Report Title

A Project Report

submitted by

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This is to certify that the report titled **ADAS for two-wheeler drivers** , submitted by **Mihir and Kunj**, to the Institute of Infrastructure Technology Research and Management, Ahmedabad, for the award of the degree of **Bachelor of Technology**, is a bona fide record of the research work done by him under our supervision. The contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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ABSTRACT

The advancement of technology has resulted in a new era of safety and assistance for two-wheeler drivers through the integration of smart wearables and artificial intelligence. This report, titled "DRIVER BEHAVIOR ASSESSMENT AND DESIGNING ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS) FOR TWO-WHEELER DRIVERS," presents the progress achieved in our B.Tech project up to the mid-semester. Our research focuses on the collection of sensor data from smartwatches and smart wearables, including parameters such as acceleration and heart rate, with the ultimate goal of training an AI model capable of detecting instances where the driver may require attention or assistance. To achieve this, we pursued three primary approaches. First, we started the development of a dedicated application for smartwatches, enabling the real-time capture and transmission of crucial data. Simultaneously, we explored the potential of leveraging the Google Fit API to extract relevant sensor data and store it in a CSV format for analysis. Furthermore, a third approach encompassed the development of new firmware or the modification of existing firmware to enhance sensor data collection and integration.

This report outlines our accomplishments and insights thus far, shedding light on the challenges faced and solutions implemented in pursuit of our project's objectives. As we move forward in our endeavor to enhance the safety and assistance systems for two-wheeler drivers, this report serves as a snapshot of our work-in-progress and lays the foundation for the development of advanced driver assistance systems that promise to improve road safety for all.

0.1 Introduction

Road accidents are a major public health problem, accounting for millions of deaths and injuries each year. Two-wheeler drivers are particularly vulnerable to road accidents, due to their smaller size and lack of protection.

Driver behavior is a key factor in road accidents. Drowsy, distracted, and impaired driving are all major causes of crashes. Advanced driver assistance systems (ADAS) can help to reduce the risk of accidents by warning drivers of potential hazards and taking corrective action if necessary.

This report presents the work done till mid-semester for a B.Tech project on developing a system for driver behavior assessment and designing ADAS for two-wheeler drivers. The proposed system uses sensor data from smartwatches and smart wearables, such as acceleration and heart rate, to train an AI model to detect when the driver needs attention or assistance.

The system is still being developed, but the work done until mid-semester has been promising. Three approaches were taken to develop the system: developing a smartwatch application, using the Google Fit API to get the data from Google Fit to a CSV file, and creating a new firmware or modifying the existing firmware.

The next steps are to collect sensor data from many drivers and train the AI model. The trained AI model will then develop ADAS for two-wheeler drivers.

The proposed system has the potential to improve the safety of two-wheeler drivers significantly. By detecting driver drowsiness, distraction, and other unsafe driving behaviors, the system can warn drivers of potential hazards and help them to avoid accidents.

0.2 Prior Research and Studies

App developers are diligently crafting applications for smartwatches and Smartphones. The primary objective of this symbiotic software ecosystem is to seamlessly collect and relay sensor data from smartwatches to their paired mobile applications, establishing a connection through Bluetooth technology.

The smartphone application adeptly processes the sensor data, where complex algorithms and analytical tools take and process this data. this will happen when developers can access to operating system. Present-day Google Wear OS, Tizen OS, and wasp-os are open-source platforms.

Another approach is to use external sensors like GPS and microcontrollers for collecting sensor data. This system employs fuzzy logic for driving diagnosis and collecting speed, acceleration, and steering data via external sensors and a microcontroller. It can track real-time vehicle positions with satellite data. The system categorizes speed into low, medium, and high levels, normalizing it to the highway speed limit.

Intelligent driver identification aimed to distinguish users and potential thieves. Data from various drivers was analyzed, and an efficient neural network architecture was established for identification.

The system's performance exhibited precise driver classification and user identification, even in scenarios involving alcohol or drowsiness. This approach holds promise for enhancing road safety and driver assessment, with future work focused on real-world applications and improved hardware.

0.3 Project Scope and Approach

In our pursuit of advancing driver assistance systems for two-wheeler drivers, we have divided our approach into two essential components, each playing a crucial role in the development of our project. As of the mid-semester milestone, our work has primarily revolved around these core aspects: data collection and the subsequent stages of feature extraction and model training. This multifaceted approach is pivotal in harnessing the power of sensor data from smartwatches and smart wearables, including parameters such as acceleration and heart rate, to create a robust AI model capable of identifying moments when a driver requires attention or assistance.

In the realm of data collection, we have explored various avenues to amass the requisite dataset for our project. Our initial endeavor involved the development of a dedicated smartwatch application tailored to capture real-time sensor data. Simultaneously, we delved into the potential of harnessing the Google Fit API to extract valuable sensor data, storing it in a structured CSV file format for subsequent analysis. Furthermore, we ventured into the realm of firmware development, aiming to create new firmware or modify existing ones to optimize sensor data collection.

Table 1. Systems and options available in wearable platforms.

Platforms	SDK-Sensors	SDK-Warehouse	REST API
Apple Health	-	X	-
Google fit	X	X	X
S-Health	-	X	-
Fitbit	-	-	X
Jawbone	-	X	X
Microsoft Health	X	-	X

Figure 1

This report provides a comprehensive overview of our work thus far, while also highlighting the journey undertaken in the pursuit of our project's goals. As we continue to delve deeper into the intricacies of data collection and the subsequent feature extraction and model training processes, the subsequent subsections of this report will provide a detailed account of our procedures and methodologies.

0.3.1 data collection

In our endeavor to collect sensor data from smartwatches and smart wearables, our journey has been marked by a diverse range of approaches, each presenting its unique challenges and insights. This section provides an in-depth exploration of the strategies we have employed up to the mid-semester point to amass the essential dataset for our project.

1. Software-Based Data Collection via Google Fit API

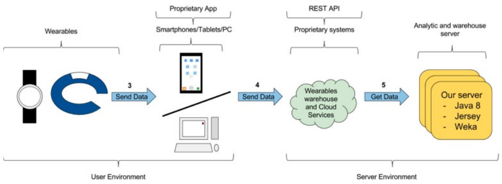

Figure 2

Our initial foray into data collection was rooted in a software-based approach, aiming to retrieve sensor data from smartwatches through seamless integration with Google Fit. To lay the foundation for this endeavor, we conducted in-depth research, drawing inspiration from the scholarly work of de Arriba-Pérez et al. [1],

who explored the collection and processing of data from wrist wearable devices. We delved into accessing sensor data through a smartphone application known as 'dafit,' which established a Bluetooth connection with the paired smartwatch. Subsequently, data obtained from the smartwatch was logged to Google Fit through the connected Google account. To harness this data for our project, we developed an Android application that interacted with the Google Fit API to request the relevant sensor data.

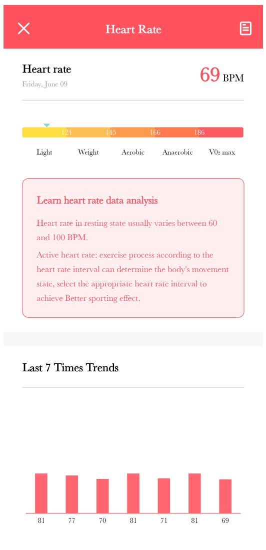

Figure 3: heartrate page in dafit

However, our initial software-based approach faced a limitation as 'dafit' did not log essential data such as heart rate and accelerometer data to Google Fit, thereby necessitating a shift in our data collection strategy.

2. Application Development for Smartwatches

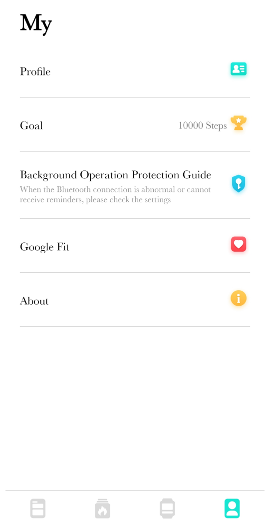

Figure 4: profile page in dafit

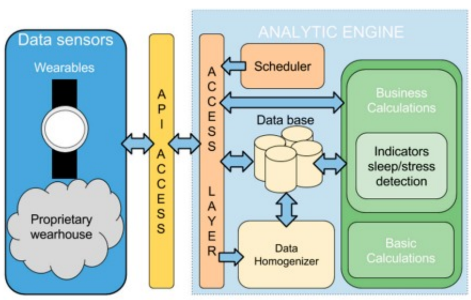

Figure 5

Recognizing the limitations of the first approach, we ventured into developing custom applications for smartwatches. This approach aimed to directly collect sensor data within the smartwatch itself. However, we encountered an obstacle, as the smartwatches we employed were restricted by their operating systems, which did not support the installation of custom applications. The inherent applications within these smartwatches were fixed, leaving us with the need to explore alternative methods for data collection.

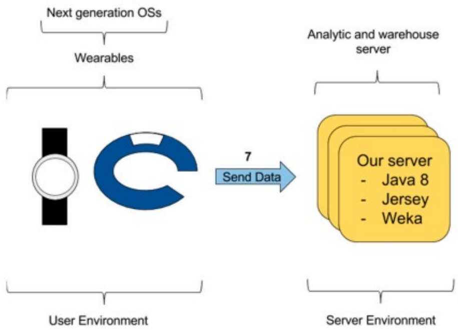

Figure 6: Direct Access From Smartwatch

3. Customizing Smartwatch Firmware and Firmware Creation

The limitations encountered in the previous approaches led us to explore the realm of smartwatch firmware customization and, in some instances, the creation of entirely new firmware. However, this endeavor came with its own set of challenges. Many smartwatch brands do not disclose the source code of their operating systems, rendering customization a complex task.

As a result, we initiated research into the hardware components of the smartwatches we were working with. Our aim was to identify the microprocessors used in the devices, ascertain the communication protocols for firmware updates, and understand the programming languages used in the smartwatch operating systems. This knowledge was critical for paving the way toward creating new firmware or modifying existing ones.

In the subsequent sections of this report, we will delve deeper into the specific methodologies and findings associated with each approach, shedding light on the challenges encountered and the insights gained in our quest to collect vital sensor data for our project.

0.4 References

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