Table of Contents

Applications Overview

Three applications, for three different technologies are included in this program package.

Vuzix Smart Glasses Application

The Vuzix smart glasses application is responsible for gathering, storing, and streaming sensor data. The application has two modes: storing, and streaming. Whilst on storing mode, the application will store the following sensor data on the devices SD card: Video, accelerometer, and gyroscope data. Whilst on streaming mode, the application will stream the following sensor data: Camera frames which simulate video, accelerometer, gyroscope, and audio amplitudes to one or more mobile devices. The mode used can be changed via gesture controls, and the starting/stopping of streaming/recording can also be prompted via gesture controls. An onscreen timer will display the elapsed time if storing/streaming mode has been started, and is therefore an indicator that the mode is running. When the application starts, it is defaulted to streaming mode. This application is responsible for accepting any Wi-Fi Direct connection requests which come from the device the mobile application is on.

Mobile Application

This application is responsible for setting up a connection between the device, and the smart glasses, and visualising the sensor data which the smart glasses stream. There are two methods of connecting to the smart glasses: Wi-Fi Direct, and Wi-Fi. The devices must be on the same Wi-Fi network if connecting via Wi-Fi. A list of Wi-Fi Direct enabled devices will be listed by pressing the Wi-Fi Direct button, which will show a menu which lists the devices, allowing the user to select one, and an attempt will be made to connect to this device. This list is populated upon booting of the application, and the rediscover button which is also on this menu will rebuild the list using devices gathered by a new discovery process. There is also an information menu prompted by pressing the information button on the Wi-Fi Direct menu which shows information relating to known issues with Wi-Fi Direct, which are outlined in the Known Issues section. If using Wi-Fi, the user will have to manually enter the devices IP address. It's worth noting that entering an IP address does not attempt to create a connection between the devices, this is done when the start button is pressed.

Pressing start will start the stream by attempting to connect to the device specified. The device connected to must already be streaming for this to work. Data which is received will then be visualised. The stream can be stopped via the stop button.

Desktop Application

This application is responsible for visualising any sensor data which the smart application has stored. Data can be loaded in via a file browser on the click of the "Load Data" button. The application accepts a folder, which will have been created for the sensor data. When selected, the data will be visualised. Multiple different data sets can be loaded in, resulting in numerous different tabs, which can each be closed by the click of a button. All visualisations are hooked up to a timeline which can be changed, thus changing the positions of the visualisations. Furthermore, the application can perform a real-time simulation of the data. It should be noted that this application does visualise audio amplitudes, even though audio amplitudes are not stored by the smart glasses application. This is done by extracting the audio from the video, which requires you to have the program "FFMPEG" installed. Installation instructions for this are found later in the "Installing FFMPEG" section, on page….

Usage Walkthrough

Vuzix Smart Glasses Application

Start-up Interface

When the application is started, you will be presented with the following screen:

Changing Modes

To change modes, you must perform a “back swipe” gesture:

Starting/Stopping

A “forward swipe” gesture is required to start/stop the application:

Mobile Application

Start-up Interface

When the application is started, you will be presented with the following screen:

Connecting the devices

Wi-Fi Direct

To connect to Wi-Fi Direct, you must select the Wi-Fi Direct button which will display a list of Wi-Fi Direct enabled devices.

To rediscover devices simply press the rediscover button.

The Information button displays information regarding known Wi-Fi Direct issues. These issues can be found in the Known Issues section.

Wi-Fi

To connect via Wi-Fi, enter the IP address of the smart glasses via click of the Wi-Fi button:

Starting/Stopping

If successfully starting the application via click of the start button, the data visualisations will appear:

If failed, the application will notify you that the start has failed, and explain why:

Stopping the application will freeze the visualisations in their current positions:

Desktop Application

Start-up Interface

When the application is started, you will be presented with the following screen:

Loading Data

Selecting the Load Data button:

Select the relevant folder. It will be formatted in the following way:

If an audio file is not found, the following shell will appear for a split second in order to extract audio from video:

If data is missing:

If files which are not relevant data are found (don't match any file names for data):

All data visualised:

Partial data visualised (data missing):

Timeline

Trackbar can be moved to adjust the positions of all visualisations:

[Mention timer in trackbar screenshot]

Pressing the start button (which changes to stop) initialises real time simulation:

Pressing the stop button (which changes to start) pauses the real time simulation.

Tabs

Loading new data creates a new tab:

Close tabs by pressing the "x" button on the tab:

Known Issues

Wi-Fi Direct Connection Issues

Connecting to Wi-Fi Direct often fails. It is difficult to determine when it fails as the connection tends to hang on an invited state, rather than outright reject the request. As a result, as the user the only indication that it may not work is if it is taking a while to "connect". When this happens, it is advisable to go into the mobile device settings, and cancel the invite. From here, go back to the application, and try to connect again. It is possible that the smart glasses will send an invite after cancelling the request. Do not accept this invite, as it is important that the mobile phone application initialises the connection, which is discussed below.

Wi-Fi Direct Connection Order

Wi-Fi Direct works by designating one device as the group owner. The application works by gathering the group owners IP address, and therefore it is important that the mobile device is not the group owner. To avoid this, the code for the connection within the mobile application, to the best of the developer's current knowledge, guarantees that it will not be the group owner.

If a Wi-Fi Direct connection has been established, and the mobile application states that a connection does not exist when pressing the start button, then it is highly likely that the order of the connections is wrong. Therefore, it is advisable to cancel the connection in the device settings, and connect again via the mobile application.

[Need to determine whether or not glasses sending request messes group order, even if rejected]

Video Streaming Frame Resolution

Detailed Sensor Information

Accelerometer/Gyroscope

Samples for these sensors are taken at ~50Hz. A value is given, which is a guide to how often a new sample should be taken. This means that, although it is set a value that equates to a value every 1/50th of a second (50Hz), it will not be exactly 50Hz.

Video

Frames streamed to the mobile application

"Video" is sent in the form of a series of frames which are captured by the camera. A "video" is not streamed, and therefore no audio is streamed to the mobile application.

Video stored and used on the desktop application

This video is stored in the MP4 format, at a frame rate of 24 (the smart glasses maximum frame rate), and the resolution of this video is [Insert here…]

[Perhaps mention audio rate]

Audio Amplitudes

Audio amplitudes are different dependent on which application is being used.

Streamed to the mobile application

Audio which is gathered on the smart glasses application for streaming to the mobile application on one or many devices is represented as a series of amplitudes taken over a specific period. This period is 1/50th of a second (therefore values are taken at 50Hz). Therefore, each amplitude is the maximum recorded amplitude between the current time, and 1/50th of a second previously. Due to limitations, often the method of returning a maximum amplitude does not return what is likely to be a valid amplitude – these values are filtered out.

Extracted audio on the desktop application

Audio on the desktop is visualised as a full audio envelope. The extracted audio is sampled at 8000Hz, and therefore 8000 amplitudes per second are visualised on the graph.

Installing FFMPEG