Building Perceptive Robots with INTEL® EUCLID™

DEVELOPMENT KIT

Amit Moran

Perceptual Computing
Systems Innovation
A “modern” robot should be able to perform the following tasks:

1. Perform a task
2. Find its way in our world and move safely
3. Understand the environment and adapt to it
4. Interact (naturally)
Hi Fred,
Water the flowers for me please.
Robot Scene Understanding
Robot Scene Understanding

- Human Recognition
- Obstacle identification
- Indoor navigation
- Object Recognition
Human – Robot Interaction
Hi Fred, Water the flowers for me please.

Human – Robot Interaction

- Speech Recognition
- Emotion Recognition
- Gesture Recognition
- Intent Understanding
- Speech (text to speech)
- Humanoid Behavior
Robot Scene Understanding

- Human Recognition
- Obstacle identification
- Indoor navigation
- Object Recognition

Human – Robot Interaction

- Speech Recognition
- Gesture Recognition
- Emotion Recognition
- Intent Understanding
- Speech (text to speech)
- Humanoid Behavior
Robotics capabilities

Sensing and perception
- Relative position and velocity estimation
- Semantic understanding
- 3D perception
- Object recognition
- Object classification
- Scene understanding
- Sensor fusion
- Sensing materials

Human-robot interaction
- Multi-modal interaction
- Relating over time (Know Me)
- Social interaction
- Emotion recognition
- Human activity recognition
- Intent recognition
- Meaningful expression
- Safe interaction
- User-aware design

Task execution
- Dynamic and compliant control
- Task and motion planning
- Navigation, mapping, and localization
- Multi-agent coordination
- Automatic feedback and adaptation
- Training and skill acquisition

Mechanics
- Cost efficient arms and grippers
- Real-time reaction and replanning
- Modeling contact dynamics
- Cost efficient actuators
- Object Manipulation
- Inherently safe mechanics
- Locomotion

System engineering
- System integration
- Serviceability and error recovery
- Modularity and interoperability
- Verification and validation
- Power-efficient computing
- Learning and data management
- Cooperative robot networks
- Security
- Privacy

Legend: Perception needed

Sources: NASA; euRobotics; internal analysis.
Perception is in the heart of modern robotics

- Unstructured Environment
- Dynamic and changing environment
- Perception
- Operate around and with Humans
- Learn and adapt to new situations
- Multi Robot collaboration
Support roboticists in their quest to innovate and create the next big thing in robotics
GETTING INTO ROBOTICS IS DIFFICULT...
INTEL® EUCLID™
DEVELOPMENT KIT

*The product, product specifications and data may be subject to change without notice
Roboticist/Makers vision solution

Complete
Standard/Community
Easy to use/ “zero-installation”

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Intel® Euclid™ - Highlights

- **Complete**
- **Standard/Community**
- **Easy to use/ “zero-installation”**

**Environmental Sensors**

**Audio**: Mics, Speaker

**Detachable Battery**

**ZR300 (Depth & Motion)**

**Intel® Atom™ Quad-Core SOC**

**Coms**: WiFi, BT, USB3, UART, HDMI

**Internal Storage Memory**

**Soft buttons**

Roboticist/Makers vision solution

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Intel® Euclid™ - Highlights

PERSON LIBRARY

- Person Detection
- Body Tracking
- Person Tracking
- Body Gestures
- Person Recognition
- Face Tracking
- Body Posture

SLAM LIBRARY

- 2D occupancy map. White area is occupied.
- Orange grid lines are one meter apart.
- Path traveled. Bright orange is more recent.
- Current position of the camera.

OBJECT LIBRARY

- Object ID
- Confidence
- Bounding Box

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Intel® Euclid™ - C&C Web interface

Scenarios

Dynamic Reconfigure

ROS nodes configuration standard

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