CSCE 483 FALL 2020
UAS PILOT DATA COLLECTION
User Manual

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Introduction

About This Manual

The purpose of this manual is intended for the developers to understand the elaborate details of code developed and used to run the UAS Pilot Data Collection Tool. Additionally it provides steps to set up the system on a new processor and how to troubleshoot the system.

About This Tool

The UAS Pilot Data Collection tool is used to record and synchronize the facial expressions and tablet interactions of a drone pilot. The device consists of a raspberry pi 4, rechargeable battery pack, PiCam 2.1, USB Webcam, and USB storage device embedded in a standard drone pilot harness. This manual is intended to help users understand how to set up and operate the system as well as provide useful information related to data storage and common error troubleshooting.

Getting Started

Formatting the USB Storage Device

- Format any USB desired using FAT32 and name the device “VIDEOS” - Note formatting the USB will erase all files on the device
- **On Windows :**
    1. Plug in the USB to a Windows PC
    2. Right click the USB in File Explorer
    3. Select “Format”
    4. Select “FAT32” under the File System dropdown
    5. Name the volume “VIDEOS” in Volume Label
    6. Click Start
    7. Let the process run, then eject the USB
- **On MacOS :**
    1. Plug in the USB to a MacOS PC
    2. Open Disk Utility (Applications > Utilities)
    3. Select the USB in the sidebar, then click Erase, Ensure you have selected the USB drive and not a single partition.
    4. Name the USB “VIDEOS”
    5. Select “MS-DOS (FAT)” under the File System dropdown

6. Select “GUID Partition Map” as the Scheme
7. Click “Erase”

Connecting the System

- **Battery Pack**
  - Connect to the USB-C port on the pi and place in the harness pocket
- **USB Webcam**
  - Connect to its USB Port on the device (designated below)
- **Pi Camera 2.1**
  - Securely connect to the CSI input port on the device
- **USB Storage Device**
  - Connect to any open USB port on the device
  - Storage device must be named “VIDEOS” - see Formatting the USB Storage Device for instructions

Operating the System

- **Put harness with device on pilot**
  - While supporting the device, put neck strap on over head
  - Wrap belt strap through neck strap and adjust for comfort as necessary
  - Lower tablet portion of device and make sure the cameras are correctly angled
- **Power Device**
  - The System Power switch is located on the Power Bank. Press it once to turn on the power bank.
  - The LED display will show how much charge the battery has.
  - The system should automatically start once powered.
- **Wait for initialization to finish**
  - LED will display a solid green LED after successful initialization
- **Start recording**
  - To start recording, press the red button once.
  - The LED will display solid red and the device will begin recording data from the video streams.
- **Stop recording**

    - To stop recording, press the red button once.
    - The system will stop recording and the LED may briefly turn off.
- **Wait for processing to finish**
    - Processing will start immediately after recording has stopped and will turn the LED solid blue. While the LED is blue the device is merging the videos, time scaling them, and exporting them to the USB device if it is attached.
    - During this time, do not unplug the device or eject the USB.
    - Once processing is finished, the LED will turn back to solid green.
- **Ending session**
    - When the device is in the green standby phase, the user may either record another session or turn the device off by toggling the power bank power switch.
    - Ensure the device is in standby before turning off power and ejecting USB.
- **Retrieving data**
    - See Viewing the Data section below
- **Encountering Errors**
    - See System Troubleshooting section below

Viewing the Data

- **USB retrieval**
    - Make sure the system is powered off.
    - Unplug the USB from the device and attach to a personal computer or other device that can read the USB.
    - Navigate to the desired folder, labeled by relative timestamp on device, to find recording data.
- **SD card retrieval** - in case of error encounters before file transfer.
    - DO NOT POWER PI as this will delete the temporary backup on the device.
    - Eject SD card from raspberry PI and attach to SD card reader on personal computer.
    - Use Paragon [link] on Windows or attach to a linux machine to read SD card contents.
    - Navigate to directory “/home/pi/Documents/localVids” to find the most recent recording session data.
    - When data is recovered, attach the SD card back to Raspberry Pi to enable the system again.
- Video viewing (VLC on Windows 7+)

    - The video files are saved as ".mp4" and have been successfully played and viewed using VLC media player on Windows 7+ systems.

How the Data is Saved

- **Format :** The videos recorded using the data collection tool will be saved in MP4 format once processing of the videos is complete.
- **List of Available Files :** [*timestamp*]
    - FaceCamVideo.mp4
    - [*timestamp*]TabletCamVideo.mp4
    - [*timestamp*]fastMerged.mp4
    - [*timestamp*]merged.mp4
- **Location :** Raspberry Pi's SD card and the USB drive plugged into the system
    - SD Card Path : ~/home/pi/Documents/localVids
    - USB Path : ~/media/pi/VIDEOS
- **Past videos:** deleted from the Pi's memory upon startup, but any saved on the USB drive will remain, allowing the user to record multiple videos in one session.

System Troubleshooting

General ErrorHandling : blinking orange LED Morse Code pattern

Recovery Potential : Certain hardware errors will allow the user to remedy the issue without restarting the system. If recovery is not viable, the user must turn off the system to either recover what data is available, or restart the system and start a new session.

- **Face camera not detected**
    - Indicated problem accessing face camera stream
    - errorFaceCam written to errorLog
    - Dot dot dot displayed on LED
    - Can be resolved by checking face camera connection, ensuring face camera works, and potentially restarting the system.
- **Tablet camera not detected**
    - Indicated problem accessing tablet camera stream
    - errorTabletCam written to errorLog
    - Dot dot dash displayed on LED
    - Can be resolved by checking tablet camera connection, ensuring tablet camera works, and potentially restarting the system.
- **USB not detected**

    - Indicated problem accessing USB storage device
    - errorUSBDetect written to errorLog
    - Dot dash dot displayed on LED
    - Can be resolved by checking USB storage device connection, and potentially restarting the system.
- **USB exceeds storage capacity threshold**
    - Indicated problem with USB storage capacity
    - errorUSBStorage written to errorLog
    - Dot dash dash displayed on LED
    - Can be resolved by increasing available storage on USB. Files must be transferred off of USB or a different USB storage device must be used. System requires a minimum of 330 MB free to ensure full transfer of large recordings.
- **Recording files not found**
    - Indicates one or both video files from recording do not exist in designated location
    - errorBadFile written to errorLog
    - Dash dot dot displayed on LED
    - Cannot be resolved without restarting the system. Recommend recovering files from SD card if desired before restarting the system.
- **Processing error**
    - Indicates either error encountered during processing of videos (merging or time scaling) or the merged video files are not where expected.
    - errorBadSync written to errorLog
    - Dash dot dash displayed on LED
    - Cannot be resolved without restarting the system. Recommend recovering files from SD card if desired before restarting the system.
- **Recording error**
    - Indicates a problem encountered during the recording session
    - errorRecording written to errorLog
    - Dash dash dot displayed on LED
    - Cannot be resolved without restarting the system. Recommend recovering files from SD card if desired before restarting the system.

ErrorCode (string)	Error Description (string)	Pattern	Recovery (Yes/No)
errorFaceCam	No Face Camera	Dot dot dot ●●●	Yes
errorTabletCam	No Tablet Camera	Dot dot dash ●●□	Yes
errorUSBDetect	No USB	Dot dash dot ●□●	Yes
errorUSBStorage	USB Full	Dot dash dash ●□□	Yes
errorBadFile	Raw Video Not Found	Dash dot dot □●●	No
errorBadSync	Merged Video Not Synchronized / Found	Dash dot dash □●□	No
errorRecording	Problem During Recording	Dash dash dot □□●	No

Additional Information

For more detailed information on the system's operation, implementation, or advanced troubleshooting and debugging, please refer to the Programmer's Manual.

Acknowledgements

Letter of Acknowledgement

We, the members of the CSCE 483 Fall 2020 team 5: UAS Pilot Data Collection, hereby acknowledge that we have read, reviewed and verified this User Manual, to submit as part of our project documentation.

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