Experimental Development of the Mobile Vestibular Platform

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Parallel Cable Robotics

- Modular design: actuators, cables, end-effector
- Movement through parallel operation of actuators
- Precise mobility within a predetermined 3-D space (feasible workspace)
- Versatility in accommodating a variety of tasks
Virtual Image

Cable Mount Locations (ex. Ceiling Panels)

Spool

DC Motor

Mobile Platform

26 Gauge Cable
Viable Present/Future Applications

- Short distance transport of hazardous materials
- Environmental monitoring of uninhabitable, remote, or hostile locations
- Safe mine detection over small predetermined regions
- External surveillance of space craft or stations
Contemporary Models

- **Skycam**: Video camera mounted robot
  - High speed mobility
  - Broadcast quality video use
  - Easily installed on pre-existing structures

- **RoboCrane**: Industrial quality robot
  - Designed by NIST
  - Manipulating of heavy and fragile loads
  - Precision in performing tasks
Cable Robot Design Layout

- **Overall Qualities:**
  - Light-weight
  - Low cost
  - Sensor-oriented functionality

- **Mechanical Aspects:**
  - Suspension by three 26 gauge cables
  - Actuators controlling operation of cable spools on platform
  - Two-tiered platform (end-effector) structure
In the Beginning ...

Components:

- **3** - LM629N-6 Precision Motor Controller IC
- **2** - LMD 18201T P+ H-Bridge DC Motor Driver IC
- **4** - Technological Arts Adapt11C24DX Microcontroller board with Motorola M68HC11 Microcontroller with 32K EEPROM
- **1** - Maxon DC Motor with Optical Quad. Amplitude Encoder Feedback
System Module Flowchart

M68HC11 on Adapt11C24DX

LM629N-6 DC Motor Driver IC

LMD 18201T P+ H-Bridge

Serial Comm

Optical Encoder Feedback

Matlab Program
Stationary PC

Maxon DC Motor /w Optical Encoder Feedback

PWM Signal
Matlab Control Center

- Serial communication with microcontroller board on mobile platform
  - Remote terminal control of platform operation
  - Simplification of microcontroller operation
  - User-friendly GUI
Moving Toward Lighter Weight

Printed Circuit Board Design

Advantages:
- Compact arrangement: 3.6’ x 3.9’
- Reduction in ‘loose’ wires during operation
- Very light weight and reproducible

Disadvantages:
- Electro-magnetic Interference
- Close proximity of lines
- Unintended loops and induction
Completed Mobile Platform
Foreseeable Obstacles/Problems

- Stretching of suspension cables under varying loads
- On board power supplies are easily exhaustible and produce excess load
Future Work/Improvements

- IR remote control for manual adjustments
- Implementation of a range of sensory equipment
- More detailed analysis of capabilities of the mobile platform (ex. feasible workspace)
- Implementation of a network of mobile platforms