The Sandia Hand

Robotic users have a need for a low-cost robotic hand that can perform highly dexterous tasks in a variety of hazardous environments. Sandia National Laboratories, in collaboration with Stanford University and Lunar, has developed The Sandia Hand for the DARPA-sponsored Autonomous Robotic Manipulation (ARM) Program to address this need. The Sandia Hand is low-cost, dexterous, and modular enabling it to support a variety of applications including:

- Counter-IED
- Countermine
- Explosive Ordnance Disposal
- Search and Rescue
- Casualty Care
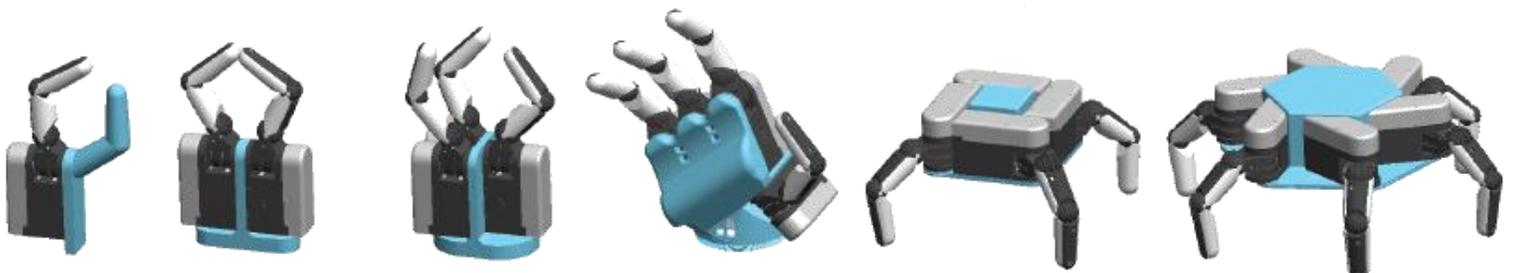- Extreme Environments

System Design

The Sandia Hand consists of a hand frame that supports a set of identical finger modules that magnetically attach and detach from the hand frame. The finger modules consist of several sensor systems that enable the hand to perform complex manipulation tasks and is supported by several imaging systems to increase function and performance. Control of the hand is realized through autonomous software, semi-autonomous collaboration with high-level human input, and low-level human control via teleoperation.

Features

- **Low Cost**: using 3D high-resolution rapid prototyping technologies for low volumes, ensuring each component is amenable to injection molding for high volumes, and designing around components found in large consumer markets has enabled significant cost reductions
- **Dexterous:** designed with four 3 Degree of Freedom (DOF) fingers to enable dexterous tasks such as finger gating while still maintaining form closure
- **Modular:** a hand frame with identical finger modules that attach through magnetic attachment with electrical power and communications achieved through spring contacts. Power to each finger socket is actively controlled, permitting hot swapping of finger modules.
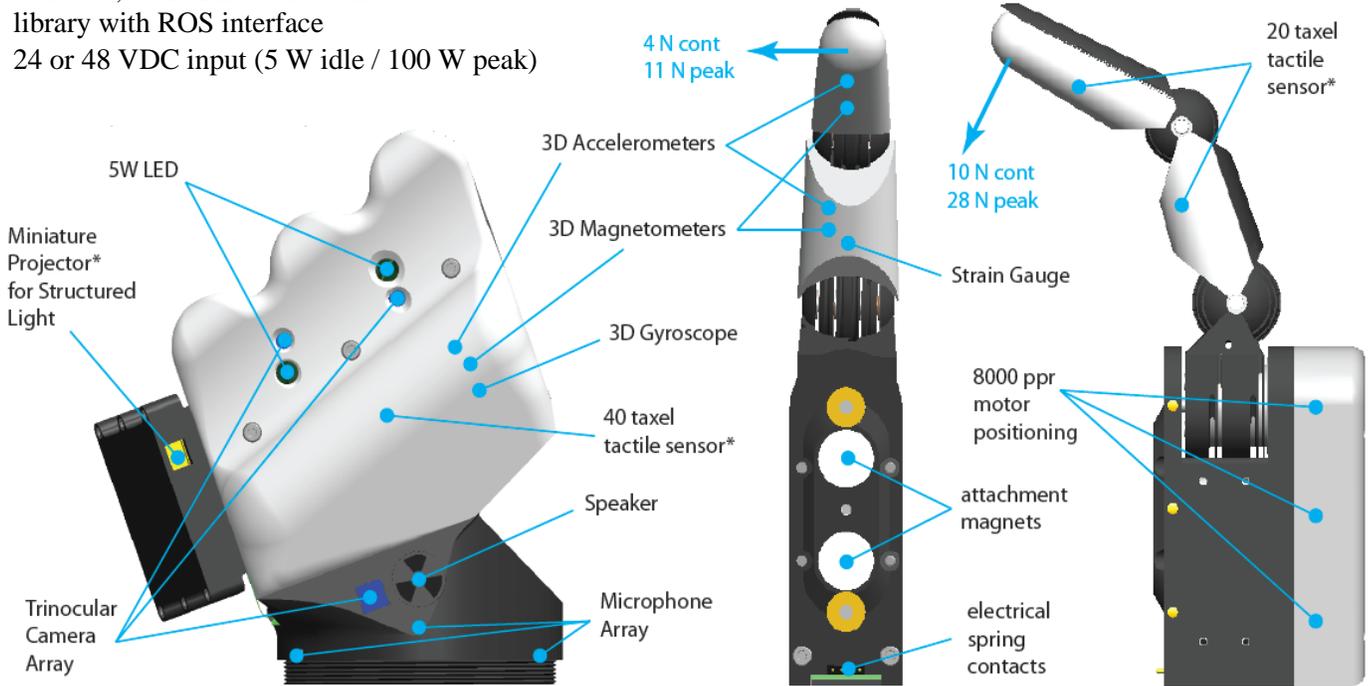
Benefits

- **Mechanical Breakaway:** fingers robustly separate from palm in overload conditions
- **Reduced down time:** easy to swap out fingers when repairs are needed vs. repairing the entire hand
- **Pluggable Tools:** swap out fingers with tool modules (screw driver, forceps, sensors, etc)
- **Customization:** limitless variations in palm geometry using the same fingers (see below)

Features and Specifications

*coming soon

- Connectivity: 10/100/1000 Ethernet, CANbus, USB Linux and Windows* driver library with ROS interface
- 24 or 48 VDC input (5 W idle / 100 W peak)

5W LED

Miniature Projector* for Structured Light

Trinocular Camera Array

3D Accelerometers

3D Magnetometers

3D Gyroscope

40 taxel tactile sensor*

Speaker

Microphone Array

4 N cont 11 N peak

10 N cont 28 N peak

Strain Gauge

8000 ppr motor positioning

attachment magnets

electrical spring contacts

20 taxel tactile sensor*

Advanced Manipulation Enabled by Robust Design

- Grasping and picking up objects
- Sorting objects
- Drilling holes
- Throwing objects
- Sliding objects
- Inserting objects
- Turning wheels, knobs, levers
- Holding objects
- Assembling objects from part kits
- Removing objects from small spaces

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