have also been taken into account when creating the Gantt Chart, as can be seen, which helped predict when certain tasks should be taking place along with their duration.

References

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