BeLOG System Report

Wei Shao

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Github Repository: https://github.com/YoungKameSennin/BeLOG-System

1 Introduction

The BeLOG System, an approach to behavior logging in therapy sessions, integrates a suite of technological components:

- **Intel NUC Mini PC:** Serves as the central unit for data processing and storage.

- **Intel RealSense D455 Camera:** Captures high-quality Depth and RGB frames.

- **Wired Microphone:** Enables audio capture for sessions.

- **T-Watch:** Acts as a Bluetooth interface with the Intel NUC, controlling the camera.

- **Android Tablet with Keyboard and Mouse:** Enables wired access to the NUC for data management.

The system's design emphasizes secure data handling. All session data are stored locally on the Intel NUC, which is isolated from internet access. This setup ensures data security and privacy. Access to the data is facilitated through a wired connection from the Android tablet, using a remote control application. This approach not only safeguards the information but also maintains the integrity of the data collected during therapy sessions.

User Manual: BeLOG System Manual

2 Bluetooth Performance Evaluation

2.1 Experimental Environment

The evaluation was conducted in an office within an engineering building, a setting that might have introduced unseen Bluetooth interference.

2.2 Interval Performance

- **100ms Interval Data:**
  Dataset1: 113 points, Standard Deviation: 21.21ms
  Dataset2: 172 points, Standard Deviation: 21.69ms
  Dataset3: 163 points, Standard Deviation: 20.24ms

- **500ms Interval Data:**
  Dataset1: 132 points, Standard Deviation: 32.43ms
  Dataset2: 132 points, Standard Deviation: 33.50ms
  Dataset3: 161 points, Standard Deviation: 32.33ms

2.3 Analysis and Relevance to Real-World Usage

The system showed more consistent and stable performance at the 500ms interval. The standard deviations for this interval were under 10% of the interval time, indicating better consistency compared to the 100ms interval, where the standard deviations were about 20%. This performance aligns with the demands of real-world therapy sessions, where longer intervals are more common. The improved consistency at the 500ms interval suggests the Bluetooth communication method is well-suited to the system's operational needs.

2.4 Consideration of Experimental Environment

The presence of potential Bluetooth interference in the engineering office environment may have influenced the results. However, in typical therapy session environments, where interference is likely to be less, the system's Bluetooth performance could be even more reliable. This reinforces the suitability of Bluetooth communication for the BeLOG System, confirming its effectiveness in practical therapy settings.

3 Code Overview

3.1 Camera_Preview.py - D455 Camera Preview Script

3.1.1 Purpose

Provides a live preview of the Intel RealSense D455 camera's depth and color streams.

3.1.2 Key Features

- Camera Configuration: Sets up the RealSense camera for depth (z16 format) and color (bgr8 format) streaming at 1280x720 resolution.

- Live Preview: Displays a continuous live preview of both depth and color streams.

3.1.3 Usage Scenario

Useful for real-time monitoring and adjustment of camera settings during therapy sessions.

3.2 Recording_Control.py - D455 Camera Control and Labeling Script

3.2.1 Purpose

To control Intel RealSense D455 camera and synchronize it with audio recording and labeling during therapy sessions.

3.2.2 Key Features

- Camera and Audio Setup: Initializes RealSense camera for depth and color streaming, and sets up audio recording parameters.

- Recording Management: Controls the start and stop of video and audio recordings.

- Real-Time Data Processing: Captures and processes both video and audio frames in real-time.

- User Input Handling: Responds to user inputs (from T-Watch) for labeling and managing recordings.

- Data Storage: Organizes and stores recordings and labels in specified directories.

- Time Formatting: Converts timestamps to a readable format for logging.

3.2.3 Usage Scenario

Ideal for behavior logging in therapy sessions, allowing for precise audio-visual recording and easy data management.

3.3 Firmware1.14.ino - T-Watch Firmware

3.3.1 Purpose

Manages the T-Watch's interface and Bluetooth communication for the BeLOG System.

3.3.2 Key Features

- Event Handlers: Contains multiple event handlers for different buttons on the T-Watch, each triggering specific keyboard commands.

- Bluetooth Keyboard Integration: Utilizes the BleKeyboard library for simulating keyboard inputs over Bluetooth.

- User Interface: Uses the LVGL library to create and manage the T-Watch's GUI, including buttons and dropdowns.

- Recording Control: Includes functionality to start and stop recording sessions and to select subjects via the T-Watch interface.

- Feedback Mechanism: Provides haptic feedback (vibration) and visual feedback (display updates) to confirm user actions.

3.3.3   Usage Scenario

Ideal for hands-free control of recording sessions in the BeLOG System, enabling seamless interaction during therapy sessions.

3.4   Conclusion

The BeLOG System integrated various technologies into a cohesive system that provides robust data capture and management capabilities. Future enhancements may include improved user interfaces, expanded data analysis features, and a single manufactured system.