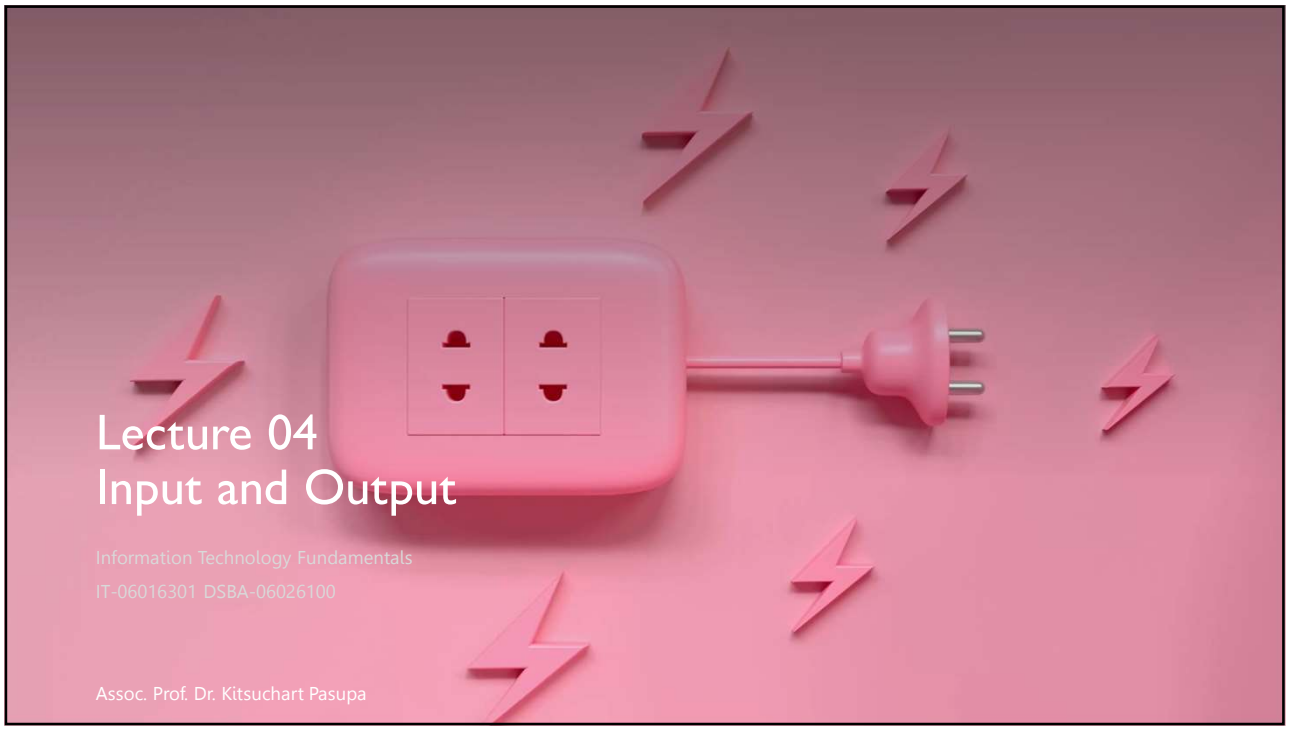

Lecture 04
Input and Output
Information Technology Fundamentals
IT-06016301 DSBA-06026100
Assoc. Prof. Dr. Kitsuchart Pasupa

1

What is input?

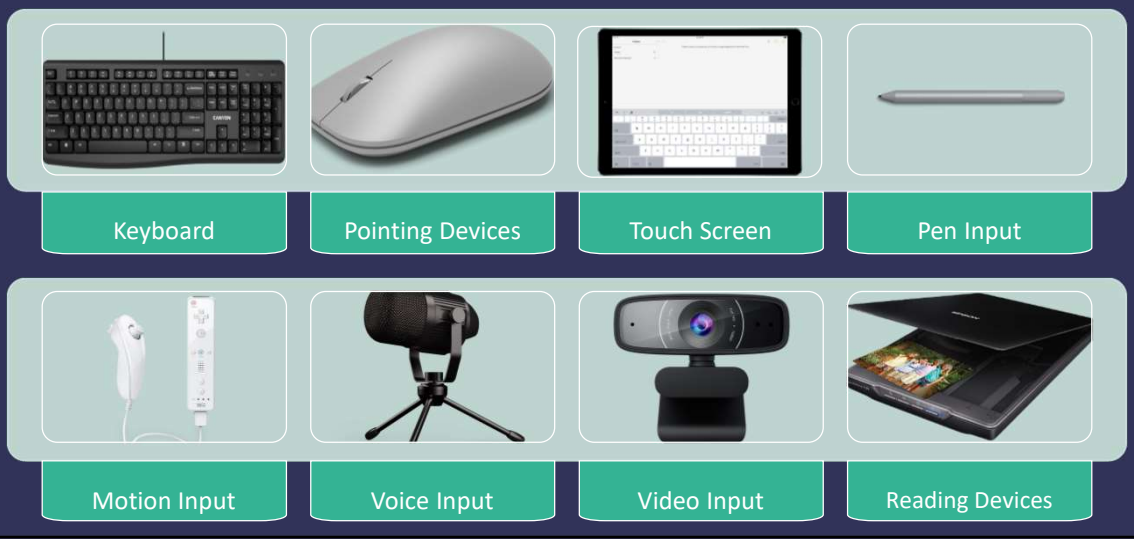
hardware

ข้อมูล เคาสั่ง → อุปกรณ์ นำเข้า → หน่วยค.จำ

- Input is any data and instructions entered the memory of a computer
- It is entered by input device
- Input device is any hardware component used to enter data or instructions into a computer

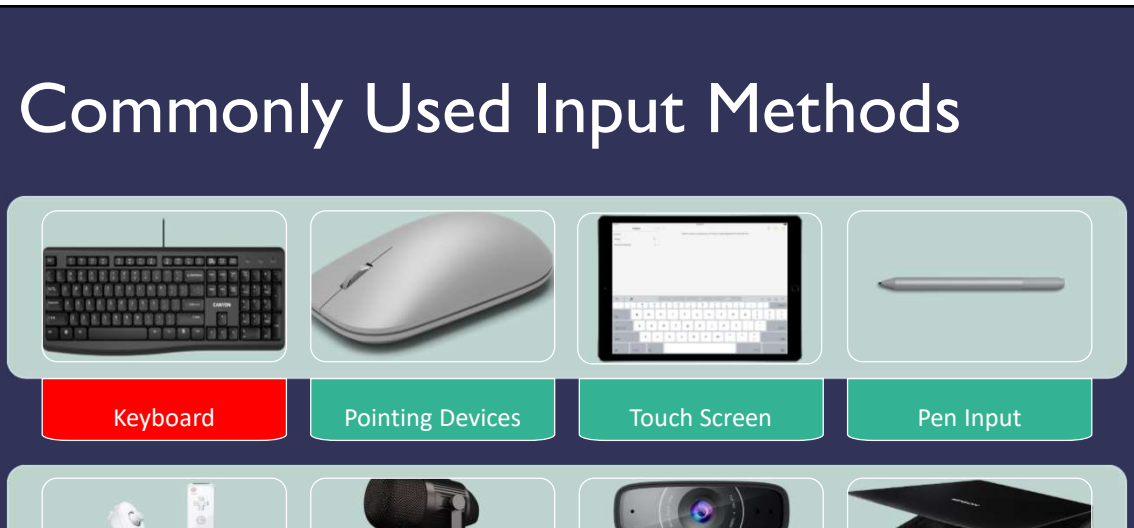
2

Commonly Used Input Methods



3

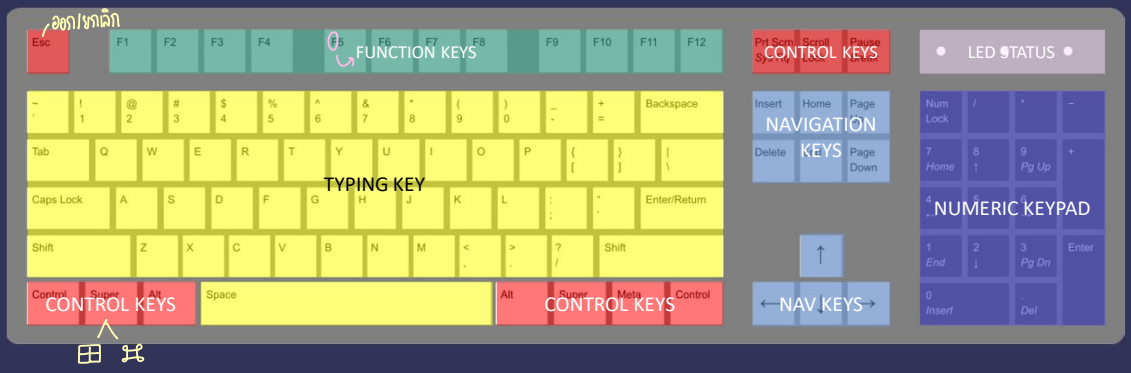
Commonly Used Input Methods



4

Keyboard

- A keyboard is an input device that contains keys users press to enter data and instructions into a computer or mobile device
- The ANSI standard 104-key keyboard (American National Standards Institute)



5

Keyboard

- Why QWERTY? Why not ABCD…?
- Reduce frequency of key jams on old mechanical typewriter

https://www.sciencedirect.com/science/article/abs/pii/S0020737383800108

6

Keyboard

- There are a variety of keyboard options

Desktop Keyboard

Laptop Keyboard

Onscreen Keyboard

Type Cover Keyboard

Mini Keyboard

Virtual Keyboard

7

Keyboard

An ergonomic keyboard has a design that reduces the chance of repetitive strain injuries of wrist and hand

- Ergonomics incorporates comfort, efficiency, and safety in the design of the workplace

8

Commonly Used Input Methods

Keyboard

Pointing Devices

Touch Screen

Pen Input

Motion Input

Voice Input

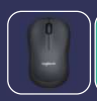
Video Input

Reading Devices

9

Pointing Devices

- A pointer is a small symbol on the screen whose location and shape change as a user moves a pointing device

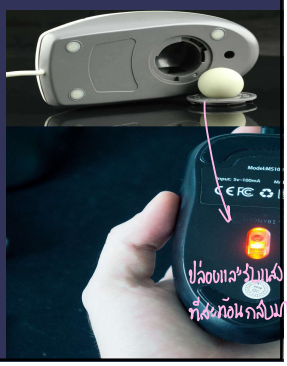

Mouse is a pointing device that fits under the palm of your hand comfortably

Touchpad is a small, flat, rectangular pointing device that is sensitive to pressure and motion เล็กแบน ใช้ต่อแรงกด, การเคลื่อนไหว

Trackball is a stationary pointing device with a ball on its top or side
✓ใช้ พท.น้อยในการควบคุม

Pointing Stick is a pressure-sensitive pointing device shaped like a pencil eraser that is positioned between keys on a mobile computer keyboard
✓ ใช้ต่อแรงกด

Types of Cursor



10

Pointing Devices

An ergonomic mouse (vertical mouse) will position your hand in more of a "handshake" shape, which takes pressure off your wrist and forearm

11

Commonly Used Input Methods

Keyboard

Pointing Devices

Touch Screen

Pen Input

Motion Input

Voice Input

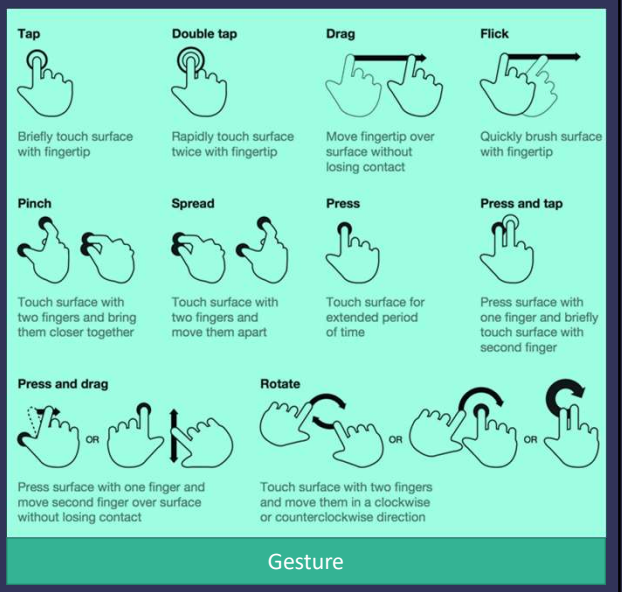
Video Input

Reading Devices

12

Touch Screen

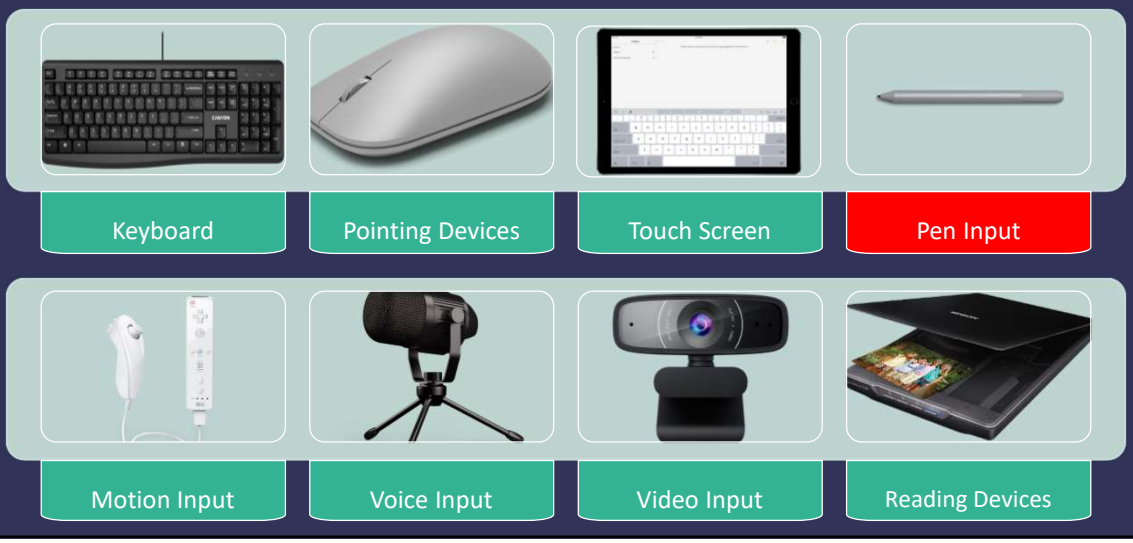
- A touch screen is a touch-sensitive display



http://babich.biz/in-app-gestures-and-mobile-app-usability/

13

Commonly Used Input Methods



14

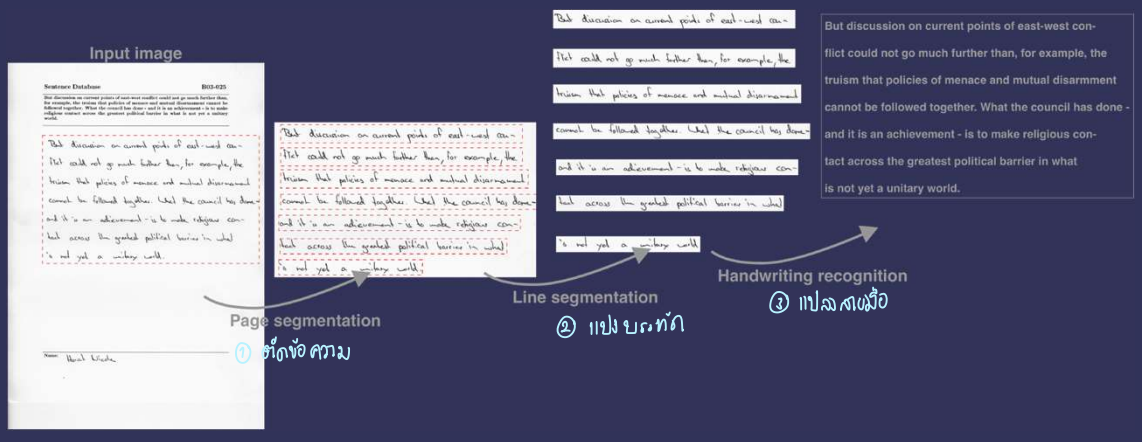
Pen Input

- With pen input, you touch a stylus or digital pen on a flat surface to write, draw, or make selections

15

Handwriting Recognition

→ Optical Character Recognition (OCR)



https://medium.com/apache-mxnet/handwriting-ocr-line-segmentation-with-gluon-7af419f3a3d8

16

Pen Input

A graphics tablet, also called a digitizer, is an electronic plastic board that detects and converts movements of a style or digital pen into signals that are sent to the computer

17

Commonly Used Input Methods

Keyboard

Pointing Devices

Touch Screen

Pen Input

Motion Input

Voice Input

Video Input

Reading Devices

18

Motion Input

-ทำท่าทางในอากาศ

- With motion input, sometimes called gesture recognition, users can guide on-screen elements using air gestures
- Examples of sensors
  - Gyroscope measures or maintains orientation and angular velocity วัดการหมุน, ค.เร่งเชิงมุม (ω)
  - Accelerometer measures proper acceleration ตรวจจับ ค.เร่งของอุปกรณ์ (x,y,z)
  - Magnetometer enables compass-like capability ทำให้อุปกรณ์มีลักษณะเหมือนเข็มทิศ
  - Infrared detection senses object position in 3D space รับรู้ตำแหน่งของวัตถุใน 3D
  - Color sensor senses object color รับรู้สีของวัตถุ

Nintendo Wii

Nintendo Switch

Xbox – Kinect Sensor

Sony Playstation Move

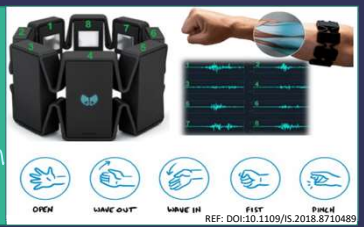
19

Motion Input

Eye Tracking (EyeTribe)
-ตรวจจับการมอง
- นิ้วก็ด
- ขนาดลูกตา

https://www.youtube.com/watch?v=XE0aANnzrL8

Forearm Tracking (Myo)
-วัดสัญญาณของกล้ามเนื้อแต่ละชนิดของแขน



REF: DOI:10.1109/IS.2018.8710489

https://www.youtube.com/watch?v=sTMr5Qk-s14

Hand Tracking (Leap Motion)
-ติดตามการเคลื่อนของมือ

https://www.youtube.com/watch?v=_d6KuiuteIA

Brain Signal Tracking (NeuroSky)
- วัดคลื่นสมอง

https://www.youtube.com/watch?v=iFBhTHGXcMQ

20

Commonly Used Input Methods

Keyboard

Pointing Devices

Touch Screen

Pen Input

Motion Input

Voice Input

Video Input

Reading Devices

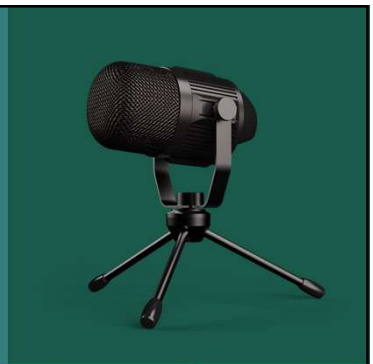
21

Voice Input

- ต้องมี microphone
- แปลงเสียง → อักษร
  speak to text
- ต้องเข้าใจภาษา
  Natural language processing

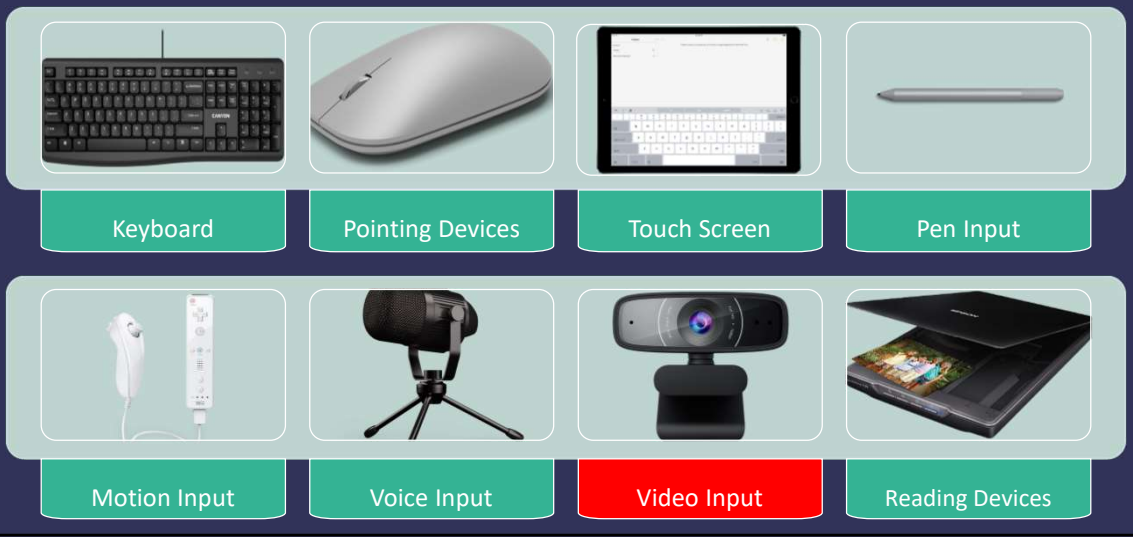
การรู้จำเสียง

- Voice input is the process of entering input by speaking into a microphone
- Voice recognition, also called speech recognition, is a process that allows people to speak naturally to a computer on any topic and to be understood accurately.



22

Commonly Used Input Methods



23

Video Input

- จับภาพเคลื่อนไหวแล้วจัดเก็บ

- Video input is the process of capturing full-motion images and storing them on a computer or mobile device's storage medium
- A webcam is a type of digital video camera that enables a user to:
  - ✓ Capture video and still images
  - ✓ Broadcast live images or video over the Internet
  - ✓ Conduct videoconferences
  - ✓ Make video calls
- Nowsday, all these devices have the same function as webcam ✓

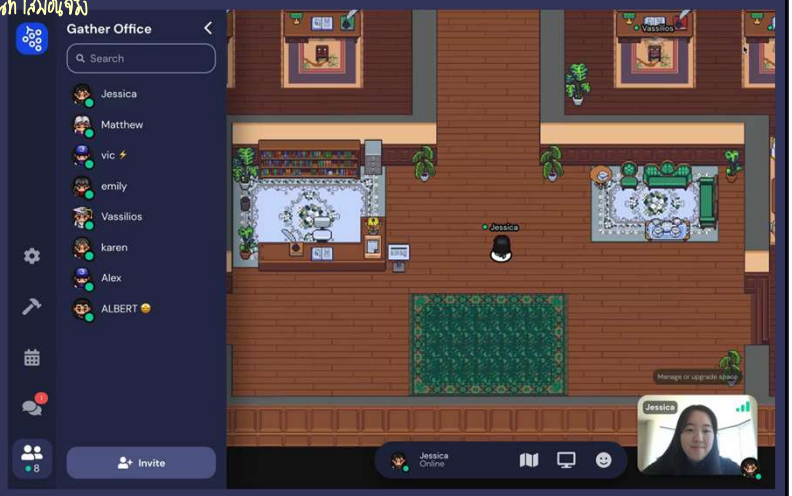
24

Video Input

- Videoconference is a meeting between two or more geographically separated people.
  - Some examples of video conferencing tools are Microsoft team, zoom, Skype, Google Meet, Jabber
- Webinar is a type of web conferencing. It is just like a seminar over the web. Webinars are useful for seminars, lectures, workshops or product and service demonstrations.
  - Some examples of webinar tools are Microsoft Team, Zoho meeting, GoToWebinar, Zoom, etc.

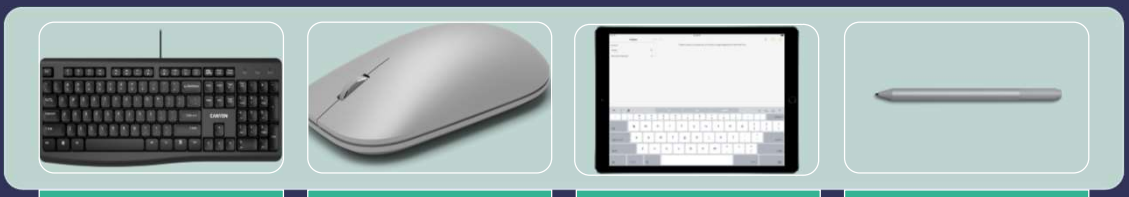
Video Input

- Gather.Town is a web-conferencing software like Zoom, but with the added component of seeing the virtual "room" you and others are occupying, and with the ability to move around and interact with other participants based on your locations in the room, just like real life.

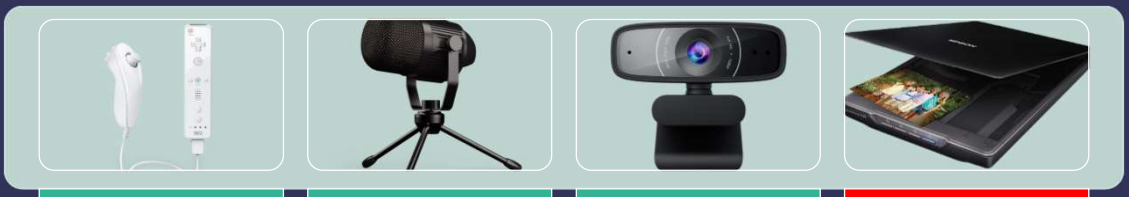


DSMLR Lab: https://gather.town/app/NBr2iJ62kgWrPtWW/DSMLR

Commonly Used Input Methods



Keyboard | Pointing Devices | Touch Screen | Pen Input



Motion Input | Voice Input | Video Input | Reading Devices

27

Reading Devices

① Scanner –ใช้แสง

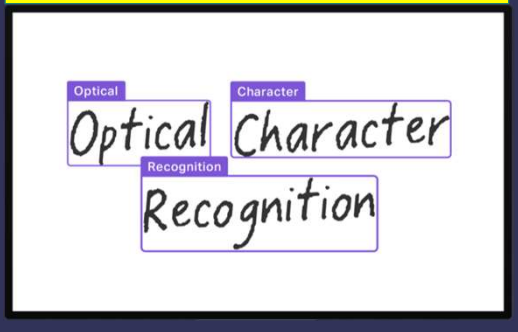
A scanner is a light-sensing input device that reads printed text and graphics and then translates the results into a form the computer can process

สร้างไฟล์ของเอกสารและรูปภาพในหน่วยความจำ ไม่ต่อ printออกมา

A flatbed scanner works in a manner like a copy machine except it creates a file of the document in memory instead of a paper copy

~~Optical Mark Recognition (OMR)~~

Optical character recognition (OCR) is a solution for automating data extraction from printed or written text from a scanned document or image file and then converting the text into a machine-readable form to be used for data processing like editing or searching.



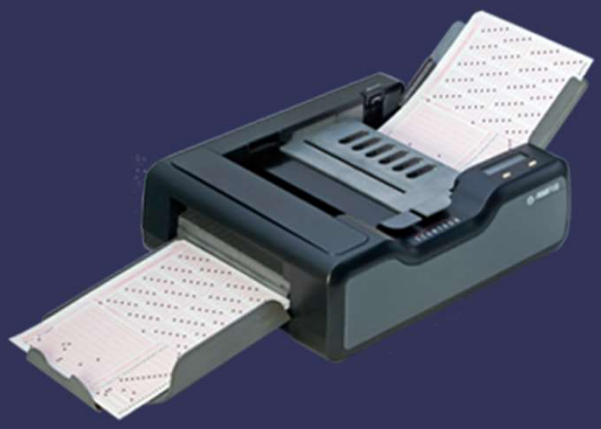
28

Reading Devices

อ่านตน.ที่ถูกฝน/แรงๆ แปร.ผวลผลต่อ

Optical Mark Recognition (OMR)

It is the process of capturing human-marked data from document forms such as surveys and tests. They are used to read questionnaires, multiple choice examination paper in the form of shaded areas.



29

Reading Devices

Bar code

a machine-readable code in the form of numbers and a pattern of parallel lines of varying widths, printed on and identifying a product.

Quick Response (QR) code

A QR code stores information in both a vertical and horizontal direction. It can contain more information than a bar code.

└ เก็บข้อมูลทั้งแนวตั้งแนวนอน → เก็บได้มากกว่า bar code

└ แสกน เห็นถึงใต้รถหัว

จะจับได้ว่า qr code นี้อยู่แนวไหน → ดีควรมต่อ

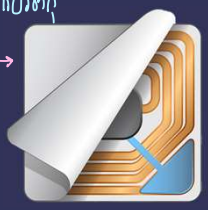
30

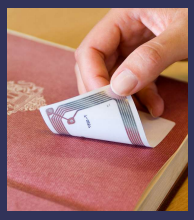
Reading Devices

ระบุตัวตน ใช้สัญญาณวิทยุเพื่อสื่อสาร กระแทกที่วงติดกับบัตร

Radio Frequency Identification (RFID)

It uses radio signals to communicate with a tag placed in or attached to an object. An RFID reader reads information on the tag via radio waves





31

Reading Devices

Magstripe Readers

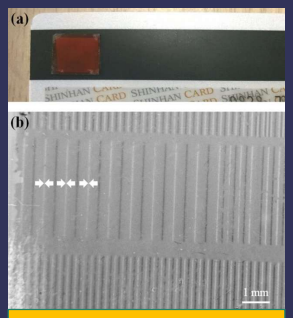
Magstripe readers read the magnetic stripe on the back of cards such as: credit/debit card, membership card

It store all the user information, such as name, account number, expiry date, country code. All these information are encoded

By 2033, none of its debit or credit cards will have a strip, with banks in many regions including Europe able to issue the strip-less cards from 2024.

เก็บข้อมูลใน chip / แถบแม่เหล็กด้านหลัง

เริ่มใช้ปี 2024



Magneto Optical image of the magnetic domains in the magnetic stripe of the credit card.

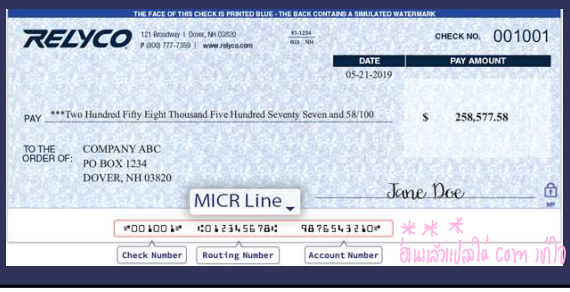
https://www.bbc.com/news/technology-58206591

Ref: www.doi.org/10.1063/1.4918907

32

Reading Devices

MICR Devices
-อ่านอักษรที่พิมพ์จากผงแม่เหล็ก MICR (magnetic ink character recognition) devices read text printed with magnetized ink
An MICR reader converts MICR characters into a form the computer can process
Banking industry uses MICR for check processing



33

What is Output?

hardware อุปกรณ์ส่งออก

ข้อมูลที่ถูกประมวลผล → แปลงเป็นข้อมูลที่ human เข้าใจได้
- text - audio
- graphic - video

Output is data that has been processed into a useful form

Output device is any piece of computer hardware equipment which converts information into human readable form.

34

Commonly Used Output Methods

Display | Printer | Audio Output | Projector | Interactive Whiteboard | Game Controller

35

Commonly Used Output Methods

Display | Printer | Audio Output | Projector | Interactive Whiteboard | Game Controller

36

Display - อุปกรณ์แสดงผล

- A display is an output device that visually conveys text, graphics, and video information
- A monitor is a display that is packaged as a separate peripheral device

Desktop Display

Laptop Display

Tablet Display

Smartphone Display

Digital Camera Display

Monitor

แยกออกมา เป็น อุปกรณ์ผ่าน ทำหน้าที่เป็น display

37

- การดูประสิทธิภาพของหน้าแสดงผล

The quality of a display depends primarily on the followings

หน้าแสดงผลทั่วไป มีขนาดมาตรฐาน กว้าง : สูง
- aspect ratio : ex 2:1
- wide screen : ex 16:9 16:10

Display

19600×900 pixel
Resolution
จน.ช่อง แนวนอน×แนวตั้ง

Response Time
เวลาในการตอบสนอง 2-16 milisec
- เวลาเปิด/ปิด pixel

250-250 Nit ยิ่งมากยิ่งสว่าง
Brightness
ค.สว่าง (Nit)
- หน่วยค.เข้มแสง
- 1 แคนเดลลา/ตร.ม. = Nit

ยิ่งน้อยยิ่งชัด
Dot Pitch
ระยะห่างระหว่าง pixel ≈ 0.33 mm.

Contrast Ratio
ค.เข้มของแสง สขาว : สดำ ex. 2000:1
อัตราส่วนมาก = แสดงสีสันดี

38

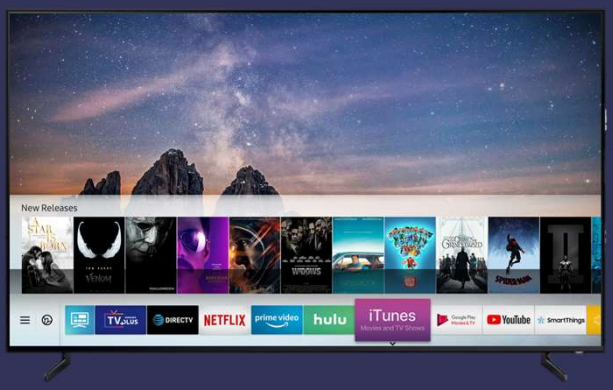
Display connector

ภาพ/analog	ภาพ analog + digital	ภาพ+เสียง digital	ภาพ+เสียง+video+audio
Video Graphics Array (VGA) →	Digital Video Interface (DVI) →	High-Definition Media Interface (HDMI) **	DisplayPort
Supporting analog signal - ปชบ. สัญญาณภาพเป็น digital	Supporting analog & digital signal	Supporting digital signal with digital audio signal	ทางเลือก An alterative to HDMI

39

Display

- Home users sometimes use a digital television (DTV) as a display
- High-definition television (HDTV) is the most advanced form of digital television
- = HDTV + internet
  A Smart TV is an Internet-enabled HDTV



40

Commonly Used Output Methods

Display | Printer | Audio Output | Projector | Interactive Whiteboard | Game Controller

41

Printer

- A printer produces text and graphics on a physical medium

พิมพ์โดยไม่โดนเนื้อของสื่อ

Nonimpact Printers

โดนเนื้อสื่อที่ใช้ พิมพ์

Impact Printers

42

Nonimpact Printer

- A nonimpact printer forms characters and graphics on a piece of paper without actually contacting the paper

Ink-jet Printers

Photo Printers

Laser Printers

All-in-one Printers

Thermal Printers

Dye Sublimation Printers

Mobile Printers

Label Printers

Plotters

Large-format Printers

43

Nonimpact Printer – Inkjet Printer

- An ink-jet printer forms characters and graphics by spraying tiny drops of liquid ink onto a piece of paper
- Color or black-and-white
- Speed is measured by the number of pages per minute (ppm) it can print
  - แผ่น/นาที

- หัวพ่น พ่นน้ำลงกระดาษ
- สั่งเครื่องพิมพ์ผ่าน คอมแล้วพิมพ์ได้
- สี / ขาวดำ
- ราคาถูก home user

44

Nonimpact Printer – Photo Printer

- A photo printer produces lab-quality photos
- Many use ink-jet technology
- Some brand allows you to print photos directly from a digital camera
- Print from a memory card

- คุณภาพเหมือนอัดที่ร้าน
- ใช้ ink-jet ในการพิมพ์
- กระดาษพิมพ์รูป 3"x5" / 4"x6"
- บางรุ่นส่งพิมพ์สั่งได้
- memory card เสียบสั่งพิมพ์

45

Nonimpact Printer – Laser Printer

- It is a high-speed and high-quality printer
- It offers both black-and-white and color

- เร็ว คุณภาพสูง แพง
- ดึงข้อมูลและประมวลผลทั้งหน้า @ หน่วยความจำของเครื่องพิมพ์ → แล้วค่อยพิมพ์
- หัวหน่วยความจำมาก = พิมพ์เร็ว
- laser beam ยิงแสงร่วมกับโทนเนอร์ที่อยู่ในตลับ

46

Nonimpact Printer – All-in-one Printer

- An all-in-one printer is a single device that prints, scans, copies, and in some cases, faxes
- It is also called a multifunction printer

• เป็นที่นิยม < home / small office
• แสกน, คัดลอก, ส่งแฟลก
• muti function printer

47

Nonimpact Printer – Thermal Printer

- A thermal printer generates images by pushing electrically heated pins against the heat-sensitive paper

• ใช้ ค.ร้อนจากหมุด ถูกให้ค.ร้อนด้วยไฟฟ้า
↓
กระดาษ ที่ มีค.ไวต่อ ค.ร้อน * กระดาษพิเศษ
• ต้นทุนถูก
• ค.ละเอียดต่ำ
→ ใบเสร็จ, ตั๋ว
→ จาง เลือนหาย

48

Nonimpact Printer – Dye Sublimation Printer

- Dye sublimation printer is a computer printing technique which uses heat to transfer dye onto materials such as a plastic, card, paper, or fabric.

49

Nonimpact Printer – Mobile Printer

- A mobile printer is a small, lightweight, battery-powered printer that allows a mobile user to print from a mobile device

50

Nonimpact Printer – Label Printer

- A label printer is a small printer that prints on an adhesive-type material that can be placed on a variety of items

- ออกแบบมาสำหรับประเภท "การ"
- ใช้ termal technology

51

Nonimpact Printer – Plotter

- Plotter are used to produce high-quality drawings

- ขนาดใหญ่
- ใช้ ink-jet

52

Nonimpact Printer – Large-format Printers

- Large-format printers create photo-realistic quality color prints
  - ใหญ่มาก
  - สร้างงานพิมพ์ที่มีคุณภาพเหมือนจริง

53

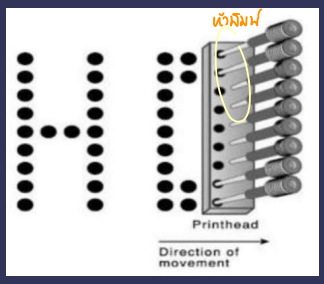
Nonimpact Printer – 3D printer

- A 3-D printer uses a process called additive manufacturing to create an object by adding material to a three-dimensional object, one horizontal layer at a time
  - ใช้กระบวนการผลิตแบบเพิ่มเนื้อวัสดุ (Additive Manufacturing)
  - เพิ่มวัสดุเป็นรูปทรง 3D
  - ค่อยๆ เพิ่มทีละชั้นในแนวนอน

54

Impact Printer – Dot Matrix Printer

- Impact printers form characters and graphics on a piece of paper by striking a mechanism against an inked ribbon that physically contacts the paper



https://www.youtube.com/watch?v=I_VBe3OO9dI

55

Commonly Used Output Methods

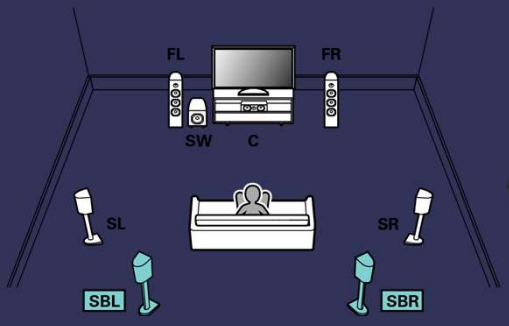
Display	Printer	Audio Output	Projector	Interactive Whiteboard	Game Controller

56

Audio Output

ลำโพงปล่อยเสียงหลายค.ถี่ พอเอามารวมกันจะเป็นเสียงที่คุณภาพ แม้นจริง

- Many users attach surround sound speakers or speaker systems to their computers, game consoles, and mobile devices to generate higher-quality sounds



Subwoofer

Center Speaker

Satellite Speakers

7.1-Channel Speakers

ลำโพงปรกติ

subwoofer => ส่งเสียงต่ำเป็นเบส

57

Audio Output

- Earbuds (also called earphones) rest inside the ear canal
- Headphones are speakers that cover or are placed outside of the ear

58

Commonly Used Output Methods

Display | Printer | Audio Output | **Projector** | Interactive Whiteboard | Game Controller

59

Projector

- A data projector is a device that projects the text and images displaying on a computer or mobile device screen on a larger screen so that an audience can see the image clearly

60

Commonly Used Output Methods

Display	Printer	Audio Output	Projector	Interactive Whiteboard	Game Controller

61

Interactive Whiteboard

- An interactive whiteboard is a touch-sensitive device, resembling a dry-erase board, that displays the image on a connected computer screen

62

Commonly Used Output Methods

Display	Printer	Audio Output	Projector	Interactive Whiteboard	Game Controller

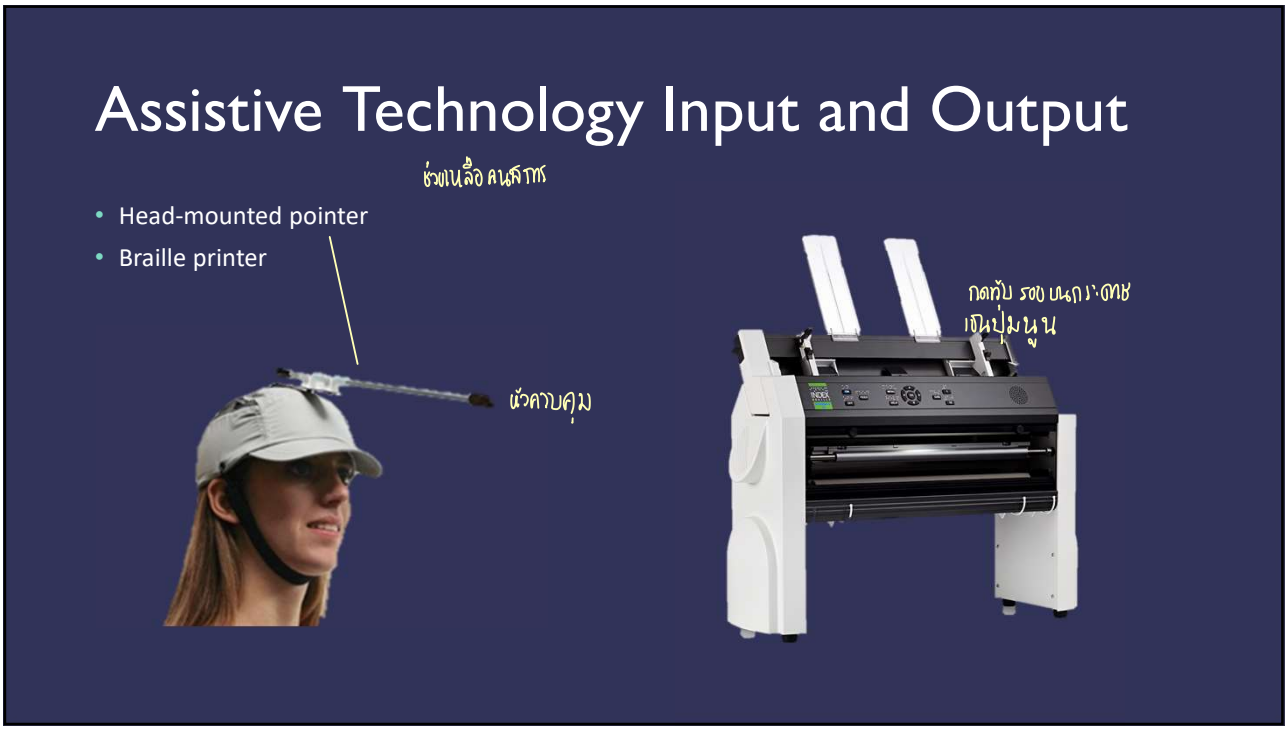
63

Game Controller

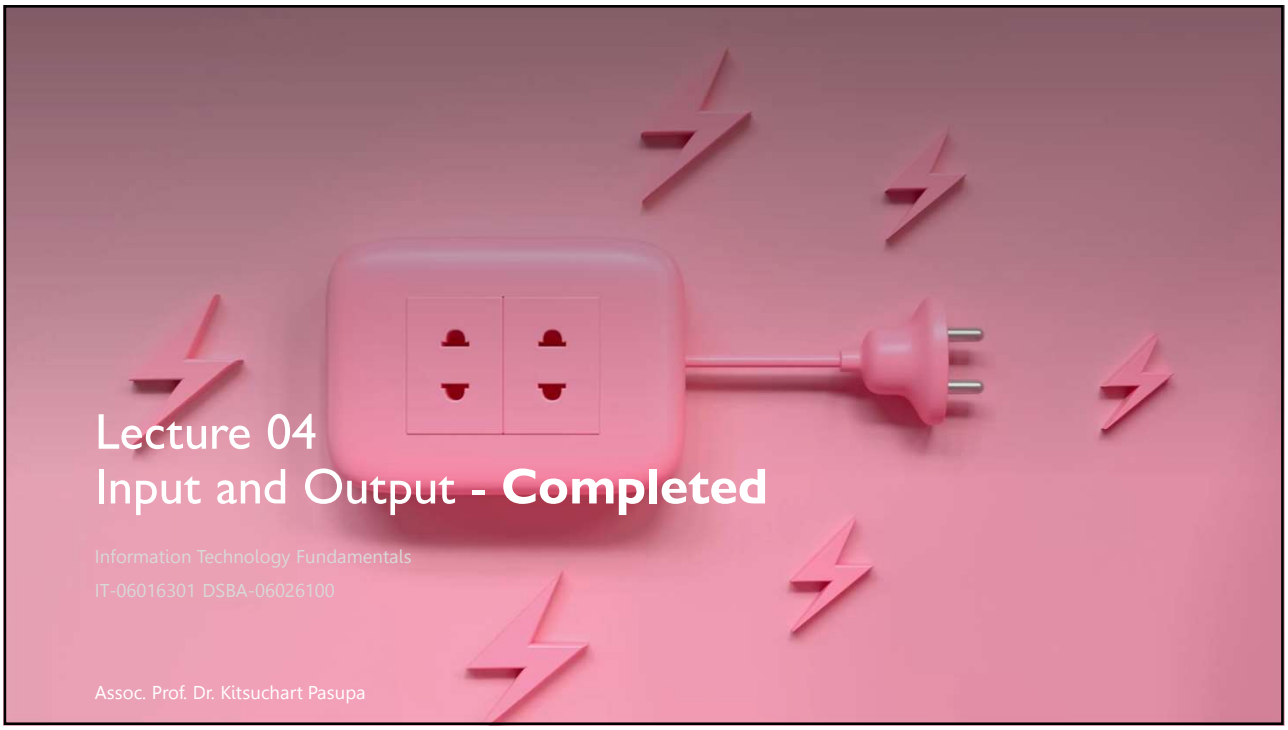
- Joysticks, wheels, gamepads, and motion-sensing game controllers can be considered output devices when they include force feedback
- Technology that sends resistance to the device in response to actions of the user

-อาจเป็น ทั้ง output input
↳ส่งแรงต้านกลับมา

64


Assistive Technology Input and Output
ช่วยเหลือ คนสูงการ
• Head-mounted pointer
• Braille printer
หัวควบคุม
กดทับ รอย บนกระดาษ
เป็นปุ่มนูน

65


Lecture 04
Input and Output - **Completed**
Information Technology Fundamentals
IT-06016301 DSBA-06026100
Assoc. Prof. Dr. Kitsuchart Pasupa

66