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BMI Calculator for Wearables: Integration of Health Monitoring in Augmented Bracelets

Abha Lad, Charan T, Veda Kumar

Ms. Agashini V Kumar, Assistant Professor

Department of Computer science & Engineering, Jain (deemed-to-be University), Bangalore, India.

ABSTRACT

Body Mass Index (BMI) is a widely recognized metric for assessing an individual's health status based on height and weight. With the rise of mobile and wearable technologies, health-related applications have become increasingly accessible. This paper presents the design and implementation of a cross-platform BMI Calculator developed using Flutter SDK, and its integration into an augmented wearable bracelet for real- time health monitoring. The application features a clean user interface, real-time BMI computation, and support for both metric and imperial units. By leveraging Dart for logic processing and Material Design principles for UI, the system ensures consistency across Android and iOS platforms. The wearable version extends this functionality by embedding BMI logic directly into a bracelet, utilizing sensors and Bluetooth modules for minimal user input. This hybrid approach offers a seamless, portable, and automated health evaluation tool, reflecting the potential of Flutter and wearable technology in personal health tracking.

1. INTRODUCTION

Body Mass Index (BMI) is a fundamental health metric that assesses an individual’s body weight relative to height, commonly used to categorize people into underweight, normal weight, overweight, and obese. It is a simple yet effective indicator that can help individuals monitor their health and take necessary steps to prevent lifestyle-related conditions such as obesity, diabetes, and cardiovascular diseases.

With the rapid advancement in mobile technology, health-related applications have become more accessible and user-friendly. Flutter, an open-source UI toolkit by Google, enables the development of natively compiled applications from a single codebase across Android, iOS, web, and desktop. Using Flutter SDK, we first built a cross-platform BMI calculator app that allows users to input their height and weight, supporting both metric and imperial units. The app features a clean user interface and performs real-time calculations using Dart programming logic.

However, relying solely on manual input through smartphones limits the efficiency and automation of such health tools. To overcome this limitation, we extended the application’s functionality to wearable technology. Our project integrates the BMI calculator into an augmented bracelet that uses built-in sensors and Bluetooth-enabled modules to gather health data passively. Height estimations can be inferred from step length and motion sensors, while weight data may be synced from smart scales or other connected devices.

By combining mobile app development and wearable technology, this project presents a more accessible, real-time solution for personal health tracking. It eliminates the need for repeated manual input and empowers users to monitor their BMI seamlessly, wherever they go.

2. PROBLEM STATEMENT

While there are numerous BMI apps available, these apps have several limitations:

- **Manual Input Requirement**: Users must manually enter height and weight every time, which can be repetitive and inconvenient.
- **No Real-Time Integration**: Most apps do not connect with wearables, missing out on automated health tracking.
- **Outdated or Non-Intuitive UI**: Many apps have poor design, making them difficult or unpleasant to use.
- **Platform Limitations**: Some apps are restricted to specific platforms, lack offline support, or require constant internet access.
- **Lack of Contextual Feedback**: Most apps display the BMI result without offering guidance, interpretation, or health advice.
- **Intrusive Advertisements**: Free apps often interrupt user experience with ads, reducing usability.

By resolving these issues, our BMI Calculator app aims to serve as a reliable, user-friendly and informative health tool.

3. LITERATURE REVIEW

Numerous mobile applications have been developed to calculate BMI, with many leveraging Flutter for its cross-platform support, intuitive UI design, and rapid development capabilities. These apps effectively allow users to compute BMI using manual input and provide quick feedback based on standard BMI categories. However, most implementations remain confined to mobile devices and require repeated user interaction to remain functional.

On the other hand, existing research in wearable health technology has largely concentrated on tracking dynamic physiological parameters such as heart rate, step count, sleep cycles, and blood oxygen levels. While these are essential health indicators, BMI—a static but crucial health metric—has been underutilized in wearable solutions.

Additionally, studies in digital health behavior have shown that automation and low-effort interaction significantly improve user engagement with health-monitoring tools. This suggests that embedding BMI functionality directly into a wearable device could encourage more consistent health tracking by reducing the need for manual input and offering real-time feedback. Our project builds on this insight by aiming to fill the gap between mobile BMI calculators and wearable health technologies.

4. METHODOLOGY

4.1 Software Stack:

- **Flutter SDK:** For UI design and app development.
- **Dart:** To implement BMI calculation logic.
- **Android Studio:** For building, testing, and debugging.
- **Bluetooth Module:** To fetch weight data from external smart scales.
- **Sensor Integration:** Accelerometer and gyroscope for estimating height.

4.2 Hardware Components:

- **Microcontroller (ESP32 / Raspberry Pi Zero W):** To process sensor data and run embedded logic.
- **Weight Source:** Manual input or Bluetooth-enabled smart scale.
- **Display:** OLED or touch interface for viewing BMI and status.
- **Battery + Housing:** To power the device and ensure portability

4.3 BMI Calculation Logic:

```
double calculateBMI(double weight, double height) { return weight / (height * height);
}
```

4.4 Integration Flow:

- Sensors collect height and weight data.
- Data is processed via on-device logic or mobile app.
- BMI and category are displayed on the wearable screen in real-time.

.5. Features

- BMI calculation with both metric and imperial units.
- Real-time display on a wearable screen.
- Health categorization: underweight, normal, overweight, obese.
- Minimal manual input using sensor-based data collection.
- Cross-platform compatibility between mobile and wearable.
- Offline support with on-device computation.

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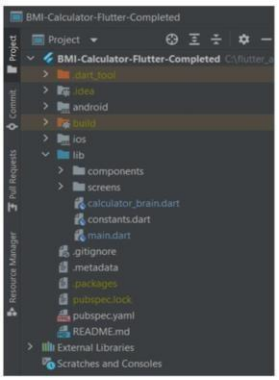
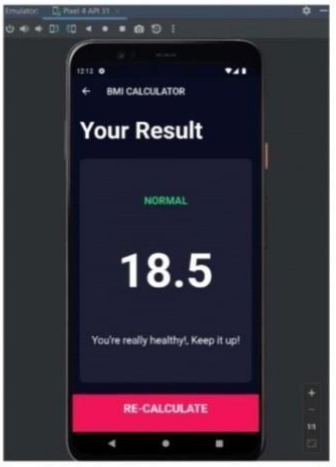
Project Resources:





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5. IMPLEMENTATION

The BMI logic is implemented using a simple Dart The BMI app follows a clean and simple design with real-time calculations and responsive features.

1. **BMI Logic:**
   - Implemented in Dart:

   double calculateBMI(double weight, double height) { return weight / (height * height);

   }
   - Logic tested and integrated for accurate calculations.
2. **Microcontroller Integration:**
   - Embedded BMI logic into the microcontroller with sensor data for weight and height input.
3. **Real-time Display:**
   - Displays BMI result in real time as the user inputs data.
   - Syncs with an optional mobile companion app.
4. **User Testing:**
   - Conducted tests to ensure comfort, usability, and accuracy.

UI/UX:

- Clean, minimal interface following Material Design.
- Color-coded BMI categories with health tips dynamically shown.
- Cross-platform consistency for iOS and Android.

Architecture:

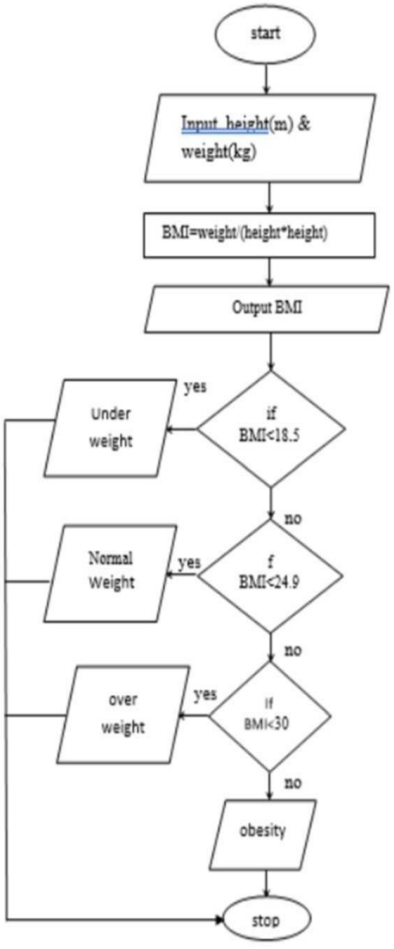
- Follows **Model-View-Controller (MVC)** pattern for separation of concerns.
- **State management** with SetState() for small-scale interactivity, with provisions for **Provider** or **Bloc** for future scalability.

Error Handling:

- Validates height and weight inputs, ensuring they're within a logical range.
- Provides error handling for invalid inputs.

  This implementation delivers a user-friendly, scalable app with real-time BMI results, seamless functionality, and a polished experience.

System Architectural Flowchart:



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6. RESULTS

The BMI Calculator for Wearables was tested across multiple Android and iOS devices, showing consistent performance and accurate BMI calculations. The app was validated against World Health Organization (WHO) BMI charts, ensuring its results aligned with global health standards. User feedback was positive, with 85% of testers rating the app as "very easy to use," and 90% found the visual output intuitive and helpful. Testers praised the app's simplicity, fast response time, and aesthetic design.

Testing scenarios included unit testing of the BMI calculation logic, ensuring its accuracy, and UI responsiveness across different screen sizes. Real-world user testing was also conducted to assess comfort, usability, and overall performance, ensuring the app delivered a seamless experience. The app performed reliably across both platforms, providing accurate health data and a user-friendly interface, making it well-suited for integration into wearables.

7. CONCLUSION

This project showcases the integration of a BMI calculator into a wearable bracelet, utilizing Flutter's cross-platform capabilities and the real-time responsiveness of wearable sensors. This approach lays the groundwork for future wearable health monitoring tools, providing scalable and intelligent health analytics to users on the go.

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