# Augmented Reality: Technology & Applications

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- **aug·ment·ed** /ôg'mentid/ Adjective
  1. Having been made greater in size or value:
- **re·al·i·ty** /rē'alətē/ Noun
  1. The world or the state of things as they actually exist

# What is Augmented Reality?
## A Picture is worth a 1000 words..!


Figure: Wikitude drive, an Augmented Reality Navigation system for smart phones.

# Overview of Session

- Introduction
- Hardware
- Software & Algorithms
- A Sample Algorithm
- Applications
- Conclusion

# Formal Description

*Augmented reality (AR) is a term for a live direct or an indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data.*

- Artificial information about the environment and its objects can be overlaid on the real world.
- Enhances ones current perception of reality.
- By contrast, virtual reality replaces the real world with a simulated one.

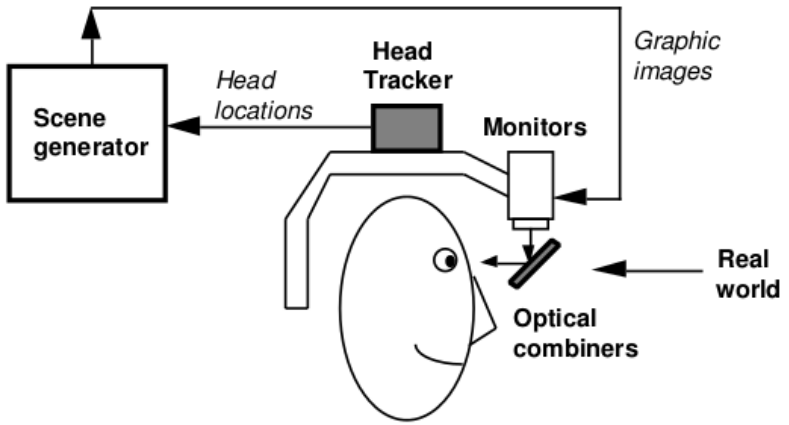
# Hardware

- Processor, camera, display & sensors such as accelerometer, GPS, solid state compass.

- Display
  - HMD
  - Handheld
  - Spatial
- Tracking
- Input Devices

## Head Mounted Display(HMD)

- Places AR over the user's view of the world.
- Either optical seethrough or video seethrough.
- Optical see-through employs half-silver mirrors.
- Increased immersive experience.



## Handheld Devices

- A small display in user's hand.
- Apt for portability and video see-through.
- Disadvantage is that in most cases user has to hold the device out in front of them.

# Display Techniques

**Spatial Augmented Reality**

- Uses digital projectors to display graphical information on physical objects.
- The tangible nature of SAR provides the passive haptic sensation.
- The user is not required to carry equipment or wear the display over their eyes.
- This makes it a perfect candidate for collaboration.
- MIT-ian Pranav Mistry's Sixth sense is all about SAR.

# Pranav Mistry Sixth Sense


Figure: Pranav Mistry, Sixth Sense Technology

# Tracking

- Tracking is following.
- May use: Digital cameras, accelerometers, GPS, gyroscopes, compasses, RFID, wireless sensors.
- The users can interact with the system using Pinch gloves.
- In Sixth sense the finger caps is basically pinch gloves.

# Dream come true..!

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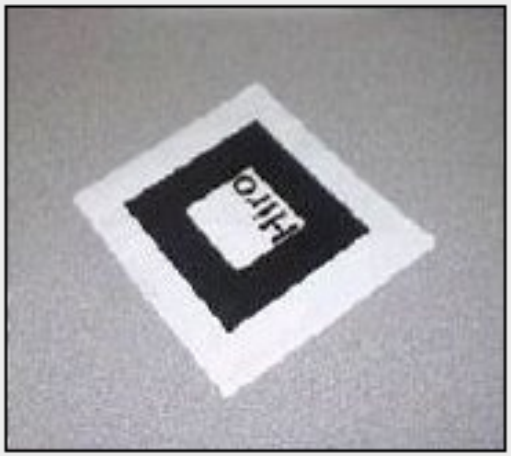
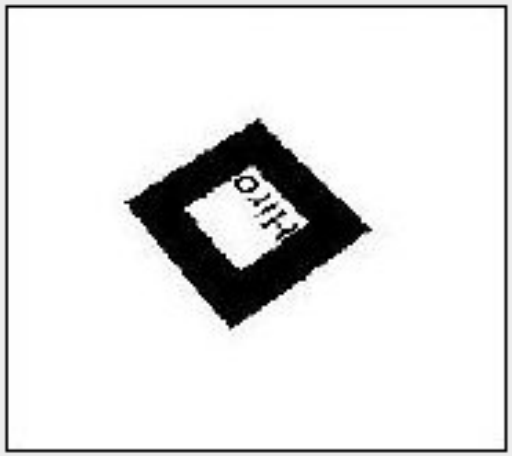
# How stuff works? - Overview

1. Capture video of the real world.
2. Search through each video frame for markers/target object.
3. Calculate the position of the camera relative to the marker.
4. Draw a computer graphics model from that position.
5. Model is drawn on top of the video of the real world and so appears stuck on the marker.
6. The final output is shown back in the display.

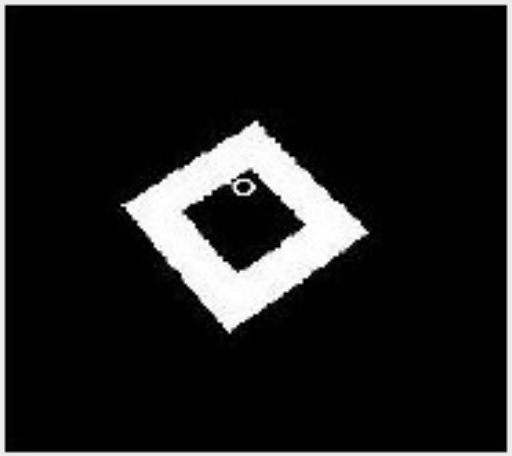
# Sample Algorithm



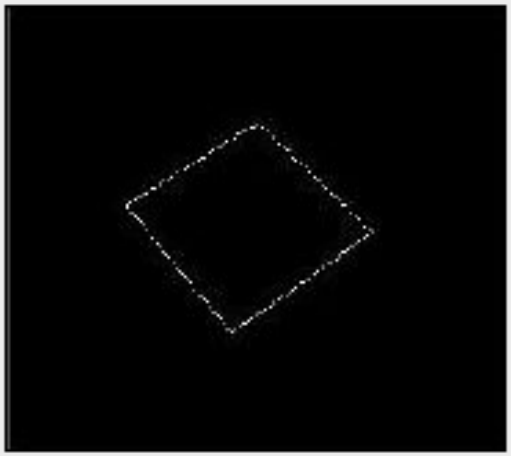

a. Original image



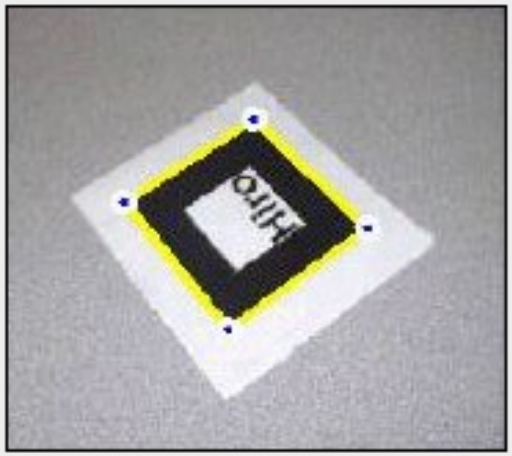

b. Thresholded image



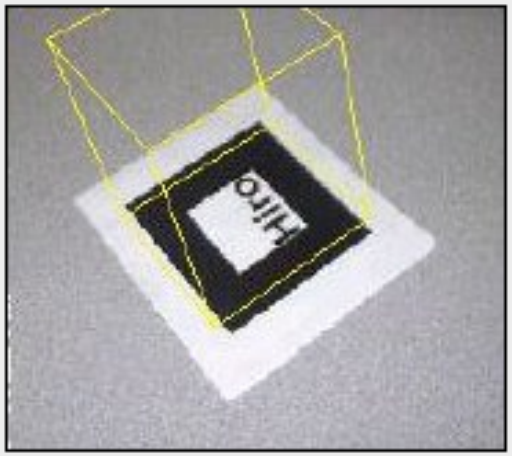
c. Connected components



d. Contours

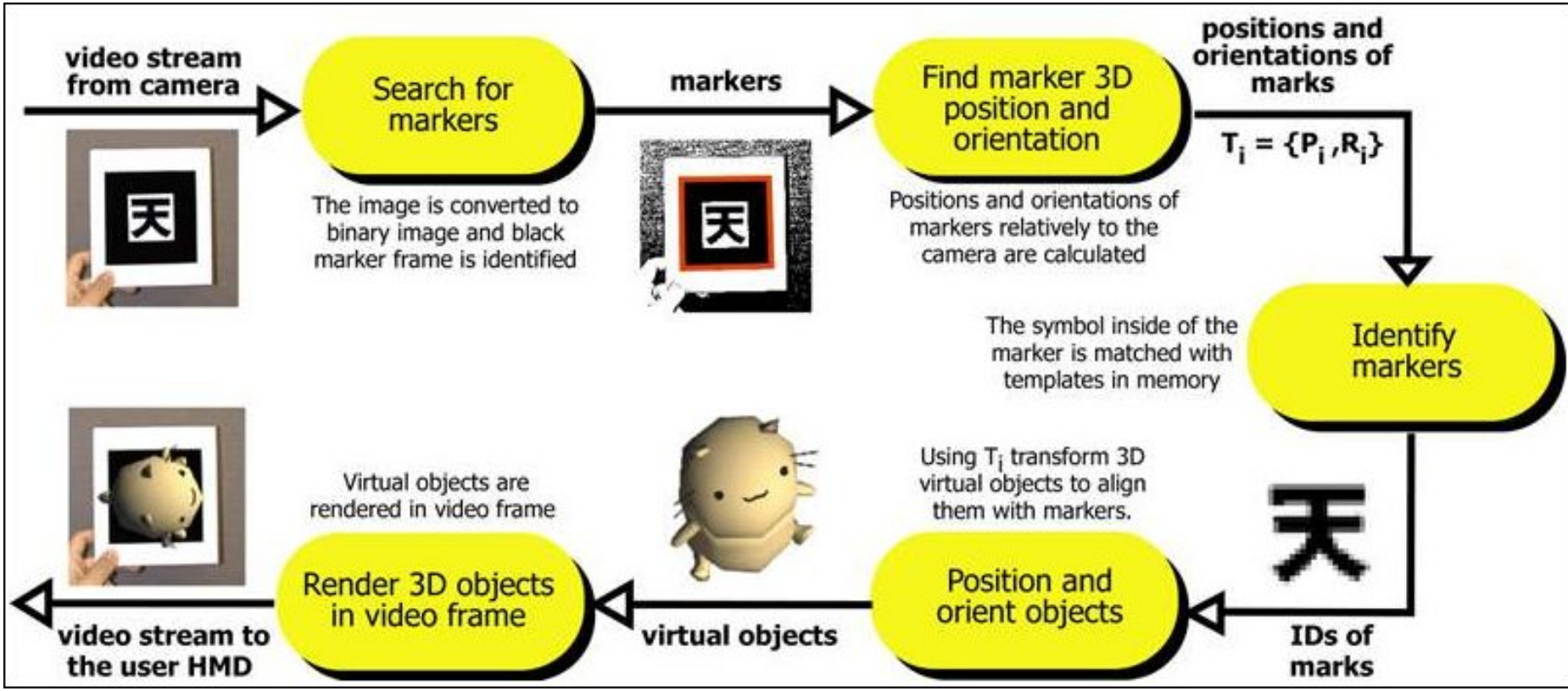



e. Extracted marker edges and corners




f. Fitted square

# Sample Algorithm Contd.



# Software Toolkits

- **ARToolKit**, an open source (dual-license: GPL, commercial) C-library to create augmented reality applications; was ported to many different languages and platforms like Android, Flash or Silverlight.
- **ArUco**, a minimal library for augmented reality applications based on OpenCv; licenses: BSD, Linux, Windows mixare, Open-source (GPLv3) augmented reality engine for Android and iPhone.
- **OpenMAR**, Open Mobile Augmented Reality component framework for the Symbian platform, released under EPL

# Applications

# Applications

- **Advertising**
- **Task support** - Surgery, Underground pipe layout, see the fetus inside the womb..!
- **Navigation**
- **Industrial** - simulate models, reduce real time prototypes.
- **Military and emergency services** - provide info such as maps, enemy locations, etc.
- **Architecture** - simulate planned construction projects.
- **Entertainment and education** - virtual objects, immersive ambience, deepen the level of perception.

# AR in Hollywood!

# Future

*Augmented reality has the potential to change the way we see the world in future.*

A Wearable Computer array, this particular array uses a CPU, GPS, HMD, graphics renderer, and human-interface-device

=>

# Conclusion

- Has the potential
- Undergoing active development.
- Open libraries like ARToolKit.
- Yet to witness applications that are so cool AND convenient.

# References


- ARToolKit - *http://www.hitl.washington.edu/artoolkit/*
- Wikipedia.org - *http://www.wikipedia.org/*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