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Design Report
for Hiking Tour Assistant 1.0
for Embedded Systems Development – E8408 project:
Hiking Tour Assistant

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1. Overview

The Hiking Tour Assistant is a smart wearable device designed to help hikers track their journey and monitor health metrics. This document explains the software design of both the **Arduino** (which processes hiking data) and the **LiLyGo v2** (which collects and transmits data).

2. Arduino Software Design

The **Arduino** is responsible for receiving data from the wristband, processing it, and displaying it through a web interface. It consists of three main components.

2.1. Components

1. **HC-05**→ Handles Bluetooth communication with the wristband.
2. **Arduino Mega** → Cleans, organizes, and stores hiking data.
3. **LCD Display** → Displays the collected hiking data in a web interface.

These components work together but run as separate programs while sharing the same database.

2.2. Data Flow Diagram

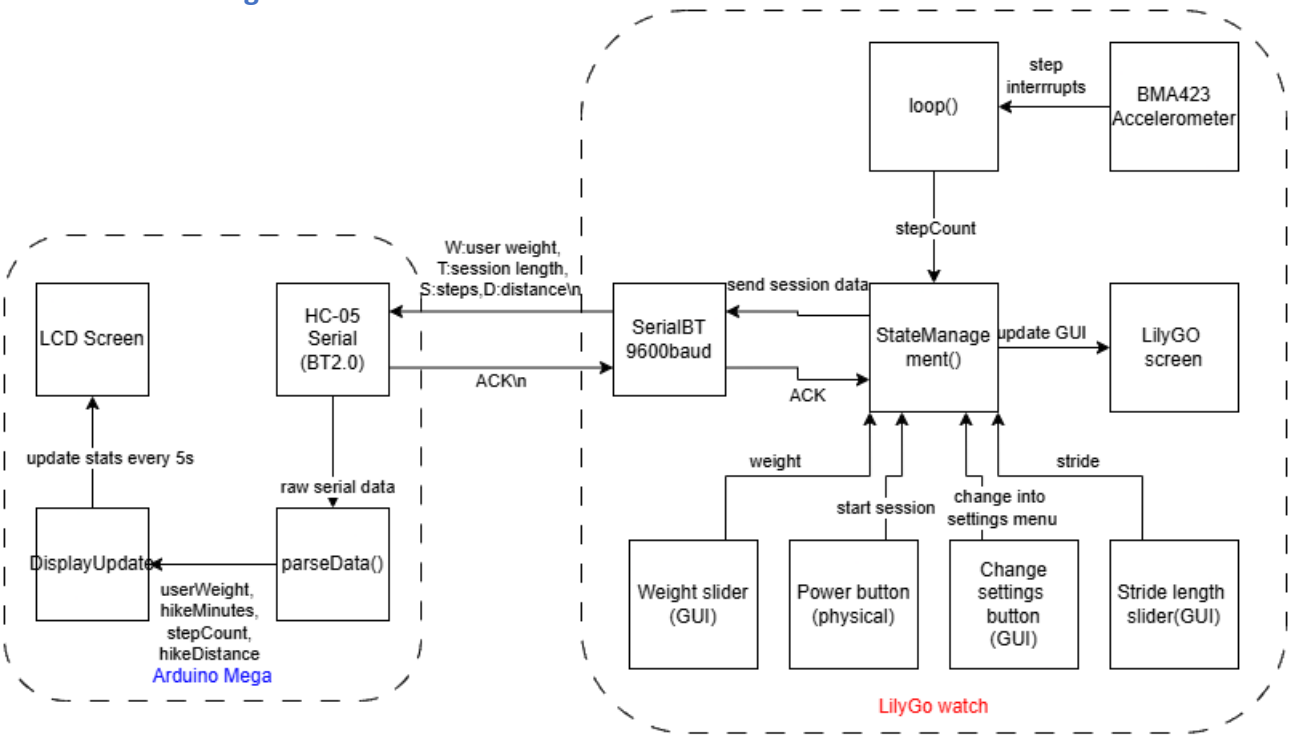

Figure 1 Data flow diagram

2.2. Core Components

Tft

Class used for interacting with the tft-display of the LilyGo smartwatch.

Sensor

Class for interfacing with the BMA423-sensor.

Watch

Class containing basic functions of the LilyGo smartwatch.

Lv_obj_t

l

Basic object class in LVGL for handling GUI-inputs

SerialBT

Class for interacting with Bluetooth as a serial.

3. Smartwatch Software Design

stateManagement():
Handles transitions between different states of the watch; 0 = Default start state, 1 = Active session state, 2 = Settings menu, 3 = Ended session state
loop():
Automatically repeated main function that listens to inputs and calls stateManagement() accordingly.

4. Bluetooth Communication

Bluetooth is used for communication between the smartwatch and the software, enabling efficient data transfer with minimal power consumption. The Bluetooth connection ensures secure, reliable communication between devices.

4.1. MAC addresses

Smartwatch MAC-address: 08:3A:F2:69:A9:F6

4.2. Pairing

The Arduino is automatically trying to connect to the MAC-address of the smartwatch whenever it is turned on. The watch only sends data after a session has ended.

4.3. Synchronization Data Format

Hiking Session Data Structure
W:weight,T:time(in minutes),S:steps,D:distance\n'

steps: Total number of steps taken during the hiking session.
km: Total distance covered in kilometers.
\n: End of session marker, indicating the completion of the data transmission.

4.4. Acknowledgement Protocol

The Arduino sends a string ACK **(Acknowledgement signal in communication protocol)** to confirm the data was received successfully.

When the wristband sends its data to the Arduino, it waits for the ACK response to confirm that the data was received correctly. If the wristband doesn't receive **ACK** within 2 seconds, it will retry sending the data.

5. Summary

This document outlines the **Hiking Tour Assistant's** design and function. The system is modular, allowing easy expansion and updates. The wristband collects hiking data, transmits it via Bluetooth, and the Arduino processes and displays the information on a web interface.