A Mobile Robot Remote Control Method Based on Posture Recognition

Speaker: Ning Wang
Advisor: Prof. Ta-Te Lin

Department of Bio-Industrial Mechatronics Engineering
Bio-Photonics and Bio-Imaging Lab
National Taiwan University
2013.08.26
Outline

- Introduction
- System Architecture
- Proposed Methods
- DEMO
- Conclusions
Introduction

- **Study Purpose**
  - To accomplish posture-based control on mobile robots with three tools:
    - Kinect
    - Arduino
    - Processing Library
Introduction

- What are they?
  - Kinect
    - A motion sensing input device by Microsoft for the Xbox 360 video game console and Windows PCs.
    - The use of Kinect will enable us to acquire the 3D information of human, therefore can be applied for posture recognition.

Reference: upload.wikimedia.org/wikipedia/commons/6/67/Xbox-360-Kinect-Standalone.png
Introduction

- What are they?
  - Arduino
    - A single-board microcontroller used to control the move of mobile robot.
    - It consists of an 8-bit Atmel AVR microcontroller and an integrated development environment (IDE).

Reference:
Introduction

What are they?

Processing Library

- An open source programming language and IDE built for the electronic arts, new media art, and visual design communities.

- Processing is the key to enable the communication between Kinect and Arduino.

Reference:
System Architecture

Hardware:

- Kinect
- Computer
- Arduino Uno Board
- Mobile Robot

Software:

- Processing
- Arduino IDE
System Architecture

Hardware on WALLE:

- Mobile Power Supply
- Ultrasonic Ranging Module
- PWM Motor Driver
- Arduino UNO Board
- Servo
- Bluetooth Module
System Flow Chart

Start

Depth Image Acquisition

Has “Wave” been recognized?

Yes

Listening Mode

Yes

Mode Switch

Kinect-control Mode

End

No

No
Proposed Methods

- Gesture Recognition
  - Use gesture recognition to initialize control process.

- Posture Recognition
  - Use posture recognition to control the behavior of mobile robot.
    - Apply position information to switch mode or move straight.
    - Apply circle detection to turn the robot.

- How to move and turn
  - Two motors and differential drive.

- How to avoid obstacle and keep moving
  - Modify direction depend on ranging data.
Proposed Methods

- Gesture Recognition
  - WAVE to initialize control process

The hand has been detected, waiting for gesture commands.
Proposed Methods

- Posture Recognition
  - SWIPE to change control mode
    - Kinect-control mode
    - Obstacle-avoidance mode
Proposed Methods

- Posture Recognition

  Move Forward

  Move Backward

  Turn Right

  Turn Left
Proposed Methods

- **Obstacle-avoidance Strategy**
  - Flow chart of obstacle-avoidance:

```
Start
↓
Receive ranging datasets
↓
Is the distance from obstacle less than 25cm?

Yes
  ↓
  Is distance from leftside less than rightside?

Yes
  ↓
  Go straight

No
  ↓
  Turn right

Yes
  ↓
  Turn left

No
  ↓
  End
```
DEMO
Conclusions

- Gesture, posture recognitions and depth information were applied to achieve human-robot interaction.

- A mobile robot was implemented and integrated with
  - Arduino
  - Kinect (Processing Library)
  - Ultrasonic ranging sensor (obstacle avoidance)
  - Bluetooth device (for remote control).

- The robot worked well in a designed square field.
Future Works

- **Potential applications**
  - Human-Machine interaction
  - Easy, sensitive, cheap and funny remote control applications
  - The control method can be extended to real four-wheel vehicles

- **Things have to be improved**
  - More gestures to be included
  - Turn more naturally
  - Better performance of obstacle avoidance
  - Elegant control algorithms should be considered
Thanks for your attention