

Human Machine Interface Gesture System for Medical Devices

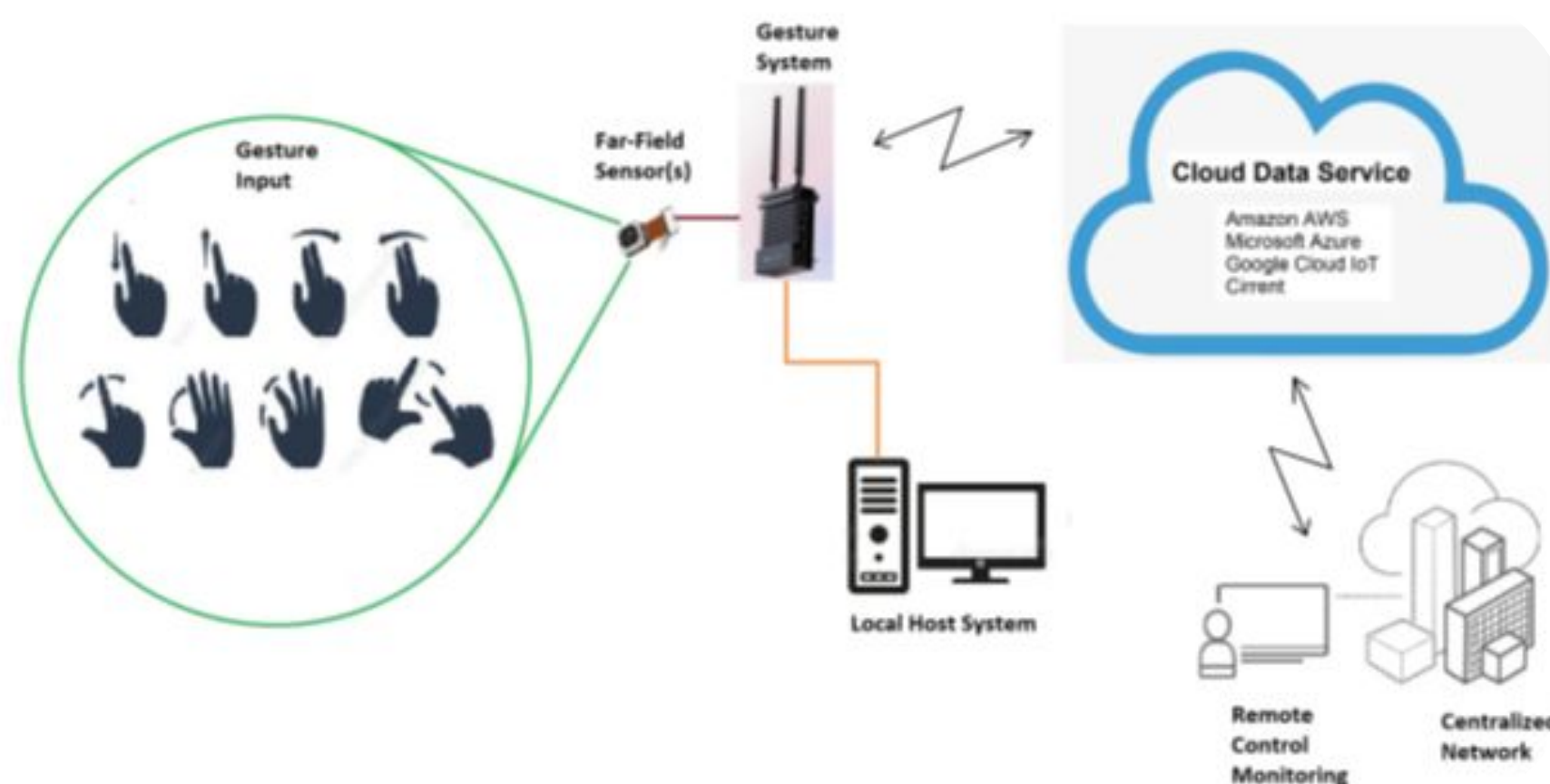
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Project Sponsor: Advanced Input Designs

Lead Instructor: Bruce Bolden

Objective

- Read in hand gestures
- Convert gestures into local machine instructions
- Send & receive data from a cloud data service



Key Requirements

- Requirement targets on the design matrix:

Azure Percept (Microsoft)	
Research (DOE)	Requirement Target
Research Architecture	
How to measure	detect both human and objects within a FOV
How to quantify/measure	300mS or less
How to measure	5mm or less
How to measure	90% or greater
Signal to noise over distance	0.2 M to 3 M
How to quantify/measure	No false or multiple repeat reports
What types to use/characteristics	Audible beep or visual indication
Definition and codify	6 to 12 gestures/ability to map to local controls

Validation

- Final prototype results::

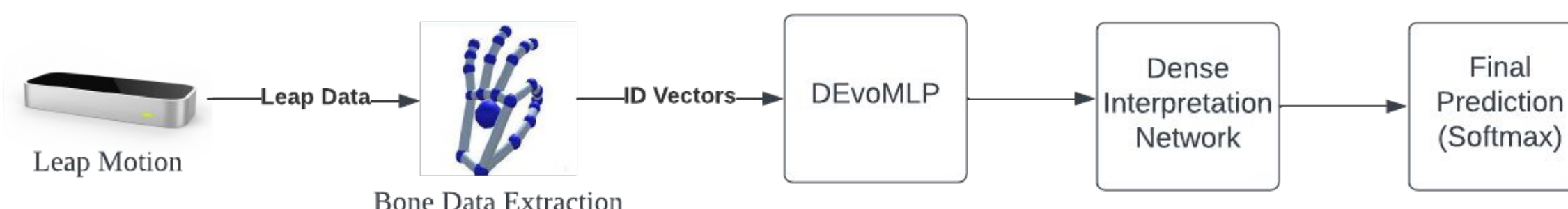
Requirements Parameter/Characteristic	Azure Percept (Microsoft) Research (DOE)	Requirement Target	Requirement Actual
System Architecture (Block Diagram, Data Flow)	Research Architecture		
Approach/Gesture Source Detection(human or object)	How to measure	detect both human and objects within a FOV	~90*
Gesture Tracking (position) processing latency	How to quantify/measure	300mS or less	5s
Gesture Tracking (position) processing accuracy	How to measure	5mm or less	90%
Gesture overall recognition rate	How to measure	90% or greater	90%
Gesture overall recognition distance range	Signal to noise over distance	0.2 M to 3 M	5ft (Vision), 20ft (Speech)
Gesture to report synchronization	How to quantify/measure	No false or multiple repeat reports	Low risk
Gesture recognition acknowledge/feedback	What types to use/characteristics	Audible beep or visual indication	Audible beep and visual indication
Gesture Library elements (gestures to recognize)	Definition and codify	6 to 12 gestures/ability to map to local controls	6 gestures

Background

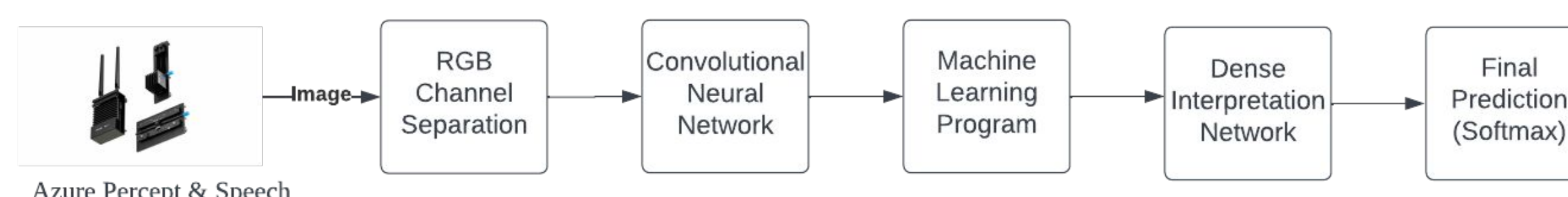
- Many hospitals today still handle most of their medical equipment by hand
- This requires that the doctors and nurses touch these devices in order to interact with the user interface and in result spend precious time cleaning and sanitizing each device after each use
- The main challenge that comes from developing a non-contact gesture based programmable human machine interface (HMI) control system is the reliability and reusability of reading in gestures and accurately outputting the desired results

Concept Development

- Leap Motion Concept:



- Azure Percept & Speech Concept:



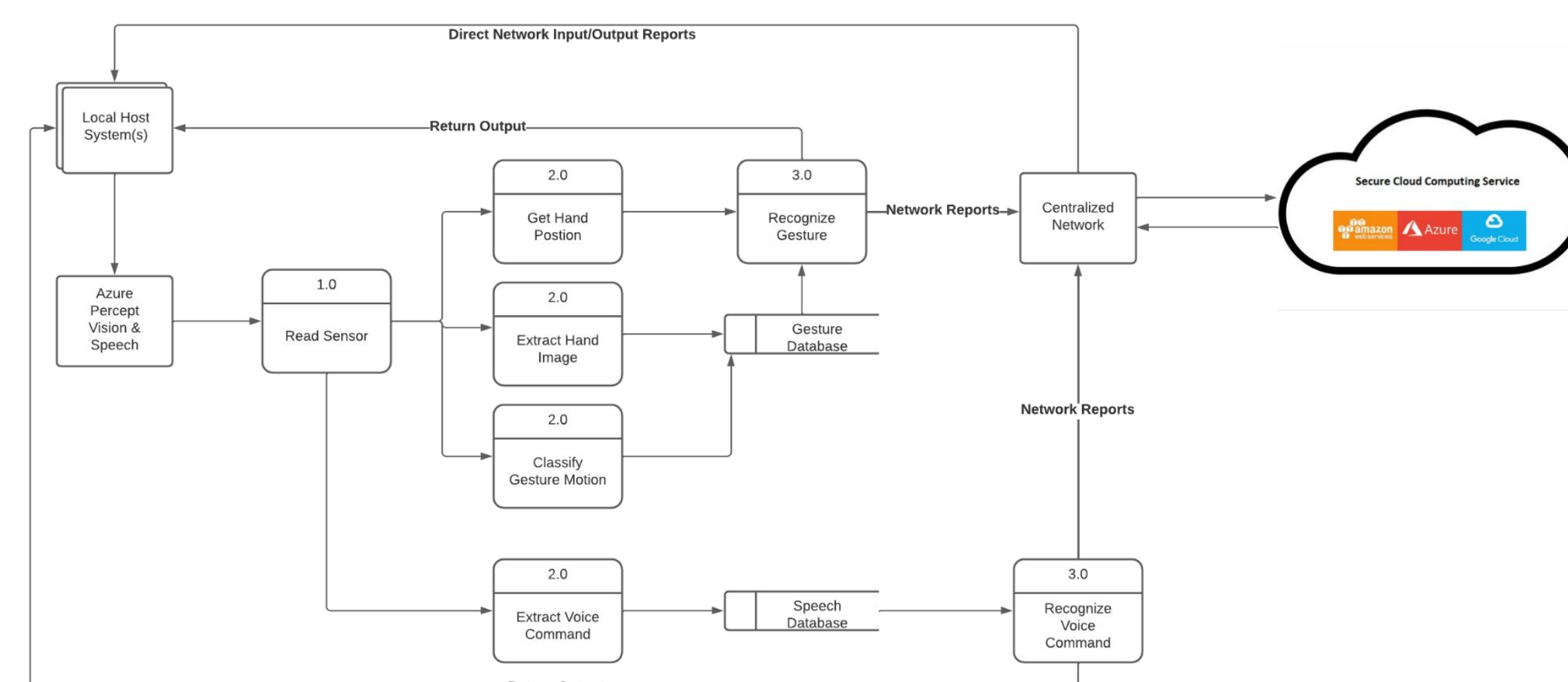
Future Development Recommendations

- The processing latency speed is the biggest area the project is likely to see massive improvement
- Increasing and adding more diverse training data will help in allowing the program to be more adaptable to different environments and human machine interactions as well as improving the recall of the program
- Increasing functionality by adding motion gestures and dual gesture/speech confirmation commands
- Testing and optimizing the program for different medical devices

Value Proposition

- The application of a non-contact human interaction system highly desirable in addressing the problem of reducing the risk of hospital acquired infections from contaminated surfaces along with saving precious time
- Our goal is to develop a HMI control system that can accurately identify gestures to replace basic manual hospital operations with a contactless gesture system

The Final Design



Acknowledgments

Team JESures would like to give special thanks to Mitch Butzer and everyone at Advanced Input Systems for giving us this great opportunity to work on a real world application.

We would also like to thank Bruce Bolden and the College of Engineering for their guidance and support.