

- R&D Topics : Robotics Technologies
- R&D Theme : Development of Intuitive Teleoperation Robot using the Human Measurement
- Principal Investigator : Shigeki Sugano (Professor, Waseda University)
- Collaborative Research Groups : Chiba University

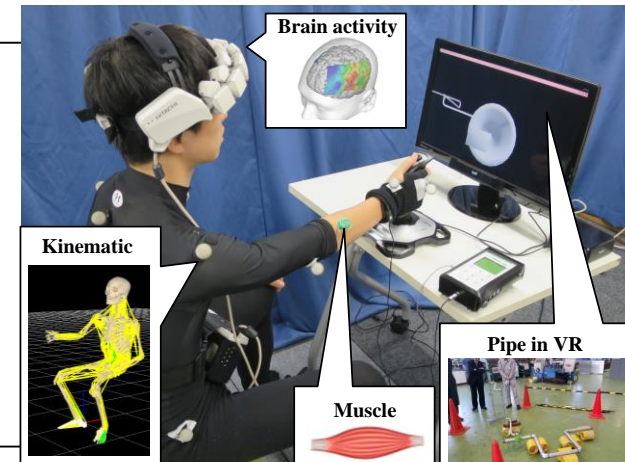


R&D Objectives and Subjects



Objectives

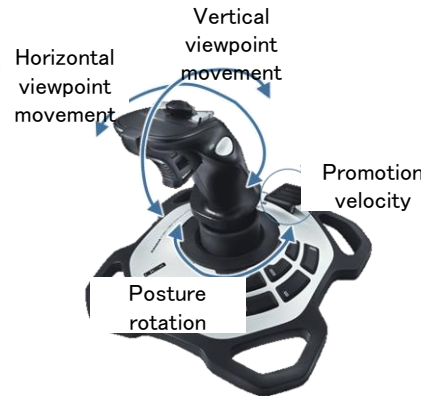
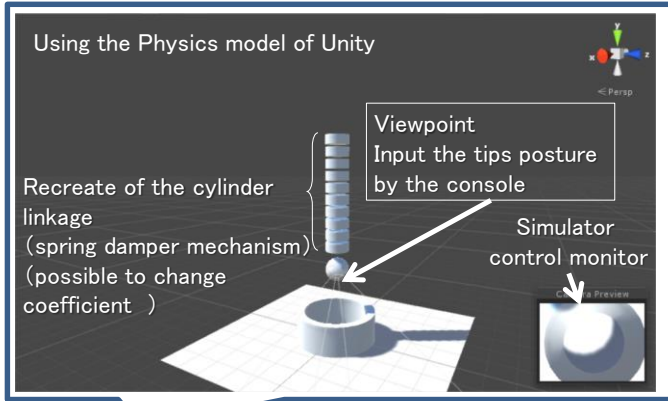
- Development of an **intuitive interface** between operator and robot
 - To be used in complex and strange working environments, such as pipelines, under bridges.
- Extraction of the **standard and common human characteristic model** for operation
 - The human measurement when operating the robot or drones.
 - In this study, the pipeline inspection robot control is the test case



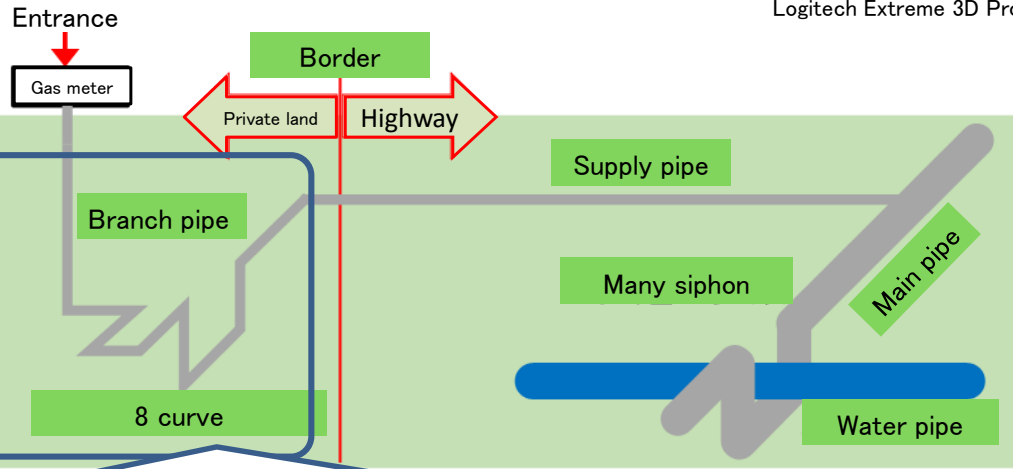
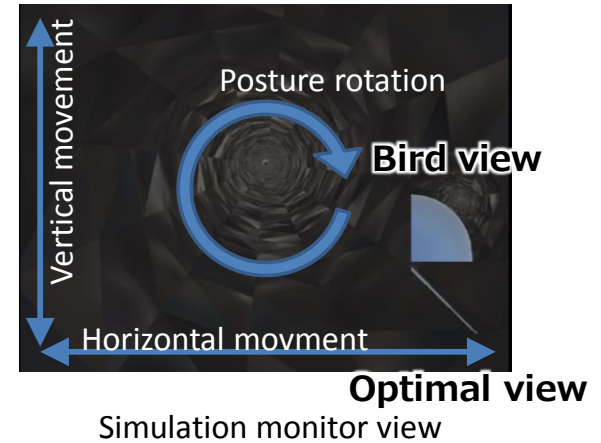
Subjects

- Construction of the **virtual pipeline inspection simulation**
- Clarification of the professional human model by measuring the human brain and muscles and a working score, such as the curvature of operations and time of accomplishment
- Design of robot configuration and a control method based on the extracted human model
 - Construction of the **intuitive robot design methodology**
- Compared with the conventional method, this study focuses on human centered design

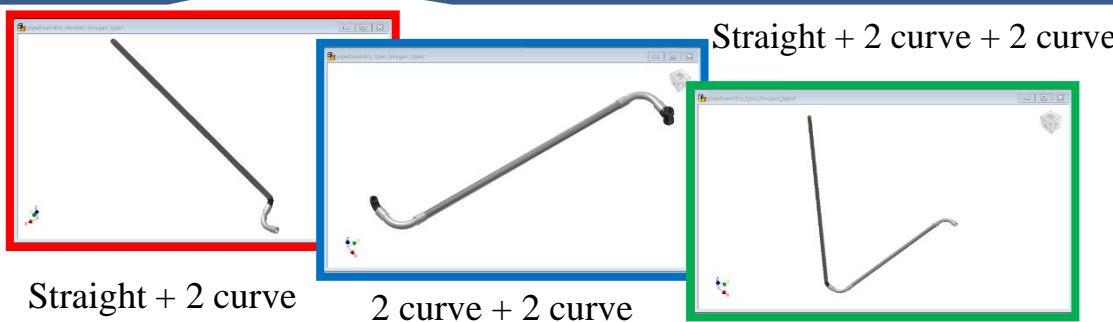
Current Accomplishments (1/2)



Logitech Extreme 3D Pro



- ◆ Pipeline inspection robot design simulator
- ◆ Viewpoint located on the tip
- ◆ Evaluation by scenario base
- ◆ Recreation of the pipe at JIS
- ◆ 25 A 8 curved pipe + 50 A pipe siphon



Construction of intuitive operability evaluation method

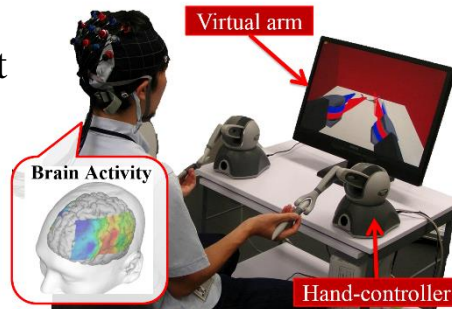
Manipulation (Viewpoint fixed)

Assumed robot

- ◆ Debris removal robot
- ◆ Drone with arms

Outcome

- ◆ **Intuitive hand-eye coordination**
- ◆ Acceptable error of tips posture between master-slave



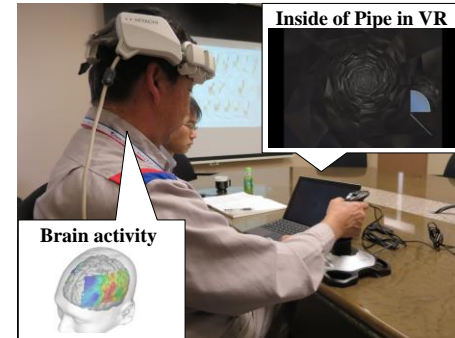
Locomotion (Viewpoint located robot)

Assumed robot

- ◆ Pipe checking robot
- ◆ Drone

Outcome

- ◆ **Controlling robot gains speed as the human walks**
- ◆ Clarification of the stress of operation by brain activation



Development device and systems

Console

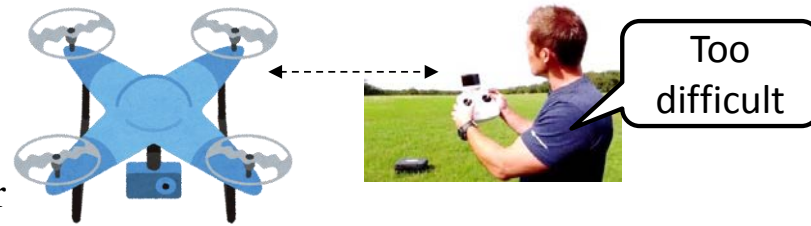
- ◆ Pitch, yaw and roll rotation of tip
- ◆ Movement of back and forth
- ◆ Utilization of **wrist range of movement**
- ◆ Force feedback by spring

Navigation

- ◆ Presentation of navigation in the monitor as **immersive reality** of operators
- ◆ Improvement of visibility as correspondence between controller and robot tip

◆ Sale of the Interface for operation

- Applicable of locomotion robots
 - ✓ Drone, submersible, pipe inspection, crawler
- Contribution
 - ✓ Promotion of robots by increasing the number of operators



◆ Operation form in society

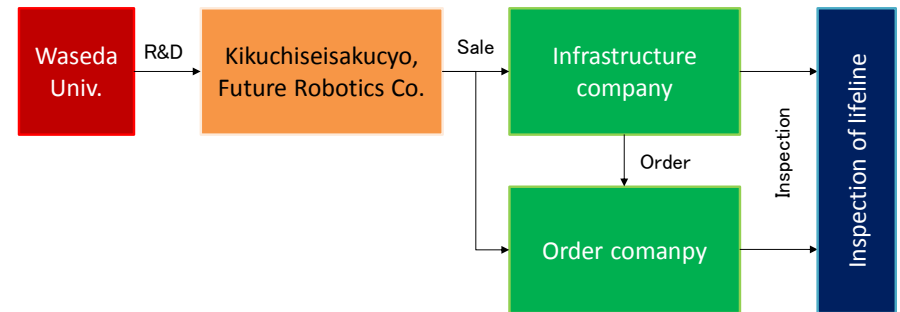
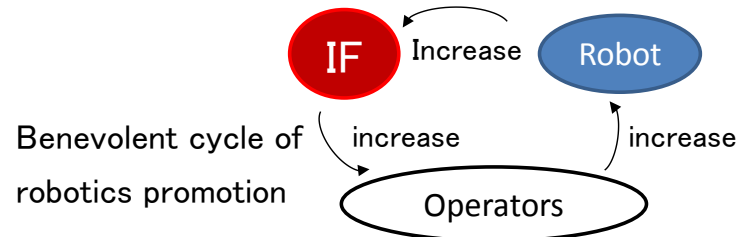
- User
 - ✓ Inspector of bridges, pipes, etc.
 - ✓ Operator of crawler robot

➤ Location

- ✓ Bridge, pipe, debris workspace

➤ Business

- ✓ Sale from Future Robotics Co. and Kikuchiseisakusyo
- ✓ Purchase of infrastructure company and order company



SIP	Sale	User
◆ Getting patent	◆ Making manufacturing line	◆ Integration of the interface and robots
◆ Construction of technology and outcome	◆ Sale	◆ Promotion of robotics installation
◆ Validation of evidence	◆ Making of special order item	➤ Increase of the operators
	◆ Maintenance	◆ Inspection of lifeline