Augmented Reality Training System for Close Quarters Combat

SNL Team

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000.

What Problem Are We Trying To Solve?

Sandia's Protective Force is responsible for protecting a diverse set of lab resources

- **Urban terrain, highly dynamic**
- **Remote areas**
- **Classified areas**

And they need to train for all of them!

Cost Mitigation

Safety Enhancement

No live fire exercises in Classified/Sensitive areas

Training in the Area 5 Reactor…..? Not with real guns.

Solution: ***use unreal guns, bullets and bad guys***

Definition of Augmented Reality

A combination of virtual objects and a real physical environment that presents both to a user in a seamless and convincing way

- **User can move around in space**
- **Augmentation must occur in real-time**

Turn this into -

This…

Some Applications of AR

- **Training – train with virtual people and things in real environments**
- **Collaboration – a number of people can see the same world and interact with it**
- **Medical – can see the patient along with sensor data (CAT,MRI) for that patient**
- **Navigation – can see real world and special info (like targets when flying a jet)**
- **Entertainment – can see virtual objects but still play part of game in the real world**

ARTS Hardware – wearable AR

Helmet

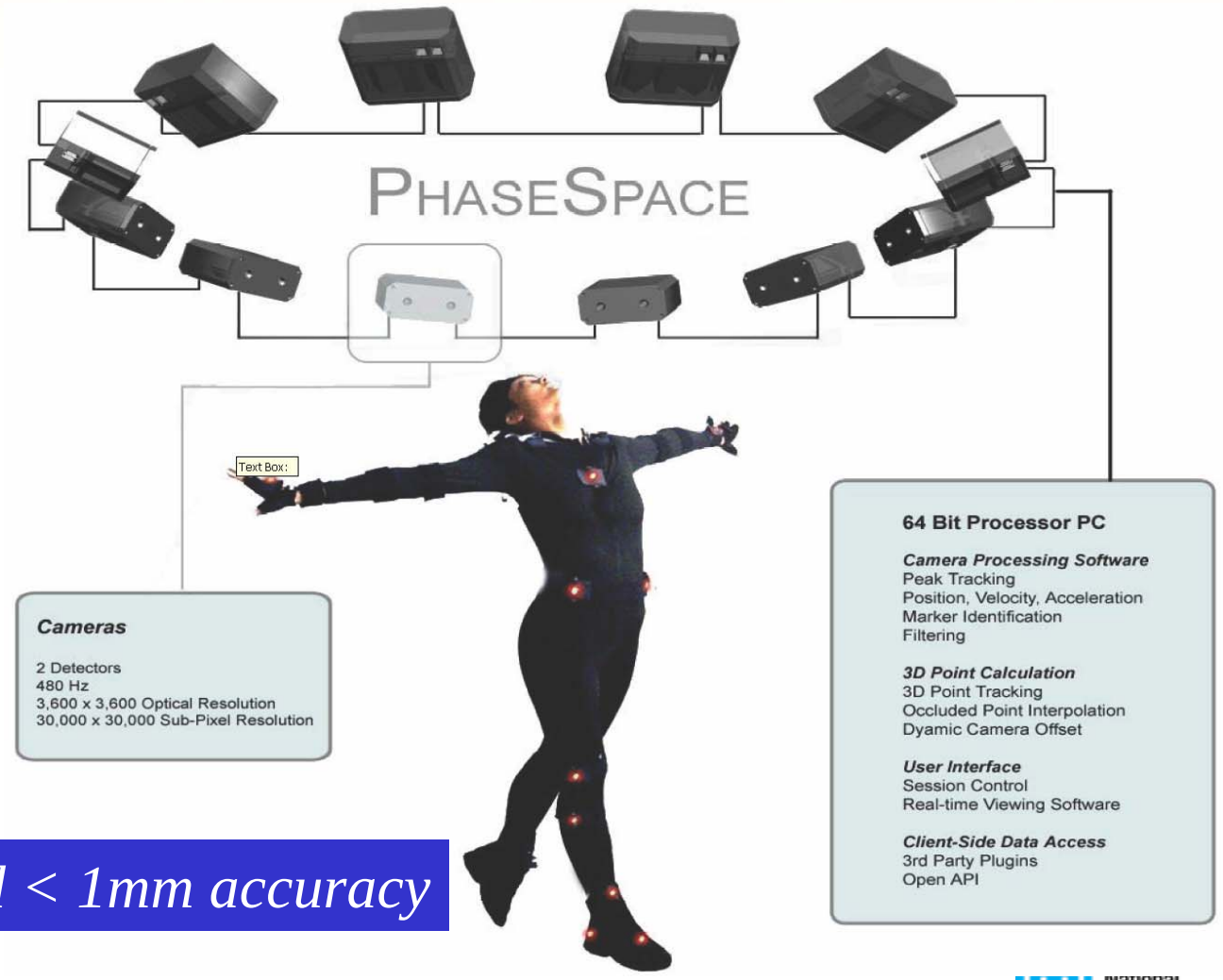
- Tracking LED's
- Camera
- HMD

Lightweight Backpack w/ Laptop

Tracked Weapon System – M4

ARTS Hardware
Precision 3D Motion Tracking

The PhaseSpace tracker is based on pulsed LED's and multi-view high-resolution linear camera arrays, operates at a high frame-rate (480hz), and has low latency characteristics.



480hz update rate and < 1mm accuracy

ARTS Project History

- **FY04 – generate prototype hardware using Intersense IS1200 – single shooter, multiple adversaries**
  - **Investigate Prototype Hardware**
  - **$300k – DOE / NNSA**
  - **$250k – DOD / TSWG**
- **FY05 – 2-person teams, move to PhaseSpace tracker**
  - **Initial multiplayer capability**
  - **$300k – DOE / NNSA**
  - **$300k – DOD / TSWG**
- **FY06 – Formal HSB study to evaluate appropriateness of the approach, comfort, efficacy**
  - **MultiPlayer Beta Test with DOE National Training Ctr.**
  - **$250k – DOE / NNSA**
  - **$250k – DOD / TSWG**

Evaluations by DOE ProForce, New Mexico State Police SWAT, Albuquerque Police Dept., DTRA & AirForce SOCOM

- **Planned for FY07 – Field Testing, develop new capabilities for Law Enforcement, DOD & other DOE applications**
  - **Field Test at DOE Nevada Test Site**
  - **Field Test at DOE National Training Ctr.**
  - **Evaluate AR Trainer for Local Law Enforcement**
  - **$900k – DOE / NNSA**
  - **$100k – DOJ / NIJ**

AR-Training Complements a Wide Spectrum of Training Technologies

Level of Realism

Live Fire Shoot House

•Real Guns & Simunition
•Paper targets or real people using dye-marking cartridges
•Exercises shooting, tactical movement and decision making skills.

AR Training System

•3D-Immersive Training
•3D Avatar moving targets
•Exercises tactical movement and decision making skills

F.A.T.S. / PRISM

•2D ProjectiveTraining Systems
•3D Avatar moving targets
Exercises tactical movement and decision making skills

National Nuclear Security Administration

Sandia National Laboratories

Training Scenario

- Trainees walks into a room and observe bad guys doing obvious harm to critical infrastructure
  - Possible variations include “good-guys” or bystanders
- Unobserved bad guy engages from a hidden venue
- Bad guys can come from around corners, behind occluding obstacles, etc.
- Trainees aim and fires weapon at bad guys, disabling and killing them

Videos

First Person View

Take Down

Videos

First Person View

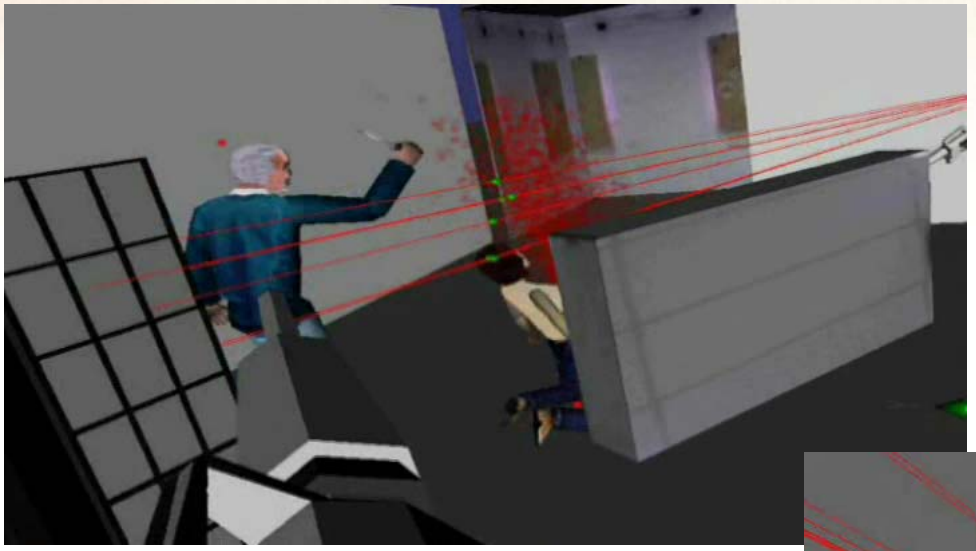
Move & Shoot

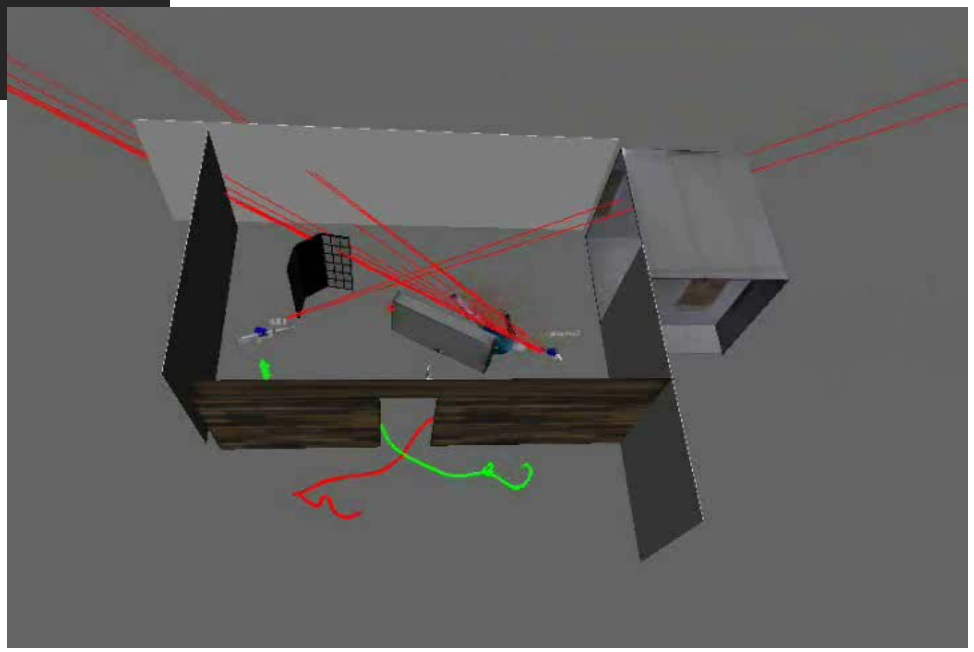
Videos

First Person View

Move Shoot with a FlashBang

Videos





After-Action Review & Analysis

Thanks For Your Attention

Any Questions?

Backups

Unique & Differentiating Aspects

- **Other similar systems require installed hardware infrastructure**
  - **All that is needed to run the system in a new environment is to survey in paper targets on the ceiling**
  - **IS1200 tracker is worn by the user, and is therefore portable.**
- **System can be set up in a sensitive/secure facility with no additional infrastructure (just paper targets).**

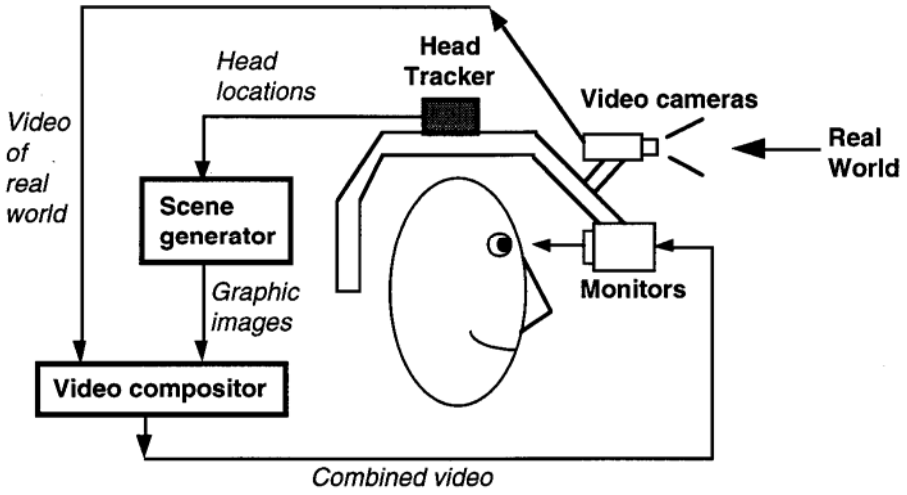
Definition of Augmented Reality

- **Need to register (align) real and virtual objects with each other for the proper effect**
  - **Requirement – Real-Time 6DOF tracking**
- **User can see and work in the physical world, but also see the virtual world superimposed on it**
- **User is not separated from physical world as in virtual reality (different set of applications)**

Augmented Reality Training System

Project Goals:

•Use Video See-Thru AR to allow the Protective Force to train against virtual enemies in real-world DOE environments, indoor & outdoor.



•Enhance the paper target shoothouse that is used today for decision support training.

•Develop a tool that can be used complex-wide in DOE & potentially transferred out to other agencies & arms of the government.