USING ROBOCOMP AND KINECT IN AUGMENTED REALITY APPLICATIONS

Leandro P. Serrano

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Augmented Reality

- What is the Augmented Reality?
- Advantages
- Tools
- Problems
- Proposed solution
- Future work
Augmented Reality – What is that?

Fusion between Real and Virtual Worlds
Augmented Reality – What is that?

Real World with extra information added

Real World

+ Extra information:
  - Measurements
  - Online connection
  - Search about the environment
  - Calculation for daily tasks
  - Merge people to profiles
  - Computer recognition

= Augmented Reality
Augmented Reality – Advantages

- Medical
- Hollidays / Tourism
- Relationships
- Security
- Physical disabled people
- Marketing
- Games
- Shopping
- Sports
- Educational
- Robotics
- Organization

Robocomp and Kinect – Augmented Reality
Augmented Reality – A real application

- Medical
- Games
- Physical disabled people
- Robotics
Training exercises for rehabilitation of disable children

Problem: Children don't follow the exercises

- Boring
- Painful
- Long in the time

Solution: Medical games with Augmented Reality
RoboComp and Kinect – Augmented Reality

URSUS – A friendly robot to play rehabilitation
RoboComp and Kinect – Augmented Reality

Whac-a-mole game for arm exercises

The exercises:

The game:
RoboComp and Kinect – Augmented Reality

What is necessary to develop this application?

– Tracking of patient's gestures
– A virtual and interactive world
– Linking the tracks to the virtual world
How can we get that tracking?

Currently there are several systems of real-time tracking, I tried with Camshift color tracking from OpenCV library.

Advantages:
- Faster
- Easy to implement
- Invisible interaction

Disadvantages:
- Just for 2D
- Light dependent
- Miss the object
RoboComp and Kinect – Augmented Reality

Improving the CamShift tracking

Using a distance filter:

- LASER
- Stereo Camera
- Kinect Sensor

Changing the color space:

- RGB
- HLS
Kinect Sensor

- Available since November 2010
- Runs on GNU/Linux and Windows
- Works with RGB camera and IR camera
- Easier to configure than stereo cameras
- Less precision than LASER but cheaper
- Open Source driver: OpenKinect (libfreenect)
RoboComp and Kinect – Augmented Reality

Kinect Sensor – How does it work?

IR Lamp

RGB Camera

IR Camera

Disparity Map

-
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Kinect Sensor – Shadows

We draw the complete image RGB: with and without Depth Info

Only image RGB

Image RGB + Depth

RGB Camera

IR Camera

Only Depth
Kinect Sensor – Shadows
Kinect Sensor – Cartesian or Spherical coordinates

This line has the same DEPTH.

This line has the same Z.
Kinect Sensor – Calibration

With RGBDemo (Nicolas Burrus)
RoboComp and Kinect – Augmented Reality

kinectComp – One Kinect to rule them all

kinectComp

Network

moleComp

mycomponentComp

mycomponentComp
RoboComp and Kinect – Augmented Reality

RoboComp – Easy components connected

RoboComp is a frame to develop software components for robotics, similar to Carmen, ROS or Orca2

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RoboComp and Kinect – Augmented Reality

RoboComp – Easy components connected

RoboComp is easily installed with script
You can create new components with proxies, QT GUI and let others components connect with yours
RoboComp – Easy components connected

RoboComp is available in SourceForge:
– Subversion repository
– Wiki and forum for help
– Bug tracker with Mantis

RoboComp provides you easies to developing:
– The API is available online and is weekly generated
– All components is based in autogenerated CMake
– It add for you other repositories and environment paths
RoboComp and Kinect – Augmented Reality

RoboComp – Easy components connected

RoboComp lets you developing without devices
RoboComp and Kinect – Augmented Reality

RoboComp – Easy components connected

And you can manage components by GUI
CamShift tracking improves with the Kinect filter by distance and with the HLS color space, but is not enough for the application.
ARToolKit – One alternative to CamShift

ARToolKit is an open source library for tracking based in markers and oriented to Augmented Reality applications.

**Advantages:**
- No light dependent
- Easy to implement
- 3D tracking with single camera
- Multiple markers and multimarkers
- It can find the object after having lost it

**Disadvantages:**
- Marker is invasive
- Marker reflection
- Miss the object
OpenSceneGraph – Creating the Virtual World

OSG is a Scene Graph built over OpenGL and let you create 3D environments based on a hierarchical tree of nodes, this nodes are controlled by matrices transform.
RoboComp and Kinect – Augmented Reality

RoboComp + ARToolKit + OSG + Single Camera

Features:

– The game is funny for children

– Adaptable for exercises by doctor

– We can connect to others components
Future Work – Replace ARToolKit

We need other tracking system less invasive but almost the same speed, recovery and working conditions than ARToolKit.

Now CamShift and Kinect is similar but no enough.

OpenTLD (Predator Algorithm) looks to work good but it depend on Matlab now, although it is porting to C++.
Thank you for your attention

I'll be glad to answer any questions