

BE 101-05 : Introduction to Computing and Problem Solving

Chapter 3 - Input devices

Narasimhan T.

1 Introduction

Input devices allow users to input data into the computer for processing. They are necessary to convert the input data into a form which can be understood by the computer. The data input to a computer can be in the form of text, audio, video etc. Input devices are classified into categories as shown in Figure 1.1:

1. Human data entry devices
2. Source data entry devices

2 Human data entry devices

These are also called manual input devices. With a manual input device the user must enter data into the computer either by typing or by pointing a device to a particular location.

2.1 Keyboard

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions. The keyboard has five sections:

1. **Typing Keys** : letter keys (A-Z) and digit keys (0-9)
2. **Numeric Keypad** : numeric keys on the right side of the keyboard
3. **Function Keys** : 12 functions keys (F1, F2, etc.) on the top
4. **Control keys** : four arrow keys and other keys like Home, End, Insert etc.
5. **Special Purpose Keys** : special purpose keys such as Enter, Shift, Caps Lock etc.

When you press a key, a number (code) is sent to the computer to tell it which key you have pressed. Once the pressed key has been identified, appropriate action is taken. For example, if the key pressed is backspace, then a character is erased.

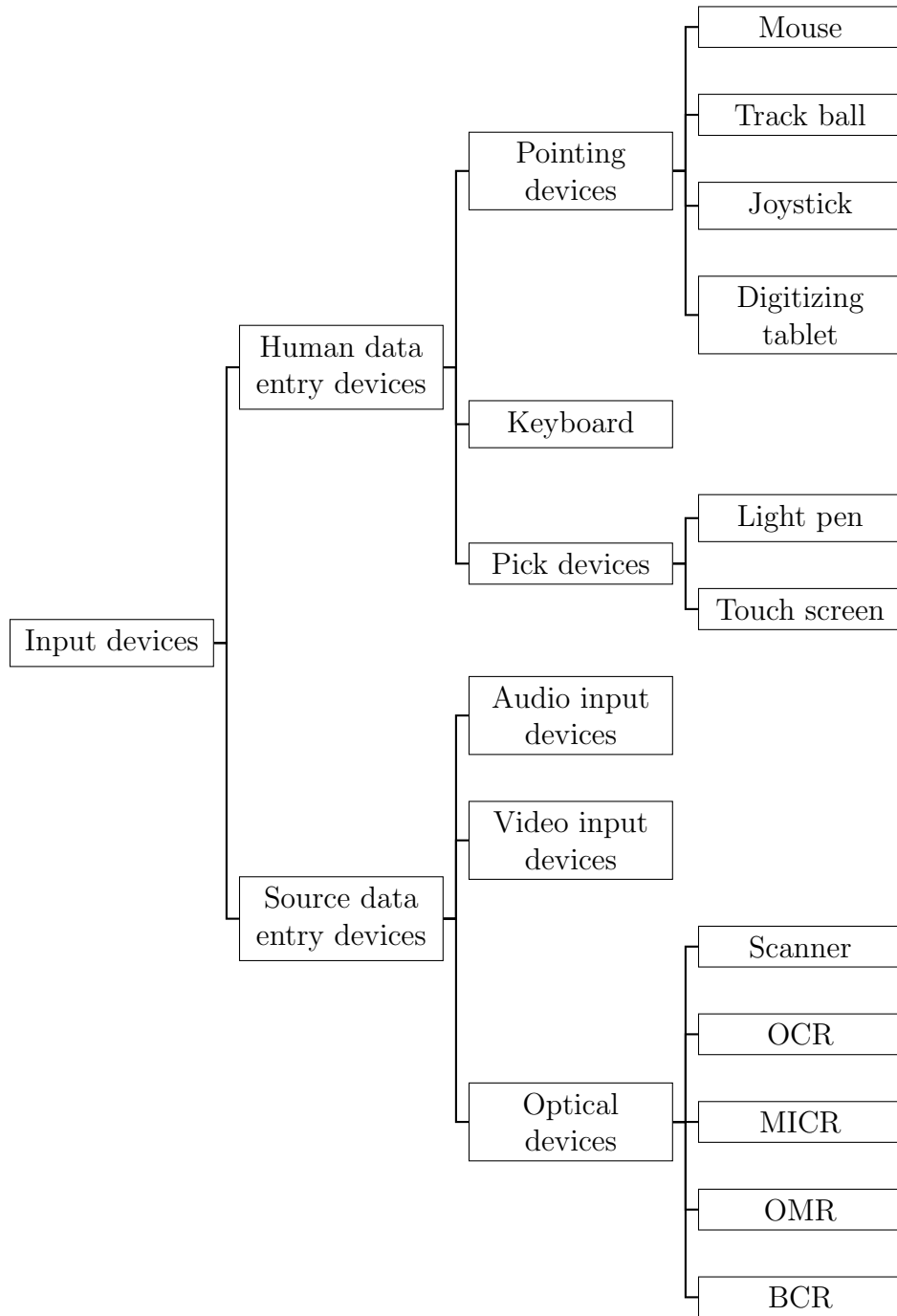


Figure 1.1: Classification of input devices

2.2 Pointing devices

Pointing devices are used for providing the input to computer by moving the device to point to a location on the computer monitor. The input data is not typed; instead, the data is entered by moving the pointing device. The cursor on the computer monitor moves with the moving pointing device. The various pointing devices are discussed below:

2.2.1 Mouse

A mouse is the most common pointing device. You move the mouse around on a *mouse pad* and a small cursor called a pointer follows your movements on the computer screen. Most mice have two or three buttons. By pressing the button, a variety of actions can be performed ranging from selecting an icon to drawing a picture on the screen. Some mice have a wheel between the two buttons that can be used to scroll down or scroll up a document. Mice are of two types:

Physical mouse/ball mouse: has a rubber ball on the back side that could rotate in any direction. When the ball moves, rollers sense its vertical and horizontal movements to track the mouse position. Sensors are also provided to sense the rate of movement of the mouse. It is also called mechanical mouse.

Optical mouse : uses a LED (Light Emitting Diode) and sensors to detect the mouse position. When an optical mouse is moved, a beam of light is reflected from its underside. These pulses of light determine the rate and direction of movement.

2.2.2 Track ball

A trackball (or tracker ball) is an alternative to a mouse. It operates in the same way as a mouse except that the ball is on top. They are popular when there is not enough space for a mouse, e.g. in portable computers. It looks like an upside-down mouse. Instead of moving the whole device to move the cursor on computer screen, trackball requires the ball to be moved manually with a finger. The trackball device remains stationary. The cursor on the computer screen moves in the direction in which the ball is moved. The trackball works in the same way as a mechanical mouse.

2.2.3 Joystick

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in an enclosure called socket. The joystick can be moved in all four directions. The direction of push of the stick and the amount of deflection determines the change in position and the change in speeds respectively. The socket contains an electric circuit that detects the movement of stick and sends the information to computer. Joystick is mainly used in Computer Aided Designing(CAD) and playing computer games.

2.2.4 Digitizing tablet

A digitizing tablet (also known as a digitizer or graphics tablet) is a tool used to convert hand-drawn images into a format suitable for computer processing. Digitizing tablet consists of two parts – an electronic tablet and a stylus. The electronic tablet is a flat pad. The stylus looks like a ball pen but has an electronic head. The user “draws” with the stylus on the tablet. Each position on the tablet corresponds to a fixed position on the screen. The tablet contains circuit that can detect the movement of pen on the tablet and that converts the movements into digital signals and sends them to the computer. Thus, as the user draws on the pad, the image is created on the screen. A graphic tablet is used for doing fine works of drawing and image manipulation applications like design of buildings and automotive designs.

2.3 Pick devices

Pick devices are used for providing input to the computer by pointing to a location on the computer monitor. The input data is not typed; the data is entered by pointing the pick device directly on the computer screen. Light pen and touch screen are some common pick devices.

2.3.1 Light pen

A light pen is a special pen which you can point at any computer monitor. When the pen is pointed at the screen, the computer can detect where the pen is pointing. Light pens can be used to “draw” on the screen or to select options from menus presented on the screen. Figures and drawings can be made by moving the pen on computer screen. The light consists of a photocell and an optical system placed in a small tube. When the tip of the light pen is moved over the monitor screen, light from the screen at the location of pen causes the photocell to respond. This electric response is transmitted to the computer that can identify the position on screen at which the light pen is pointing.

2.3.2 Touch screen

A touch sensitive screen (or simply, a touch screen) is a special type of display unit. When you touch the screen, the computer senses where you have pressed. Touch screens can be used to choose options which are displayed on the screen. Touch screen consists of a clear glass panel fitted with sensors that is placed over the view area of computer screen. It also has a controller that translates the information captured by the glass panel sensors to a form that the computer can understand. Touch screens have a grid of light beams (infra red beams) that criss-cross the surface of screen. When a fingertip is touched on the screen, the beam is broken, and the location is recorded. The recorded location is sent to the computer via the controller of touch screen. Touch screen are generally used in applications like Automated Teller Machine (ATM), public information computers like hospitals, airline reservation, railway reservation, supermarkets, etc.

3 Source data entry devices

Source data entry devices are devices that use special equipment to collect data at the source, create machine-readable data and feed it directly into the computer. They are also called direct data entry devices. Since the user does not need to manually enter the information, errors are reduced. Direct data entry devices are used when large volumes of data must be entered into the computer quickly. They can be used to feed audio input, video input or any other form of input.

3.1 Audio Input Devices

Audio input can be provided to the computer using human voice or speech. Microphone is an input device to input sound that is then stored in digital form. A sound card translates analog audio signals from microphone into digital codes that the computer can store and process. Sound card also translates back the digital sound into analog signals that can be sent to the speakers. Translating spoken words into text is also known as speech recognition or voice recognition. Voice recognition systems listen to what people are saying and carry out the instructions given

to them when people speak. The user can dictate the commands to the computer, instead of typing them. Speech recognition systems are costly and difficult to develop since the computer has to be trained to recognize the voice of user. They are generally used by people who have difficulty in typing or by people with disabilities.

3.2 Video Input Devices

Video input is provided to the computer using video camera and digital camera. Video camera can capture full motion video images. The images are digitized and can be compressed and stored in the computer disk. Webcam is a common video camera device. A video capture card allows the user to connect video devices like camcorders to the computer. When a video sequence is captured the computer stores this as a sequence of still images called *frames*. These frames are displayed quickly one after the other to create the illusion of a moving picture.

Digital camera works like video camera but usually capture still images. The digital camera digitizes the images, compresses them and stores them on a memory card like flash memory. Later these images can be transferred onto a computer for editing. Computer vision is an area of computer science that deals with images. Computer vision has applications in areas like robotics and industrial processing.

3.3 Optical input devices

Optical input devices are special types of input devices that use optical technology (light source) to input the data into the computers. Some common optical input devices are discussed below.

3.3.1 Scanner

Scanner is an optical input device which works more like a photocopy machine. It is used when the input information (a picture or a text) is available on a paper and it is to be transferred to the computer for further manipulation. A scanner uses light as an input source to convert an image into an electronic form called bitmap image. The denser the bitmap, the higher is the resolution of the image. The quality of scan increases with the increase in resolution. It works by shining a beam of light at the image being scanned and measuring how much light is reflected back using an optical sensor. The amount of light that is reflected back tells the computer how light or dark the image is at each point. The light and optical sensor scans (reads information) the document one line at a time. This process must be repeated down the picture for all the lines to input the whole image. Scanners come with utility software that allow the stored scanned documents to be edited, manipulated and printed. There are two different types of scanner :

Flat-bed scanner : provides high quality scan in a single pass. It is a box shaped machine similar to a photocopy machine and has a glass top and a lid that covers the glass. The document to be scanned is placed on the glass top which activates the light beam beneath the glass top and starts the scan from left to right.

Hand-held scanners : are portable and can be held in hand. The light/sensor must manually be pushed along the image/document to be scanned. The scanned documents are converted and stored as an image in the computer memory.

Flat-bed scanners are preferable as they can scan larger images and are more accurate than hand held scanners. On the other hand, hand-held scanners are cheaper and more portable.

Hand-held scanners have to be moved at a constant speed over the document to be scanned, to get good quality scans. They are used for low volume of documents, small pictures or photos. They are difficult to use if full page document needs to be scanned. Some of the documents that are primarily scanned using hand-held scanners are price tags, label and ISBN number on books.

3.3.2 Optical Character Recognition (OCR)

An optical character recognition system consists of a scanner and a software called OCR software. The scanner is used to scan an image of a page of text to be read into the computer. The software then examines the page and extracts the text from it, storing it in a form called ASCII text that is editable. OCR uses optical character reader for text recognition. The reader scans text optically character by character and stores the scanned image as bitmap image which is a grid of dots. The OCR software then translates the array of dots into text that the computer can interpret as words and letters. To recognize the words and letters of text, the OCR software compares the pattern on the scanned image with the patterns stored inside the computer. The text files generated via OCR can be stored in different formats like .doc, .txt.

3.3.3 Magnetic Ink Character Recognition (MICR)

The Magnetic Ink Character Recognition (MICR) system reads characters printed in a special magnetic ink into the computer. MICR input device is generally used in banks because of a large number of cheques are to be cashed/processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. When a cheque is passed through a Magnetic Ink Character Reader, the magnetic field causes the read head to recognize the characters or numbers on the cheque. The main advantages of MICR are that it is very fast and accurate (less error prone). MICR readers can only read one special font which can represent only numbers and a few punctuation marks. Information printed in magnetic ink is also very secure. It is not possible to change the information by writing over it with a pen and the printed numbers are not damaged by folding (as often happens with cheques). Both the reader used by MICR and the special ink are expensive.

3.3.4 Optical Mark Recognition (OMR)

OMR is a special type of optical scanner used to recognize the marks made by pen or pencil on a printed form. OMR systems are used by examination boards to check the answers to multiple choice examinations. The student answers each question by darkening/markings a particular circle using a pencil. The OMR reader scans the forms and detects the marks by their darkness (the marked portions will be darker than the surrounding portions on the paper). The reader detects where the marks are placed by shining a light at the page and measuring the amount of light reflected. Less light is reflected where the marks have been made. The pattern of marks is interpreted and stored in the computer. OMR is also used to read forms, questionnaires, order forms, etc Input using OMR is accurate and very fast. Problems can occur if the OMR forms get creased as the reader may jam.

3.3.5 Bar Code Reader

It is a device used for reading bar coded data. A barcode is made up of a sequence of bars or lines of different widths that are machine readable. Different groups of bars are used to represent different numbers. A printed barcode is therefore simply a way of representing a number. The number is often printed above or below the barcode so that humans can read it. The information normally included on a barcode for a product is country of origin, manufacturer and item code. Barcodes are read using reflective light by barcode readers. It may be a hand held scanner or may be embedded in a stationary scanner. It scans a bar code image, converts it into an alphanumeric value. This information is input to the computer which interprets the code using the spacing and thickness of bars.

Hand-held barcode readers are used in departmental stores to read the labels, and in libraries to read labels on books. Barcode readers are fast and accurate and are used to determine the items being sold, number of each item sold or to retrieve the price of item. Barcodes are not easily damaged and can normally still be read if they are creased or not stuck onto a flat surface. They can be printed using a normal printer and ink and so are cheap to produce.