

Design & Implementation of Human-Computer Interfaces

NPTEL-MOOCS

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Scope of the Course

- We're going to learn about “engineering interactive software”
- TWO key concepts
 - Interactive software – specifically “computer software that are interactive”
 - “Engineering” such software – how to design, develop and implement such software

Scope

- Let's start with understanding interactive systems and software
 - How those are different from other software!

Computers?

- What comes to our mind when we talk of “computer”

Computers?

- Desktop or laptop (for those belonging to older generations)

Computers?

- Smartphone or tabs for the younger generation

Computers?

- Are these the only computers we use?

Computers?

- No!
- We are actually surrounded by “computers”

Digital Pedometer



Is it a computer?

Definition of Computer (Oxford English Dictionary)

Computer (n) – an electronic device which is capable of receiving information (data) in a particular form and of performing a sequence of operations in accordance with a predetermined but variable set of procedural instructions (program) to produce a result in the form of information or signals

Digital Pedometer – a Computer?

- What it does?

Digital Pedometer – a Computer?

- Identify that you are walking
 - Differentiate between “walking” and “standing”

Digital Pedometer – a Computer?

- Keep count of number of steps

Digital Pedometer – a Computer?

- Not easy - you are likely to walk at different speeds at various instants
- Try to count the number of steps mentally while walking to get some idea on the challenge involved!

Digital Pedometer – a Computer?

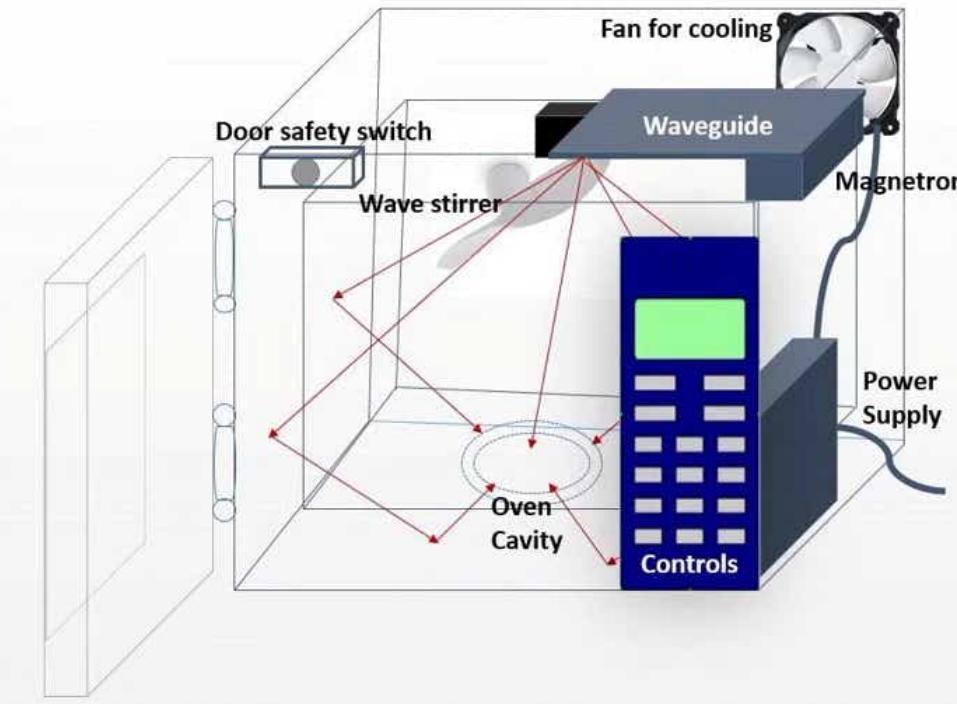
- Convert the number of steps to distance covered
 - Should “know” the formula for conversion
 - Perform the “conversion”

Digital Pedometer – a Computer?

- Formula “stored” somewhere in the device for use
- Device “computes” the formula

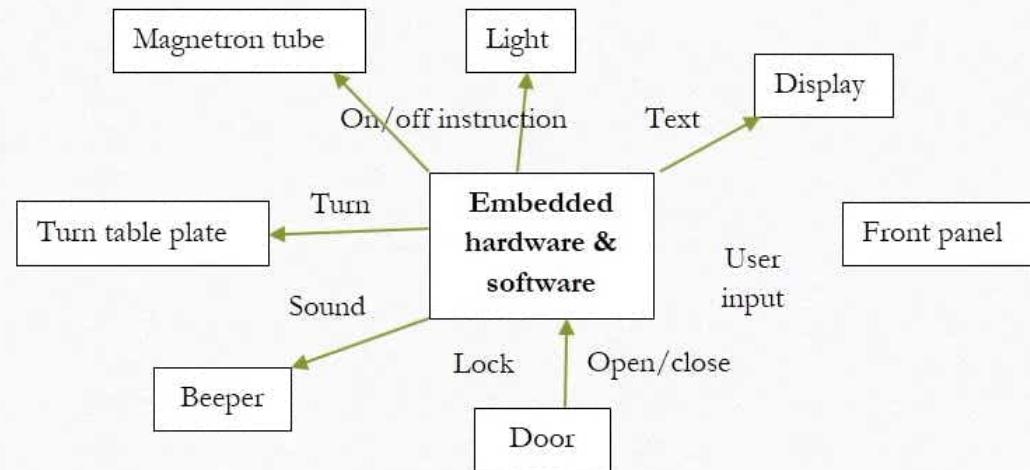
Fits perfectly the definition of a computer

Another Example



Microwave Oven

Micro-oven as “Computer”



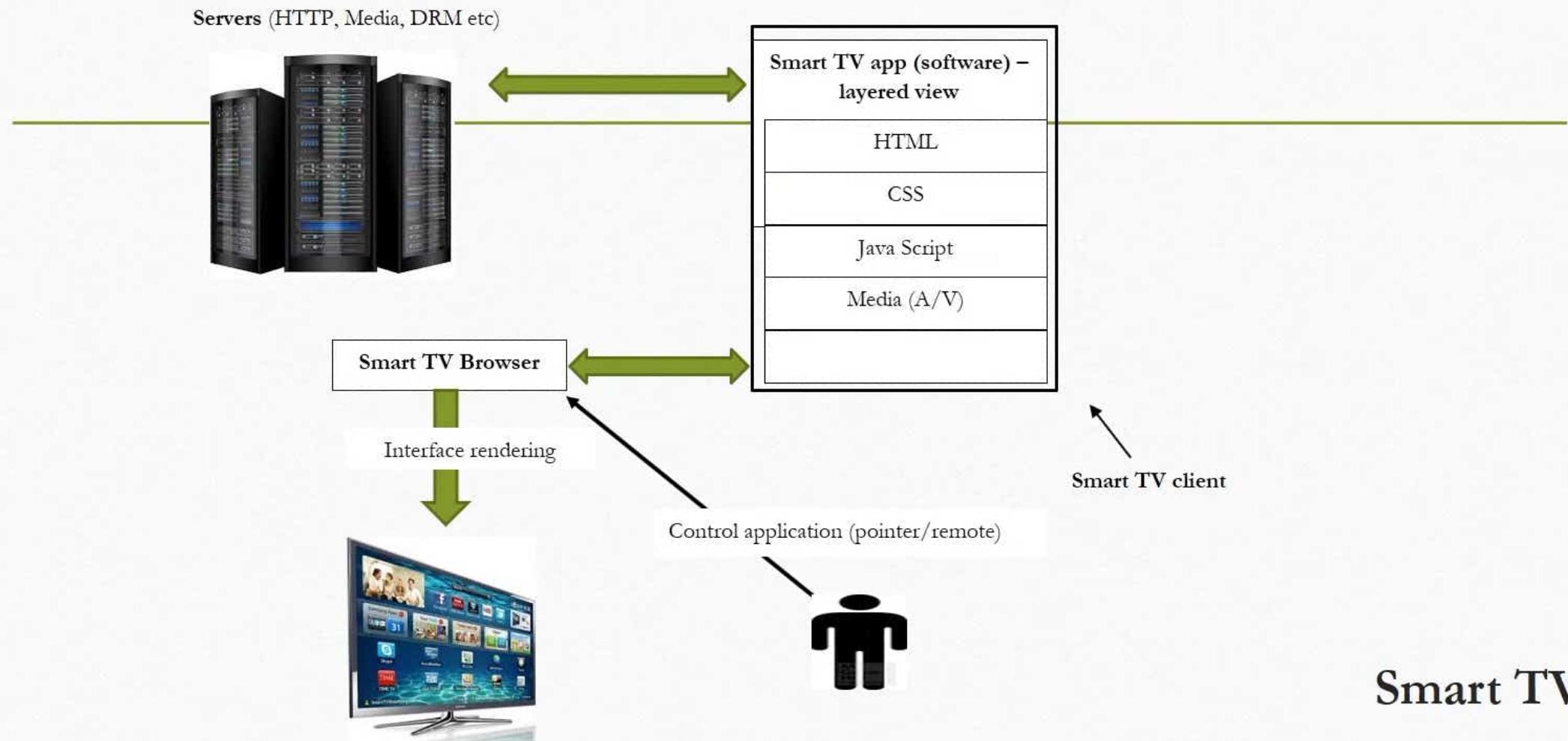
Microwave Oven

Third Example



Smart TV

Few More “Computers”



What the Examples Tell Us?

- These are “interactive” (computing) systems
- “Interaction” takes place between “computer” and “user”
- **However, users are “laymen users” (not technology experts)**

Question?

- Is it necessary for the users to know “about the technology behind”?

Another Example



Outcome

- Make the user anxious
 - Did I do something wrong?
 - How to get out of it?
 - Should we refrain from performing any more things?

Outcome

- May lead to loss of motivation for further use

User-Centric Design

User-Centric

- System design should not force users to learn about the underlying technology

User-Centric Design

- How to design systems/products that the users find easy to use?

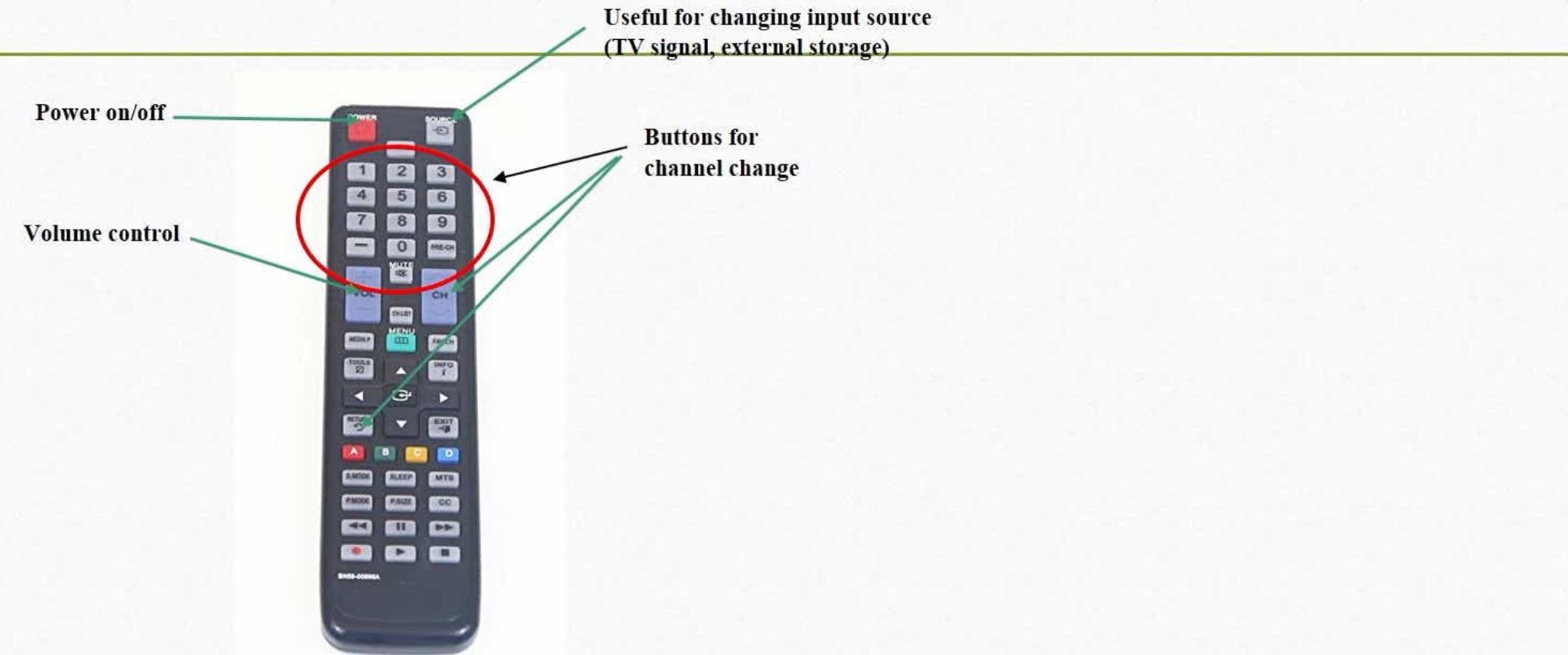
A Case Study: TV Remote Control



Common Activities with TV Remote

1. Control brightness, contrast, γ -correction and many more things
2. Input channel number (typically 3 digits) for channel selection
3. Control voice level
4. Watch movies from external devices (pen drive, hard disk or even your smart phone).
5. Watch the photos or videos from our digital camera on the TV screen

A Case Study: TV Remote Control



A Case Study: TV Remote Control

The buttons in this block are used occasionally, to navigate menu options



A Case Study: TV Remote Control



Rarely used buttons.
Many of us are probably
not even aware of their
functions

A Case Study: TV Remote Control

- The remote actually supports many more activities than the set of common activities

A Case Study: TV Remote Control

- By putting *every control options* on a single device, the remote-control actually succeeds in scaring away many potential users (at least initially)

User-Centric Design

- The process to design products, which are computers, in which the users' needs and expectations are taken care of by considering their characteristics

User-Centric Design

- Consider the remote control again (an interface to a computer, that is the TV)

User-Centric Design

- It contains buttons (elements of the interface)

User-Centric Design

- The buttons are placed in a particular way (the geometric layout of the interface)

User-Centric Design

- When we interact with the TV using the remote (say, to select a channel), we visually *perceive* the system state and its change (from the TV screen)

User-Centric Design

- We continue performing the operation till we are sure that *we achieved what we wanted (system state matches with our goal state)*

User-Centric Design

- Design **elements** that are acceptable to the users

User-Centric Design

- Design layouts that meet users' expectations

User-Centric Design

- Help user perceive the “system state”

User-Centric Design

- Design interaction that fulfils needs of the users, by taking them to desired “system states”

A Little Bit of History!

Historical Evolution

- Roughly four broad phases, with certain overlap in between

Phases of Evolution

- The pre-history (1940's to 1970's) – This is before the advent of “personal computers”

Phases of Evolution

- The early phase (1980's till the early 21st Century)
 - the era of personal computers

Phases of Evolution

- The pre-modern phase (late 1990's - first decade of the 21st century) –widespread use of mobile personal computing devices, notably smart-phones and tablets

Phases of Evolution

- The modern age (2011 onwards) – era of “interconnected” devices

The Pre-History: Notable Developments

- The video display units in the 1950 (the SAGE system with light pen as input)
- Sketchpad (E Sutherland), 1963 – GUI and interaction
- NLS (oNLine System) [D Engelbart and team], 1968 – Mouse
- Release of first commercial microprocessor (Intel 4004) – 1971
- The Dynabook (Allan Kay) - 1972

The Early Phase: Notable Developments

- Early PCs (not very successful)
 - Xerox Alto – 1973
 - Altair 8800 (MITS) – 1974
 - Apple I (1976) and II (1977)

The Early Phase: Notable Developments

- IBM PC (1981) – first successful PC
- Xerox Star (1981) introduced concepts such as GUI, WYSIWYG, metaphors
- Direct manipulation idea (Shneiderman) – 1982
- Apple Mac – 1984
- WWW (1989)
- Mosaic web browser - 1993

The Pre-Modern Phase: Notable Developments

- Palm pilot – 1996 (PDA)
- Nokia 9000 – 1996 (combined PDA and mobile phone functionalities)
- Android 1.0 – 2008
- Other “smart” and “intelligent” consumer electronic products proliferated during this period

The Modern Phase: Notable Developments

- Ubiquitous computing environment
- Mark Weiser introduced the term in 1991
- Related terminological developments
 - IoT, Kevin Aston, 1999
 - Cyber-Physical System (CPS), Helen Gill, 2006

Book

- **Bhattacharya, S.** (July, 2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw-Hill India
 - Print Edition: ISBN-13: 978-93-5316-804-9; ISBN-10: 93-5316-804-X
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Chapter 1, Sec 1.1 – 1.3