

Data Collection System

for Smart Endoscope Study

Data List

DATA NAME	DATA TYPE	DATA RATE	ACCURACY	HARDWARE	SOFTWARE
Head Pose	Pose	20HZ	0.8mm/0.7°	Head Fixture, 6 DOF Reference, Aurora	NDI Tracker
Suction/Pointer Pose	Pose	20HZ	0.8mm/0.7°	Suction Tool, 6 DOF Cable Tool, Aurora	NDI Tracker
Endoscope Pose	Pose	20HZ	0.8mm/0.7°	Endoscope Adapter, 6 DOF Reference, Aurora	NDI Tracker
Fiducial Position	Pose	20Hz	0.8mm/0.7°	Standard Probe, 6 DOF Probe, Aurora	NDI Tracker
Endoscope Video	RGB Video	30HZ	N/A	PointGrey Camera	Point Grey Driver
Gaze	Gaze	30HZ	N/A	GazePoint	GazePoint API
CT Scan*	Dicom	N/A	N/A	X-RAY	3D Slicer
Statistical Data*	Dicom	N/A	N/A	Database	3D Slicer

Comment: all data except CT Scan and Statistical Data, is logged using rosbag. Gaze information is collected on a Windows computer and then transmitted to and logged on Linux. *This data is provided before the surgery.

Hardware List

PART NAME	QUANTITY	UNIT COST	VENDOR
Suction/Pointer Tool	1	\$30	WSE Manufacturing
Endoscope Adapter	1	\$30	WSE Manufacturing
Head Fixture	1	\$30	WSE Manufacturing

PART NAME	QUANTITY	UNIT COST	VENDOR
Aurora 6DOF Reference, 25mm Disc, Standard	2	\$400	DNI
Aurora 6DOF Cable Tool, 2.5 x 12mm	1	\$225	DNI
Aurora 6DOF Probe, Straight Tip, Standard	1	\$1,075	DNI
Aurora Window 50-60 Field Generator with Detachable Cable	1	\$5,415	DNI
Aurora V3 System Control Unit Kit	1	\$4,412	DNI
Aurora 4-port Sensor Interface Unit V3 Kit - 4P FW3.000	1	\$2,499	DNI
Flir Grasshopper3 GS3-U3-41C6C-C Camera	1	\$1,450	FLIR
GazePoint GP3 Eye Tracker 150HZ	1	\$1,995	GazePoint
Windows Computer	1	\$500	Dell
Linux Computer	1	\$1,300	Dell

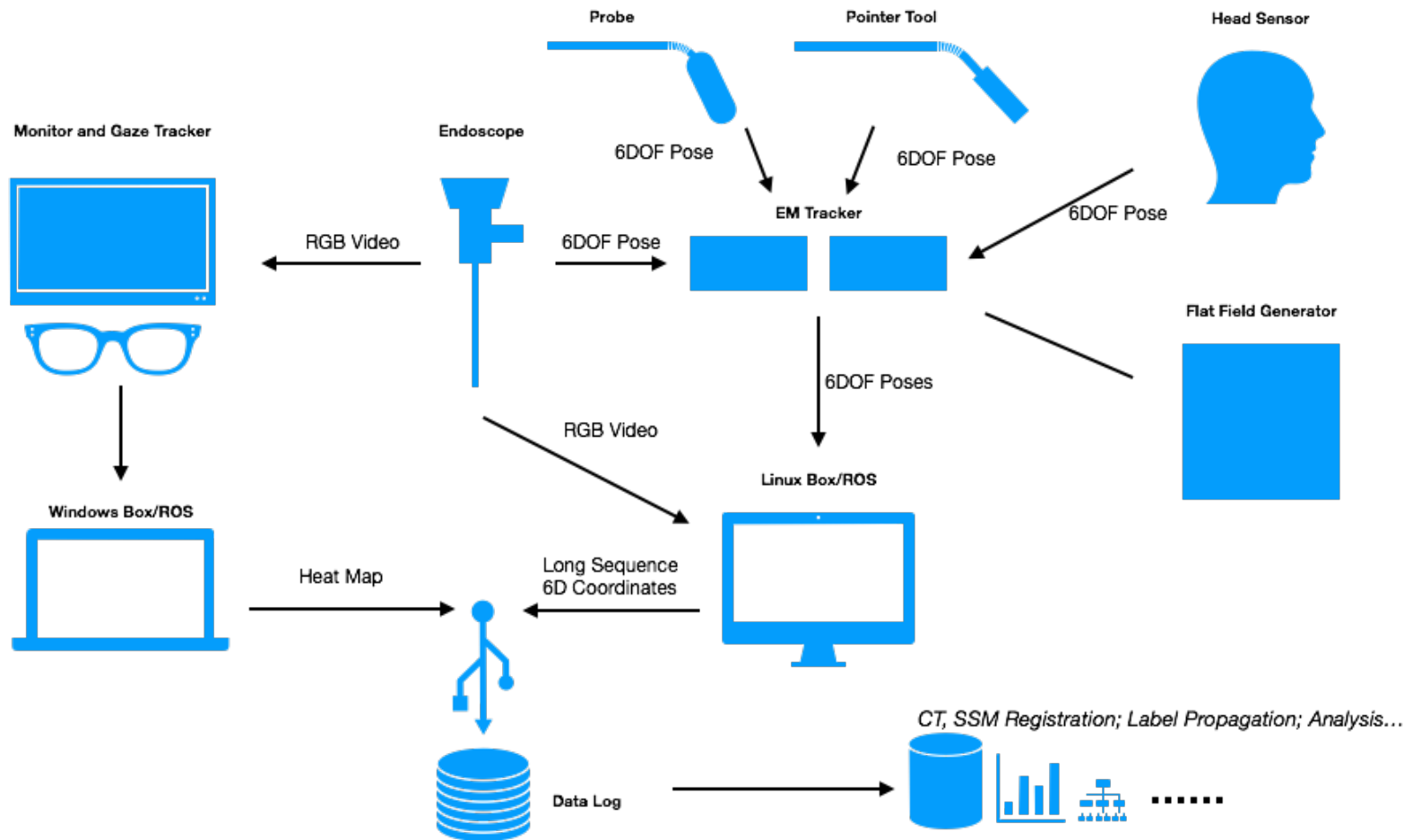
Comment: Surgical tools are not included. Manufacturing materials and tools are not included.

Software List

PACKAGE	OS/SYSTEM	DEVELOPER	SOURCE
NDI Tracker	Ubuntu 16.04/ROS	Anton Deguet	https://github.com/jhu-saw/sawNDITracker/tree/devel
Point Grey Driver	Ubuntu 16.04/ROS	Chad Rockey	https://github.com/ros-drivers/pointgrey_camera_driver
Experiment Controller	Ubuntu 16.04/ROS	Rui	https://github.com/RuiYinRay?tab=repositories
Gaze Point	Windows/SDK	GazePoint	Offline
GP ROS Wrapper	Ubuntu 16.04/ROS	Rui/Cong	https://github.com/RuiYinRay?tab=repositories

Comment: FYI

Data Flow



Experiment Work Flow

Before the experiment:

1. Prepare cadaver head either by implanting fiducials (preferably non-metallic, but with good CT contrast).
2. Obtain a CT scan of the skull.
3. Locate the fiducials in CT.
4. Find the positions of fiducials in CT using 3D Slicer.
5. Perform GDIMLOP registration to sinuses in order to obtain sinus structures.

During the experiment:

6. Setup data Collection System
7. Prepare the cadaver head with plastic bags and towels (ON A TRAY)
8. Drill Holes on the cadaver head thru the adapter
9. Screw the EM reference onto the cadaver head
10. Run roscore (roscore)
11. Run NDI Tracker Node (roslaunch ndi_tracker_ros ndi_tracker)
12. Run Master Launch and configure the panel (roslaunch sep_master master.launch)
13. Use the probe tool to touch and record the positions of the fiducials
14. Position the surgeon
15. Switch Monitor to Windows
16. Calibration for gaze tracker
17. Start collecting gaze tracker data
18. Switch monitor to Linux
19. Project the endoscope stream on the monitor
20. Run the gaze tracker node
21. Start recording data
22. Start the experiment
23. Finish the experiment
24. Stop recording data

After the experiment:

25. Head??????
26. Tools??????
27. Table??????
28. Disposal??????
29. Perform registration algorithms(?) to register tool frame to CT frame
30. Recognize and delete Aurora data which is out of range
31. Map Gaze data to endoscopic video

Aurora:

Positions of Fiducials:

Collected -----> Registration -----> CBCT

Pose of Head:

Pose of Endoscope:

Pose of Suction:

Endoscope Camera:

Gaze:

Collected