

Software Requirements Specification and UI Design

SMART STICK – Multi-Directional Blind Assistant

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1 Introduction

1.1 Purpose

This document provides the Software Requirements Specification (SRS) and User Interface (UI) design for the Smart Stick – Multi-Directional Blind Assistant. It defines system functionality, constraints, and user interaction mechanisms.

1.2 Scope

The Smart Stick is an embedded assistive device that uses ultrasonic sensors to detect obstacles in multiple directions and alerts the user through vibration feedback.

1.3 Definitions, Acronyms, and Abbreviations

- SRS – Software Requirements Specification
- MCU – Microcontroller Unit
- UI – User Interface
- HC-SR04 – Ultrasonic Distance Sensor

1.4 Overview

This document follows the IEEE SRS standard and includes system requirements and UI design details.

2 Overall Description

2.1 Product Perspective

The Smart Stick is a standalone embedded system integrated into a walking stick. It consists of ultrasonic sensors, a microcontroller, vibration motors, and a power supply.

2.2 Product Functions

- Detect obstacles in front direction
- Detect obstacles on the side direction
- Detect pits, stairs, or sudden drops
- Provide vibration-based feedback

2.3 User Characteristics

- Visually impaired users
- No technical training required
- Ability to sense vibration feedback

2.4 Operating Environment

- Indoor and outdoor usage
- Battery-powered operation
- Normal environmental conditions

2.5 Constraints

- Limited battery capacity
- Ultrasonic sensor accuracy limitations

2.6 Assumptions

- User understands vibration patterns
- Stick is used in an upright position

3 Specific Requirements

3.1 Functional Requirements

- The system shall detect front obstacles.
- The system shall detect side obstacles.
- The system shall detect pits and stairs.
- The system shall generate different vibration patterns for each condition.

3.2 Non-Functional Requirements

3.2.1 Performance

- System response time shall be less than 500 ms.

3.2.2 Reliability

- The system shall operate for 6–8 hours on a single charge.

3.2.3 Usability

- The device shall be lightweight and easy to handle.
- Alerts shall be intuitive and distinguishable.

3.2.4 Safety

- All components shall be electrically insulated.
- The system shall not cause physical harm.

4 System Requirements

4.1 Hardware Requirements

- Microcontroller (Arduino Nano / Uno)

- Ultrasonic Sensor (HC-SR04) – 4 units (Front, Left, Right, Down)
- Vibration Motor
- Rechargeable Battery
- Switch and Voltage Regulator

4.2 Software Requirements

- Arduino IDE
- Embedded C / C++
- Sensor interfacing libraries

5 User Interface Design

5.1 UI Overview

The Smart Stick does not use a graphical screen. The user interface is implemented using vibration feedback and physical controls, designed for visually impaired users.

5.2 Input Interface

- Power ON/OFF switch
- Automatic sensing without user input

5.3 Output Interface

- Continuous vibration – Front obstacle detected
- Slow vibration – Side obstacle detected
- Fast vibration – Pit or stair detected

5.4 UI Design Principles

- Minimal interaction required
- Easy to learn vibration patterns
- Immediate feedback for safety

5.5 UI Workflow

1. User switches ON the device
2. Sensors continuously monitor surroundings
3. MCU processes sensor data
4. Corresponding vibration alert is generated

6 Circuit diagram

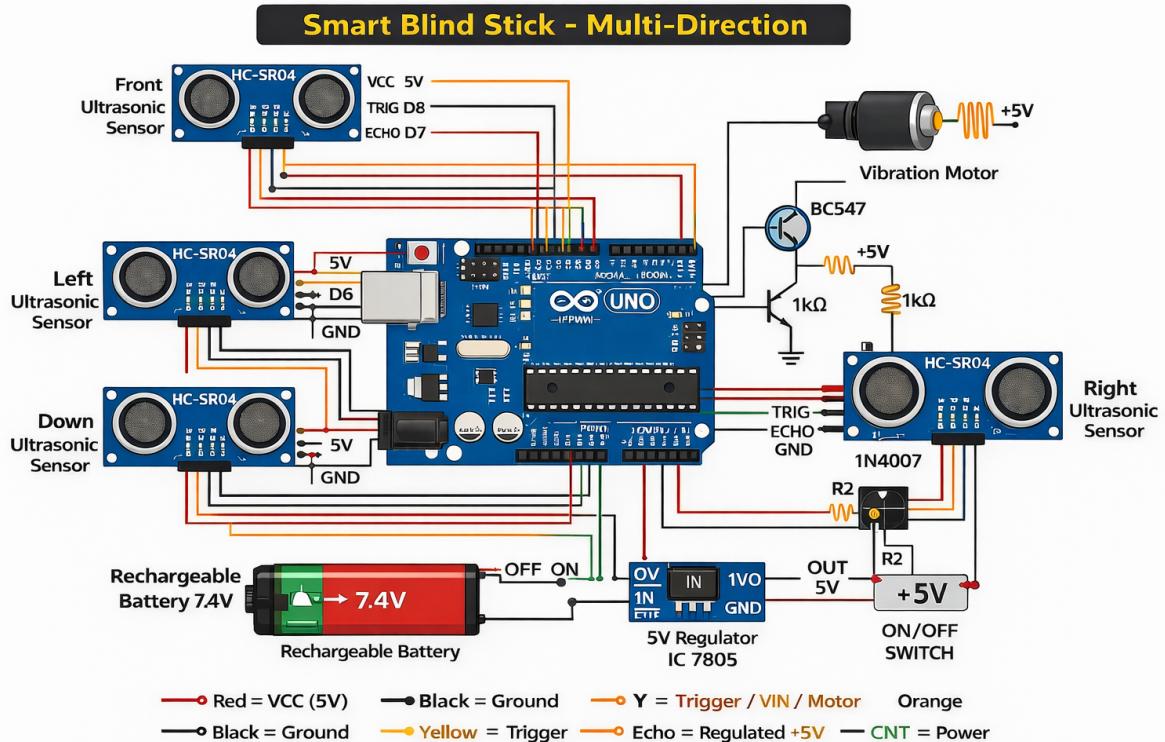


Figure 1: This is circuit diagram

7 Future Enhancements

- Voice output interface
- Mobile app UI via Bluetooth
- GPS-based navigation UI

8 Conclusion

This document presents the IEEE-compliant SRS and UI design for the Smart Stick – Multi-Directional Blind Assistant. The system is designed to be affordable, user-friendly, and effective in real-world scenarios.