

Smart Cycle Dashboard

Abstract

Cycling is a popular mode of transport and fitness, but riders often lack access to integrated, real-time data that enhances both safety and health tracking. This project presents a Smart Cycle Dashboard using ESP32 to monitor heart rate, temperature, speed, and turning direction. It features automatic turn indicators, a mobile app interface, and modular sensor integration. With future GPS support and solar charging plans, this solution aims to modernize cycling without increasing cost or complexity.

Introduction with Motivation

Modern cyclists face challenges such as:

- Manual hand signaling that compromises safety.
- Difficulty monitoring vital signs like heart rate and temperature.
- Lack of low-cost systems that integrate health and navigation features.

Motivation: To develop an affordable, multi-functional dashboard that supports safe, connected, and health-aware cycling.

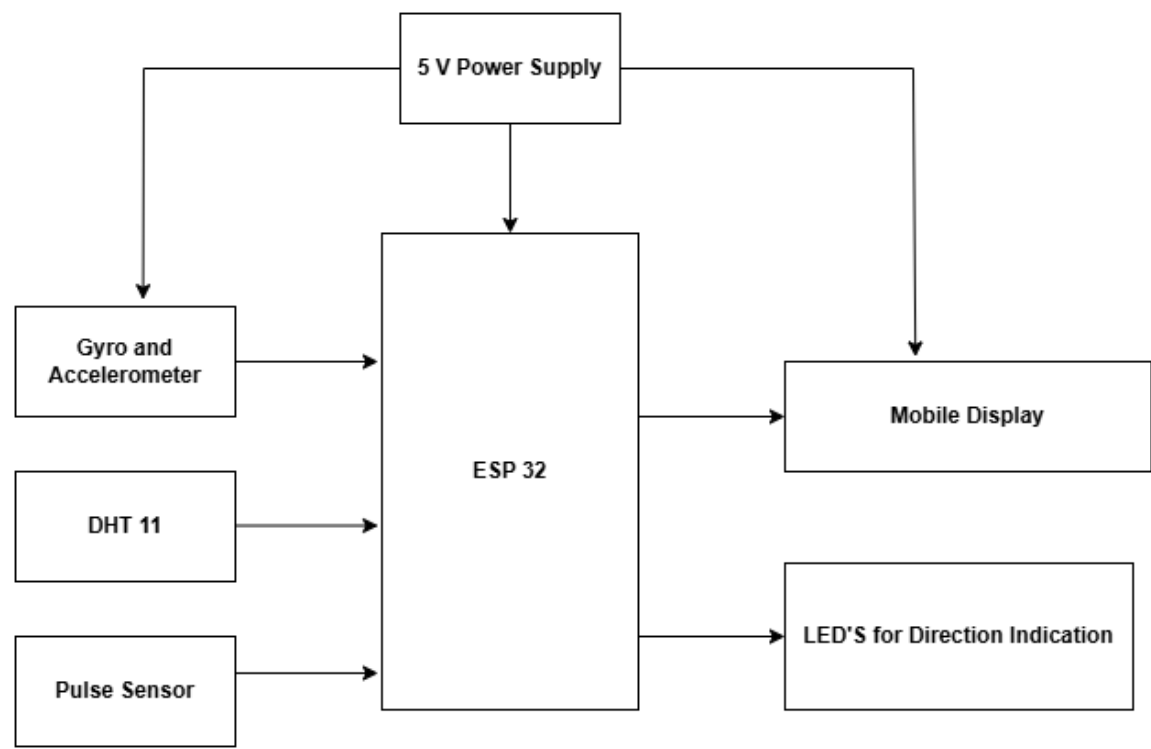
Proposed Solution

The Smart Cycle Dashboard is a compact IoT-enabled system with the following key features:

- Health Monitoring: Pulse and temperature sensors track vitals in real time.
- Safety Features: Auto turn indicators using a gyroscope to detect tilt.
- Speed Monitoring: Basic speed calculations derived from motion sensors.
- Mobile App: Bluetooth-based data display and logging using the Blynk app.
- Scalability: Designed for future GPS integration and solar power.

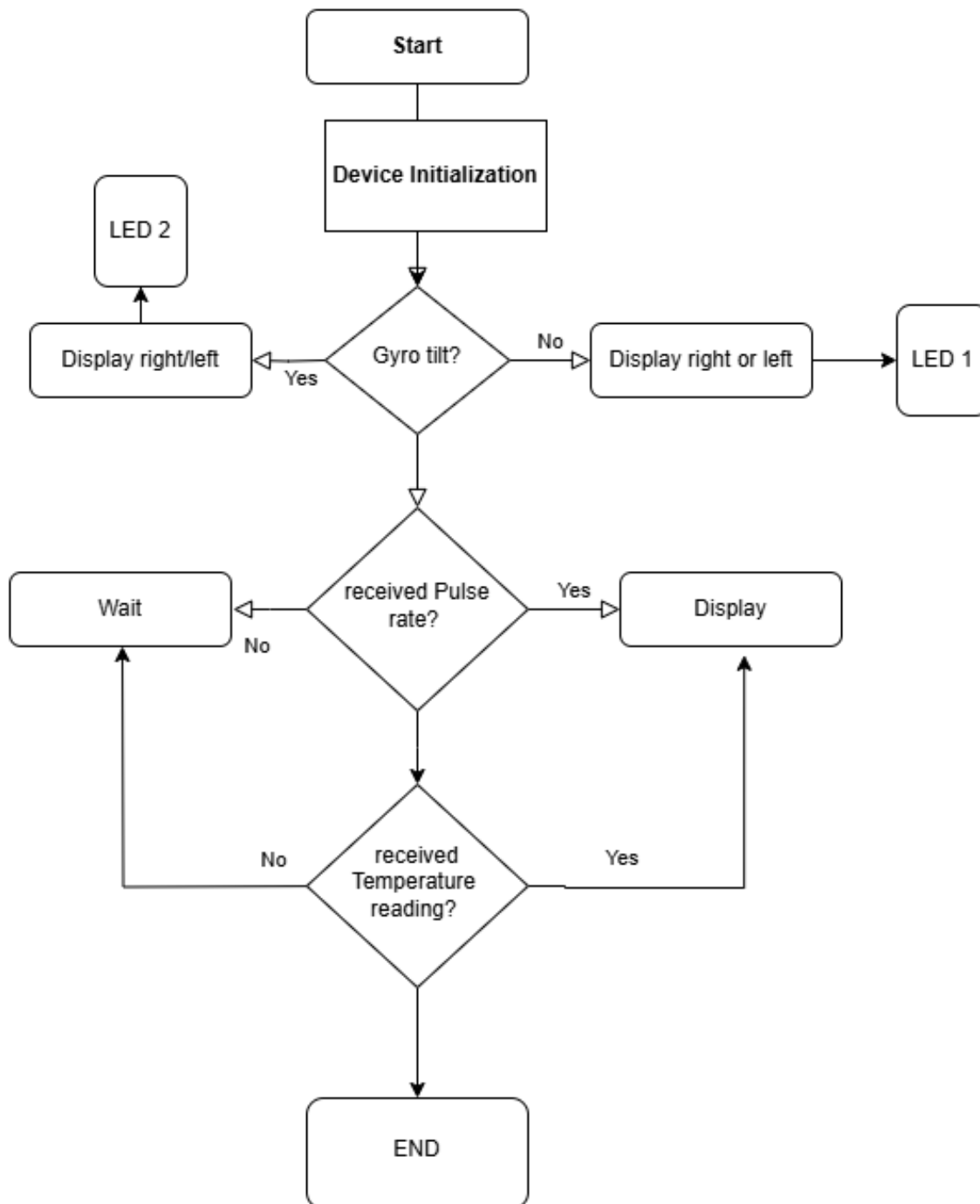
Hardware Architecture with Block Diagram

The system is centered on the ESP32 microcontroller, which connects to various sensors and peripherals. The block diagram below illustrates the setup:



Flowchart

The software logic follows a structured decision-based flow, ensuring efficient data acquisition and display. The process flow is as follows:



Software Architecture and Mobile Application Using Blynk

Software Overview:

- Sensor Initialization: All sensors are initialized during startup.
- Data Acquisition: Periodic collection of heart rate, temperature, and motion data.
- Tilt Detection: Motion from the gyroscope triggers turn indicator LEDs.
- LCD Display: Real-time display of all vital signs.

- Bluetooth Communication: Uses ESP32 Bluetooth to send data to a mobile phone.

Mobile Application (Blynk):

- Developed using the Blynk IoT platform.
- Receives: Heart Rate, Temperature, Speed, Direction Indicator Status.
- Allows: Live monitoring during rides, Basic historical data tracking.

Functionality Overview and Future Improvements

Current Functionalities:

- Real-time health monitoring (heart rate, temperature).
- Direction indication based on tilt sensing.
- Bluetooth data transmission to mobile app.
- LCD display for quick on-bike viewing.

Planned Future Enhancements:

- Live GPS Tracking and Route Mapping.
- Crash Detection and SOS Triggering.
- Solar Charging for sustainable energy.
- Speed Limit Notifications in the mobile app.
- Community Engagement via riding challenges and statistics.

Conclusion

The Smart Cycle Dashboard addresses key safety and health-monitoring gaps for cyclists through a low-cost, microcontroller-based platform. With its modular sensor integration, Bluetooth connectivity, and app support, it offers both practicality and potential for expansion. This solution promotes a safer, smarter, and more connected cycling experience for users at all levels.