

Distributed 3-D Mobile Sensor Network

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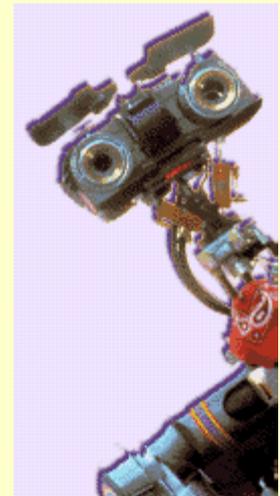
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Introduction

- Biological Organisms make use of multiple viewpoints in sensing to accurately perceive the environment



- Most artificial sensory systems, however
 - uses static arrangement of multiple sensors
 - move by wheels
 - move in only two dimensions

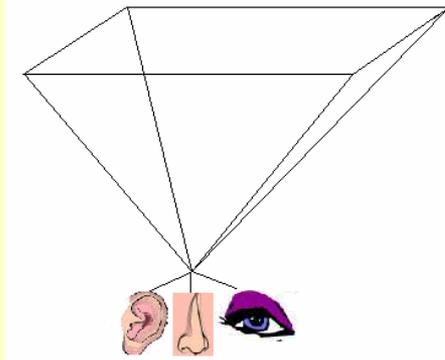


Purposes

- Animal monitoring
 - not to disturb animal while directly monitoring its movement and activities
- Surveillance
 - can be used with new homeland security bill in airports and other large public enclosures
- TV and Film
- Public Speaking

How Can We Fix This?

- Build a distributed sensor network
 - allow accurate positioning of sensors in three dimensions
- System will consist of small, modular sensors and actuating components
 - allow active mobility of visual, audio and olfactory sensors in three dimensions



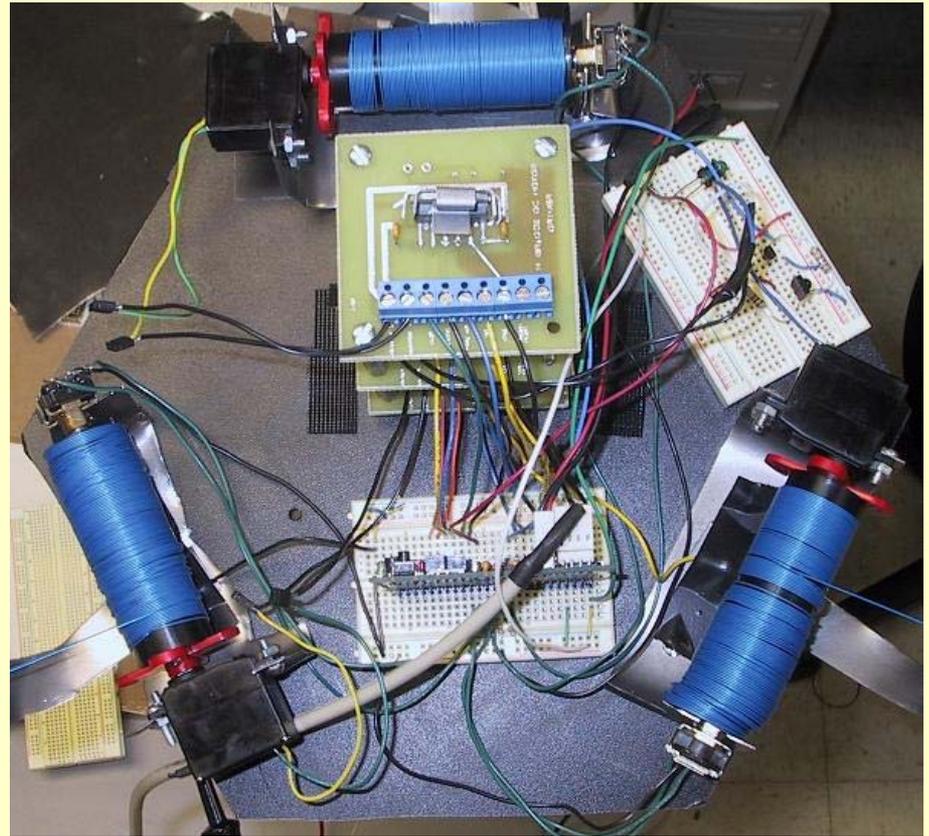
Method of Solutions

A Little More Detail

- Sensor modules connected to a number of thin cables
 - provide 3-dimensional mechanical support
 - distribute power and networking connectivity
- Using control software, small actuators will wind or unwind connected cables
 - 3-dimensional positions of suspended sensors can be quickly and freely adjusted

Hardware

- System integrates motors on sensor node for adaptability
- DC motor control
 - Provides more precise speed control than previous system using servo motors
 - H-bridges used to control DC motors



Hardware Continued

- 28-gauge wire used as network cables to attach sensor node to ceiling
- Encoders monitor length of network cables for accurate positioning



- Voltage across network cables charges on board battery, which is used to power system
- Infrared remote control functionality added to make system computer independent

System Set-Up and Control Software

- Three DC motors wind and unwind string holding platform
- Control software
 - runs on Motorola HC11 microcontroller
 - calculates ratio of motor speeds to one another based on current position and new position and sets motor speeds accordingly
 - encoders monitor change in length of string to give new (x,y,z) coordinates

Prototypes

- Two separate prototypes were built
 - First prototype had motors mounted on ceiling and moved weight



Prototypes Continued

- Second prototype has motors mounted on sensor node for adaptability



Summary and Discussion

- System needed to move freely in three dimensions
- Current technology is limited by being static or moving in two dimensions
- Proposed system will have sensor modules attached to motors that will wind and unwind string, moving the modules in three dimensions

Recommendations and Ideas for the Future

- Adaptable system too heavy for motors to move accurately
- Need better DC motors for more reliable performance
- Network multiple nodes together to develop large network of sensors

