

# Human Computer Interface(HCI)



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# Outline

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# Introduction



## Human

- The end-user
- The members of an organization

## Computer

- Hardware
- Software

## Interface

- A point where two objects meet.
- A point where the human can tell the computer what to do.
- A point where the computer displays the requested information.

# What is HCI?



- A process of information transfer
  - User to Machine
  - Machine to User
- HCI is also referred to as Man Machine Interaction.
- HCI is what the user sees and includes:
  - The physical controls
  - What the system looks like?
  - How the system accepts input from the user?
  - How the system responds to user input?
  - How the system outputs the results of processing?

# Types of Interfaces



- **Command Line Interface (CLI)**

A CLI displays a prompt, the user types a command on the keyboard, the computer executes the command and provides textual output.

- **Menu Driven Interface**

The user has a list of items to choose from, and can make selections by highlighting one.

- **Graphical User Interface (GUI)**

Uses windows, icons, menus and pointers (WIMP) which can be manipulated by a mouse (and often to an extent by a keyboard as well).

- **Natural Language Interface**

Can range from simple command systems to voice activated text processing. Commands are spoken in “normal” language.

# Existing Technologies

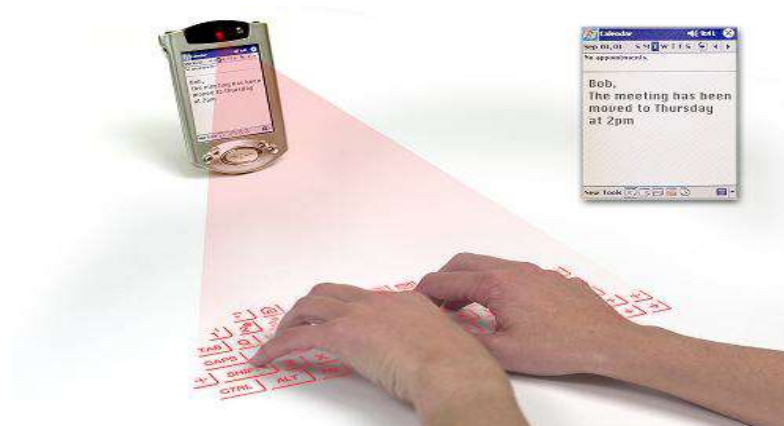


- The existing interfaces differ in the degree of complexity both because of degree of functionality or usability.
- The user activity has three different levels:
  - Physical
  - Cognitive
  - Affective
- The existing physical technologies for HCI basically can be categorized by human senses.
- These devices are basically relying on three human senses: vision, audio, and touch.

# Advances in HCI



- The new advances in HCI can be categorized in 3 sections: wearable devices, wireless devices, and virtual devices
- Examples:
  - GPS Navigation Systems
  - Military super-soldier enhancing devices
  - PDA
  - Canesta Keyboard(QWERTY pattern)



# Contd..



- Recent advances of research in HCI are in these areas:
  - Intelligent and Adaptive interfaces
  - Ubiquitous computing(UbiComp)
- These interfaces involve different levels of user activity: physical, cognitive, and affective.
- **Intelligent and Adaptive Interface:**
  - Intelligent HCI designs are interfaces that incorporate at least some kind of intelligence in perception from and/or response to users.

Ex: Speech enabled interfaces that use natural language to interact with users and devices



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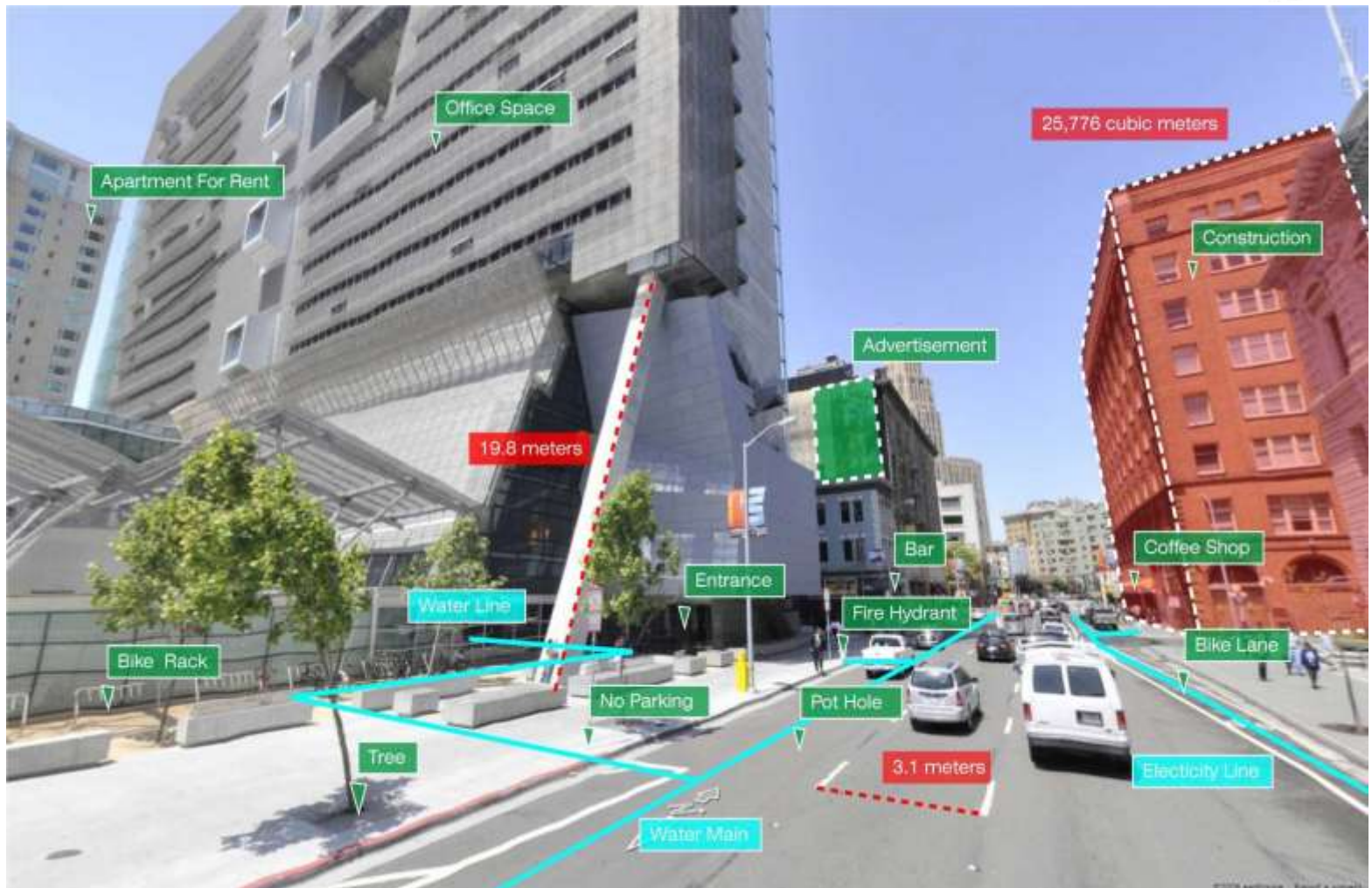


- Adaptive HCI designs, on the other hand, may not use intelligence in the creation of interface but use it to interact with users.

Ex: A website using regular GUI for selling various products

- Intelligent and adaptive interfaces are active interfaces
- Non-Intelligent interfaces are passive in nature
- Tablet PC is an example that uses both intelligent and adaptive interfaces and it has handwriting recognition ability.
- **Ubiquitous Computing:**
  - The idea of ubiquitous computing was to embed computers everywhere in the environment and everyday objects so that people could interact with many computers

# Contd..





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# Architecture



- Architecture of any HCI systems is identified by:
  - Number of inputs and outputs in the system
  - Diversity of inputs and outputs in terms of modality
  - Workings of these diverse input and output for interaction purpose
- Based on different configuration and design of interface, HCI systems can be divided into:
  - Unimodal HCI system
  - Multimodal HCI system



# Unimodal HCI System



- An interface mainly relies on number and diversity of its inputs and outputs which are communication channels that enable users to interact with computer via this interface.
- A system that is based on only one modality is called *unimodal*.
- Based on the nature of different modalities, they can be divided into three categories:
  - Audio-Based
  - Sensor-Based
  - Visual-Based

# Audio Based HCI



- It deals with information acquired by different audio signals.
- The information gathered from audio signals can be more trustable, helpful and in some cases unique providers of information.
- Key components:
  - Microphone  
  - ASR(automated speech recognition) and NLU(natural language understanding) software
- The main research areas of Audio based HCI are divided into:
  - Speech Recognition
  - Speaker Recognition
  - Auditory Emotion Analysis
  - Human-Made Noise/Sign Detections
  - Musical Interaction



# Sensor Based HCI



- It has the wide range of applications in our day-to-day life.
- The common feature in every application is that at least one physical sensor is used between machine and human to provide interaction.
- Some of the sensors range from being very sophisticated to primitive :
  - Pen-Based Interaction
  - Motion Tracking Sensors/Digitizers
  - Haptic Sensors
  - Pressure Sensors
  - Keyboard, Mouse, Joysticks



# Visual Based HCI



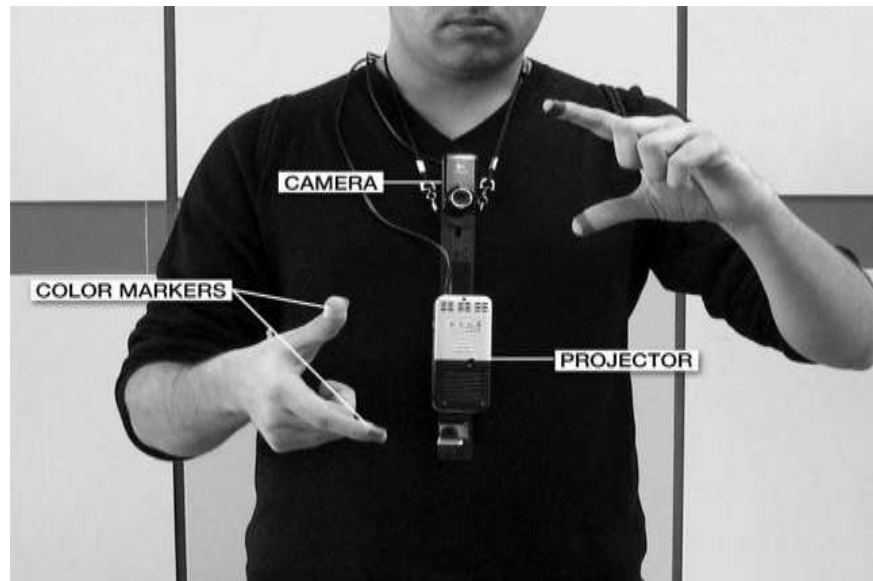
- It is also called as machine vision which is the observation of an environment using cameras.
- In this, different aspects of human responses can be recognised visual signals.
- Detection, identification and tracking of a real life entity and its translation into meaningful machine/computer input.
- The main research areas of visual based HCI are:
  - Facial Expression Analysis
  - Body Movement tracking and Gesture recognition
  - Gaze Detection
- Sixth Sense is one of the Visual based HCI technologies which is a wearable “Gesture Based” device.



# Sixth Sense



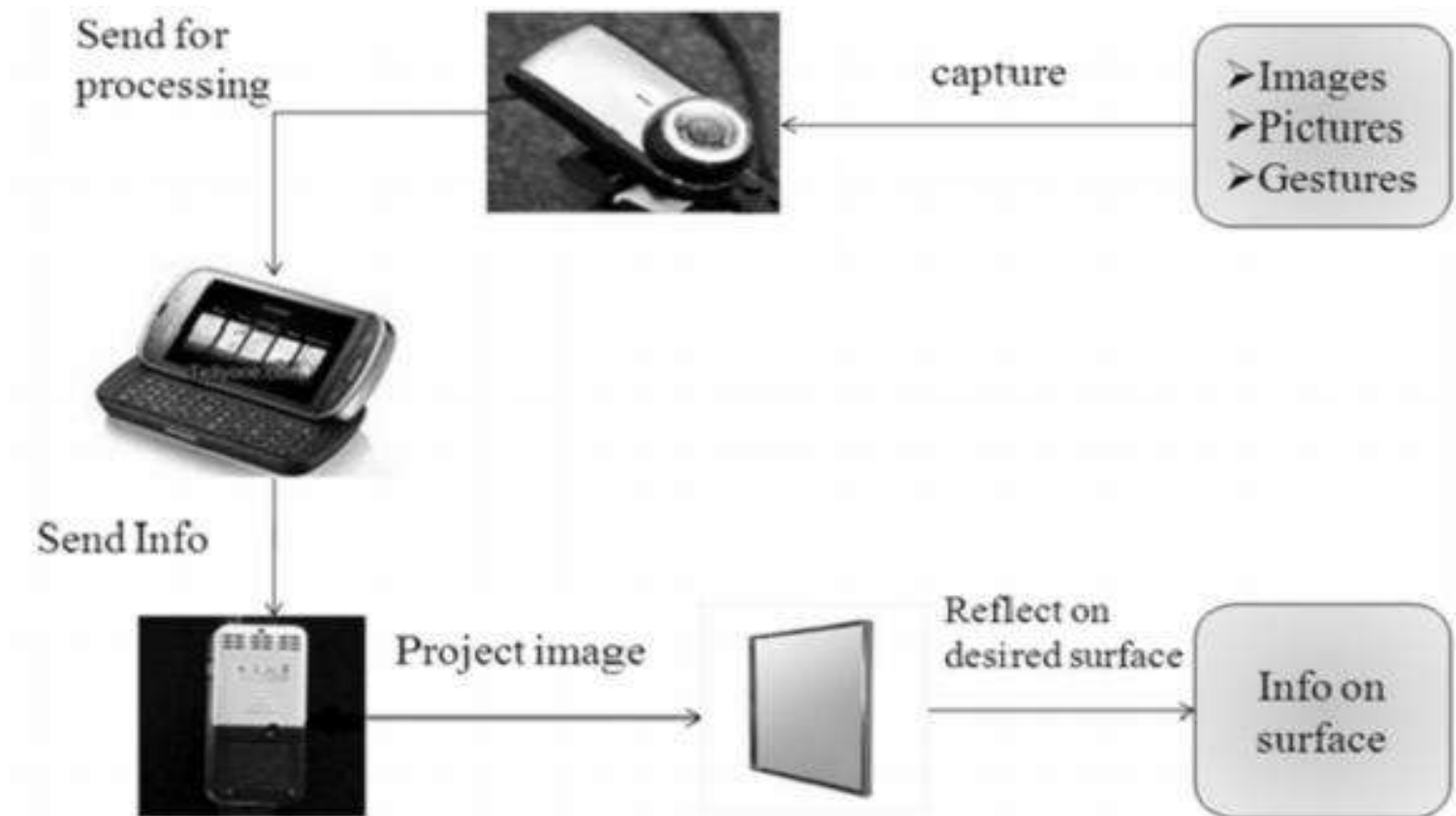
- A small projector-a pendant prototype to be worn around the neck
- Connected to the mobile computing device in the user's pocket
- **Components:** Camera, Projector, Mirror, Mobile Component, Colour Markers



# Sixth Sense



## Working:



# Sixth Sense



- Application
  - Take pictures



# Limitations of Unimodal HCI



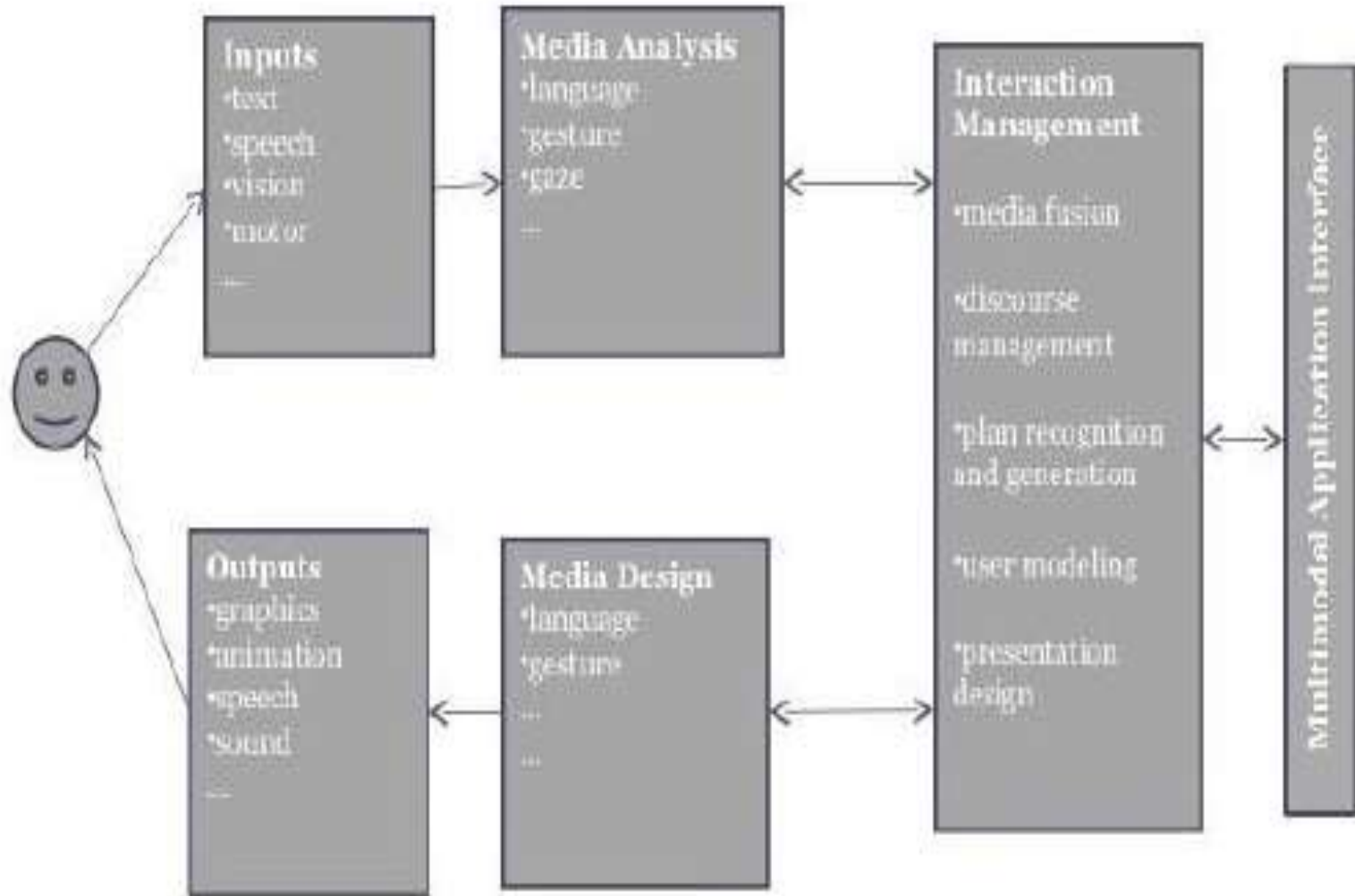
- Not a natural way of human interaction
- Usually designed for the ‘average’ user
- Fails to cater to the needs of a diverse category of people
- Difficult to use by disabled, illiterate and untrained people
- Cannot provide universal interface

# Multimodal HCI System



- Combination of multiple modalities, or usage of more than one independent channel signals for the interaction between a user and a machine is termed as multimodal human computer interaction system (MMHCI).
- A multimodal interface acts as a facilitator of human-computer interaction via two or more modes of input.
- It is easy to use by disabled, illiterate people.
- A classic example of a multimodal system is the “Put That There” demonstration system.

# Multimodal HCI System



# Bharati - A Multimodal Web Interface



- A internet user interface for both language and computer illiterate people: text, speech, icon

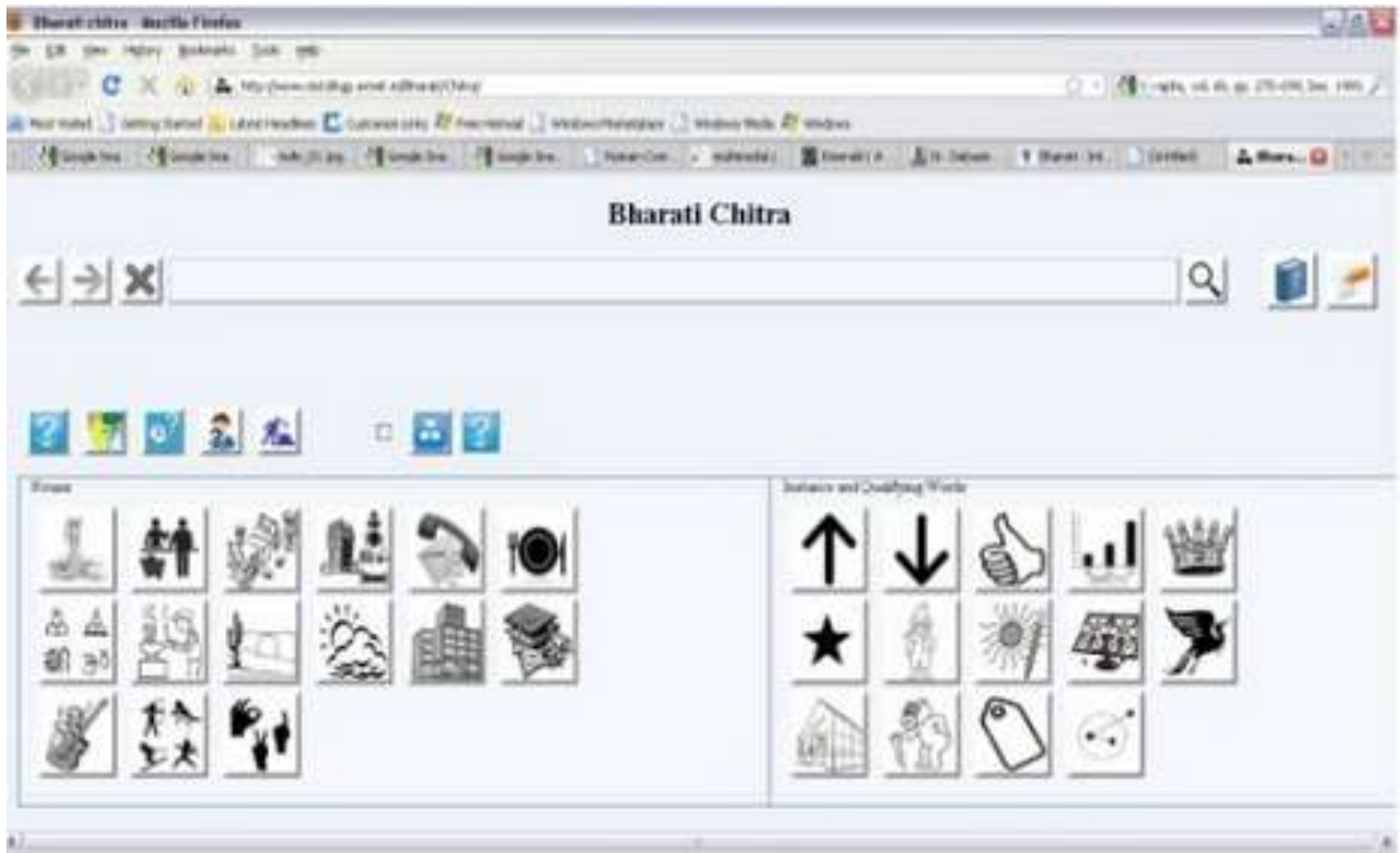




# Bharati Chitra



- Iconic module for the people unable to read/write in their mother tongue.





# Bharati Dhvani



- Speech based module for those who can speak but not reading/writing ability in their mother tongue.



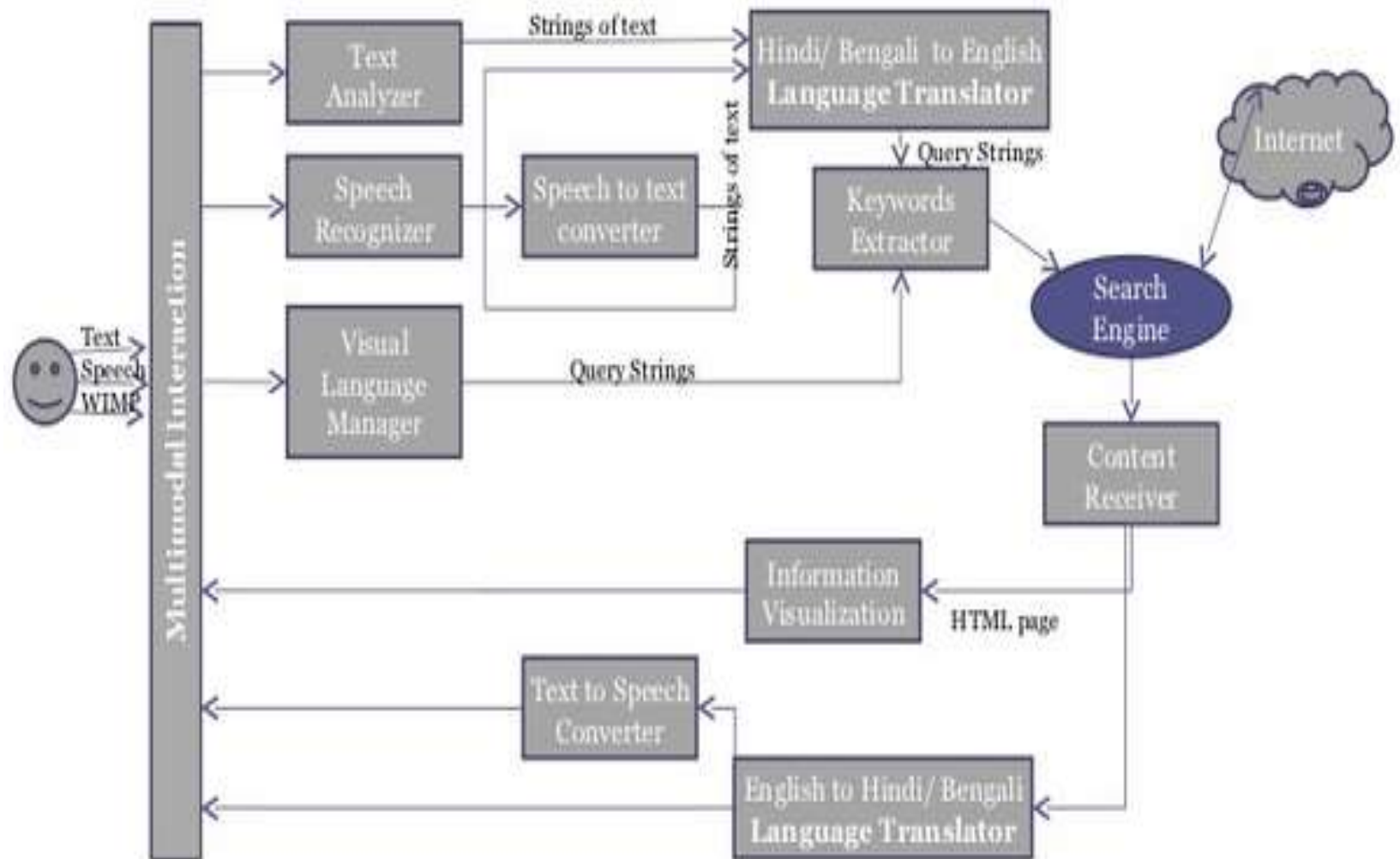
# Bharati Akshar



- Text based module for the user unable to use English.



# Multimodal Framework of Bharati



# Applications



- Intelligent Homes/Offices
- Driver Monitoring
- Intelligent Games
- E-Commerce
- Helping People with Disabilities

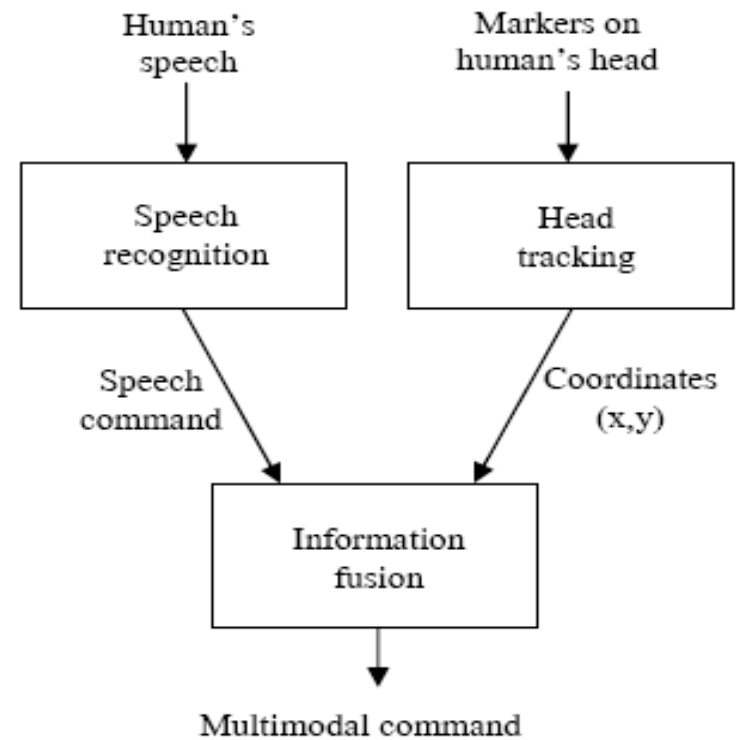
# Helping People with Disabilities



- A good application of multimodal systems is to address and assist disabled people.
- In this system users can interact with machine using voice and head movements.
- Two modalities are used and both are active continuously: speech and head movements.
- Speech provides the needed information about the meaning of the action that must be performed with an object selected by the cursor.
- The head position indicates the coordinates of the cursor on the screen at the current moment.



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# Command Line Interface



- **Advantages**

- Very flexible with the use of “switches” (options)
- Good for “expert” users - can quickly access commands
- Uses the fewest system resources

- **Disadvantages**

- Requires the user to learn “complex” commands or language
- “Hidden” features i.e. if the command is unknown we cannot make use of that feature
- Not very good for novice users

# Menu Driven Interface



- **Advantages**

- No need to learn complex commands/language
- Easier for a novice to learn/use
- Ideal when there are a limited number of options (efficient)

- **Disadvantages**

- Can be frustrating for experienced users i.e. the command they want to use is buried 5 levels deep.
- User interface may be limited by screen space and number of options available.



# Graphical User Interface



- **Advantages**

- Most suitable interface for inexperienced or novice users
- Many generic packages for a GUI will share common features

- **Disadvantages**

- GUIs use more system resources than other types of interface

# Natural Language Interface



- **Advantages**

- No training required
- Can be quicker than keyboard entry
- Hands-free
- Can be used by the disabled

- **Disadvantages**

- Emerging technology – still contains “bugs”
- Difficulty in dealing with homonyms
- Difficult to recognise all the different ways of saying things (and regional dialects)
- Artificial languages are often more precise

# Conclusion



- Quality of system depends on how it is represented and used by user
- Therefore, enormous amount of attention has been paid to better designs of HCI.
- Virtual reality can be the common interface in future
- UbiComp is trying to embed the technology in the environment and make it invisible at the same time.
- Natural and Neural Interfaces are the future of Human-Computer input interfaces

# References



- [http://en.wikipedia.org/wiki/Human\\_Computer\\_Interface](http://en.wikipedia.org/wiki/Human_Computer_Interface)
- <http://hci.stanford.edu/courses/cs547/>
- A. Chapanis, *Man Machine Engineering*, Wadsworth, Belmont
- [http://ijcsms.com/journals/Volume%2011,%20Issue%2002,%20Aug%202011\\_Paper25.pdf](http://ijcsms.com/journals/Volume%2011,%20Issue%2002,%20Aug%202011_Paper25.pdf)
- D. Te'eni, "Designs that fit: an overview of fit conceptualization in HCI", in P. Zhang and D. Galletta (eds), *Human-Computer Interaction and Management Information Systems: Foundations*, M.E. Sharpe, Armonk



**THANK YOU!!!**