Input devices for PC

RNDr. Róbert Bohdal, PhD.

Input devices

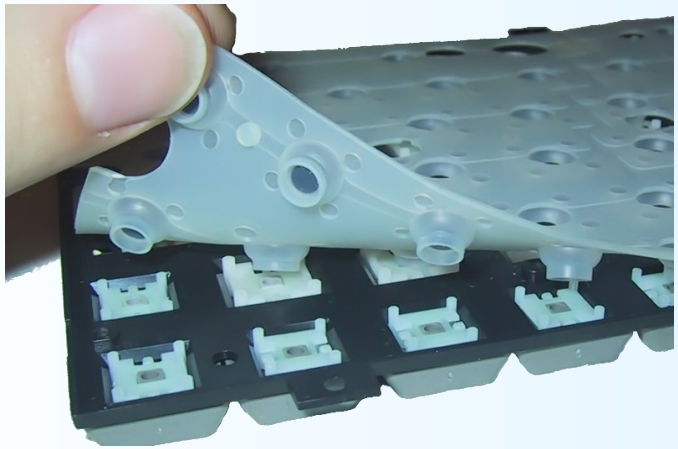
- Keyboard (dome-switch, mechanical, membrane, spring)
- Mouse (mechanical, optical diode/laser)
- Trackball
- Joystick
- Pointing stick, trackpoint
- Touchpad, tablet
- 3D mouse (3d controller), 3D data glove, trackers
- Game consoles (XBox, Playstation, Wii)

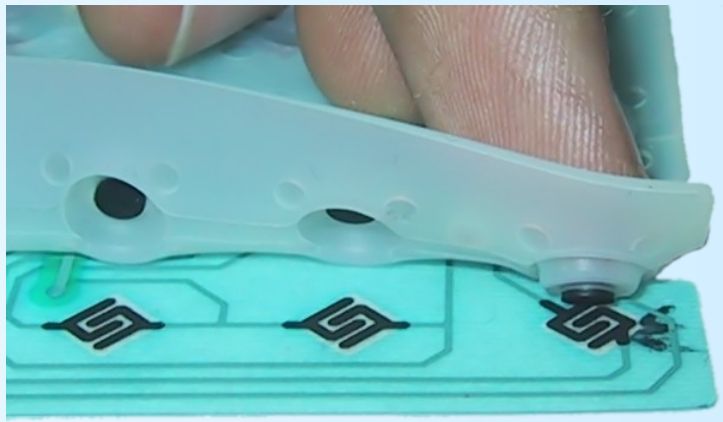
History of inp./outp. devices

PDP-1 r. 1960

Dome-switch keyboards

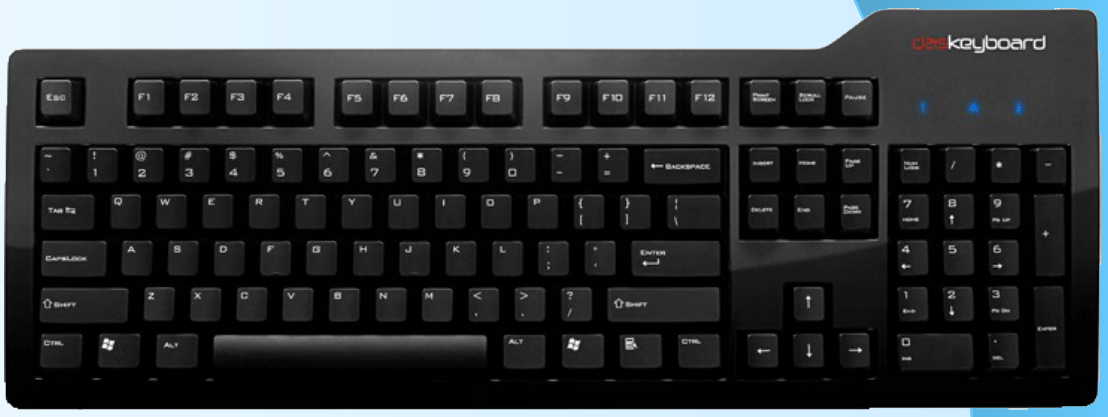
- They are currently the most used. They are easy and cheap.
- They use the technology of an older membrane keyboard.
- When a key is pressed, it collapses the dome, which connects the two circuit traces and completes the connection.
- Their durability is limited by the number of presses.
- They are used in mobile phones, remote controls, etc.





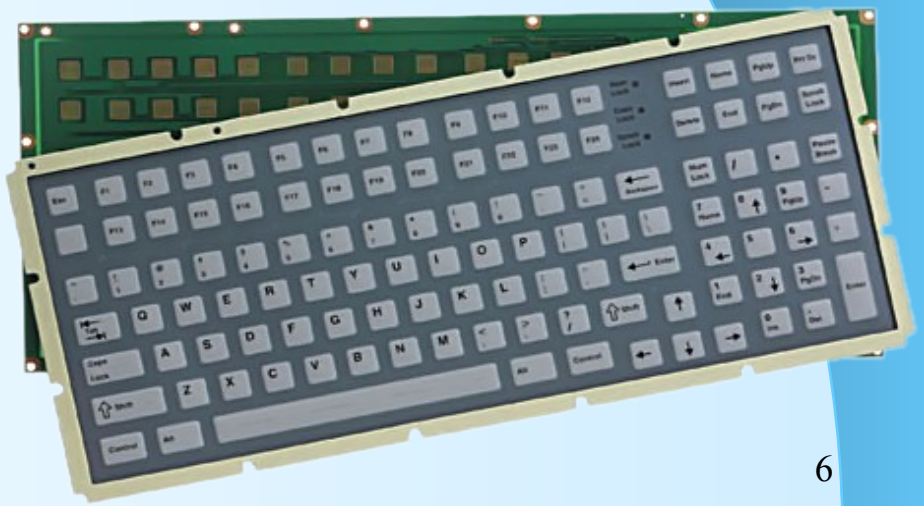
Mechanical keyboards

- It belongs to the oldest type of keyboards.
- They are very durable and heavier than the previous types. They are much more expensive.
- Pressing the button mechanically connects two contacts, as in the case of conventional switches.
- Each switch is composed of a housing, a spring, and a stem.



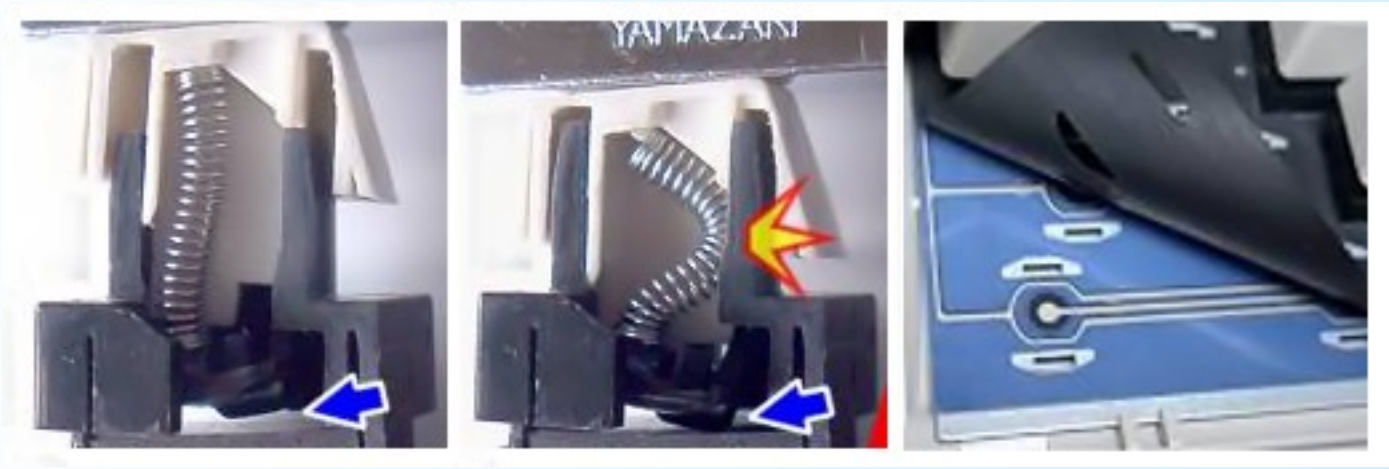
Membrane keyboard

- They were popular at the beginnings of personal computers in the 1970s.
- Keys are not separated. All are made up of one piece of rubber layer.
- When the user pushes down at a particular position, their finger pushes the front layer down through the spacer layer to close a circuit at one of the intersections of the grid.



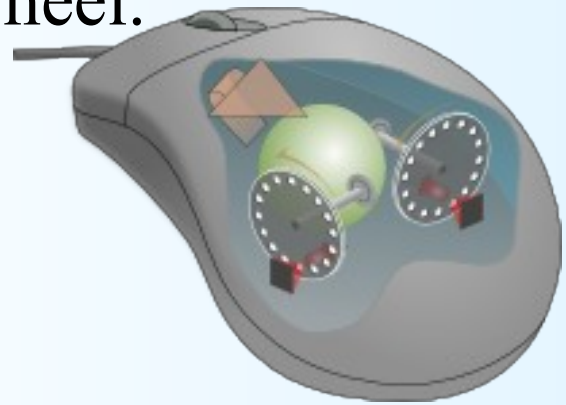
Spring keyboards

- This technology is mainly used by IBM.
- These are more expensive and more durable keyboards.
- The spring mechanism controls a small hammer that strikes a capacitive or membrane switch.
- The switch is responsible for the tactile and aural response of the keyboard.



Mechanical mouses

- This device was invented by *Engelbart* in 1968.
- When moving the mouse over the pad, the ball is rotated and the movement is transmitted to two small shafts. The first one is used for sensing the change of the *x*-position, the second one for *y*-position.
- The shafts rotate the wheel with holes that interrupt the light beam from the diode to the sensor. The number of interruptions per second determines the speed of movement.
- To determine the direction of movement, there are two pairs for each wheel.



Optical mouses

- They have been in use since 2000. – *Agilent Tech.* They have no moving parts, so they are dust-resistant.
- Mouse has a small, red LED that bounces light off that surface onto a CMOS sensor which sends each image to a DSP for analysis.
- Based on the analysis of image sequences, the DSP determines how the mouse moves.
- The laser also serves as a source of light. These mice are more accurate.
- They can not be used on glossy and translucent pads.

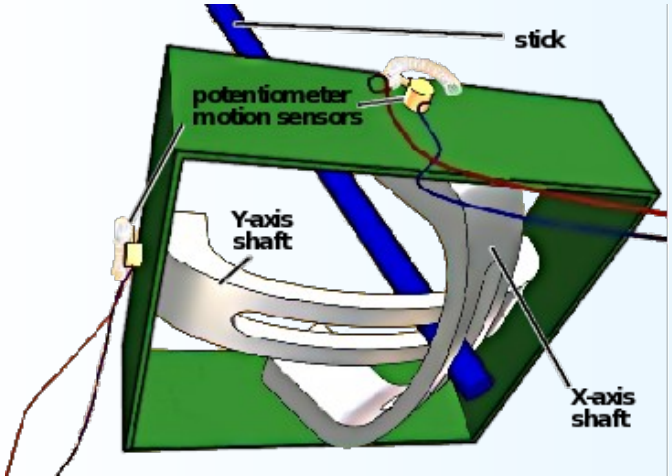
Trackball

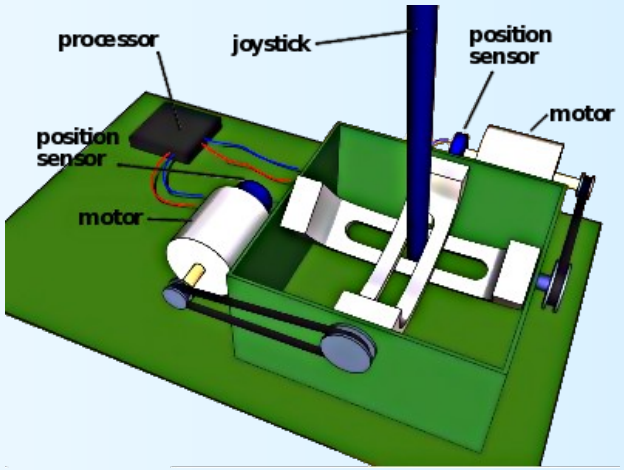
- This device was used earlier than a mouse.
- It worked on the same principle as a mechanical mouse with a ball.
- It was also used in laptops, later was replaced by a touchpad.

Joystick

Joysticks originated as controls for aircraft ailerons and elevators in 1908.

- 1944 *Germany* – used to guide anti-ship missile.
- 1980 *Atari* – game controller (arcades, flight simulators).
- **proportional** – The deviation is sensed in absolute coordinates. There are *digital* and *analog* types.
- **non proportional** – only the direction is given, the cursor position is calculated from how long the switch is on.
- Feedback - the lever creates resistance when moving, lever vibration.



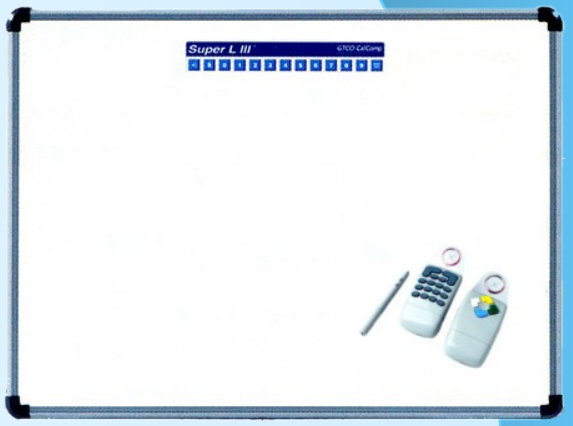


Trackpoint

- Replaces the mouse. It is mainly used in laptops.
- The device uses a force-sensitive sensor (*tensometric* joystick) that the user pushes (usually by a finger) the trackpoint.
- It uses a pair of tensometers for each direction *x*, *y* separately.
- The speed of cursor movement depends on the force used.

Touchpad, tablet

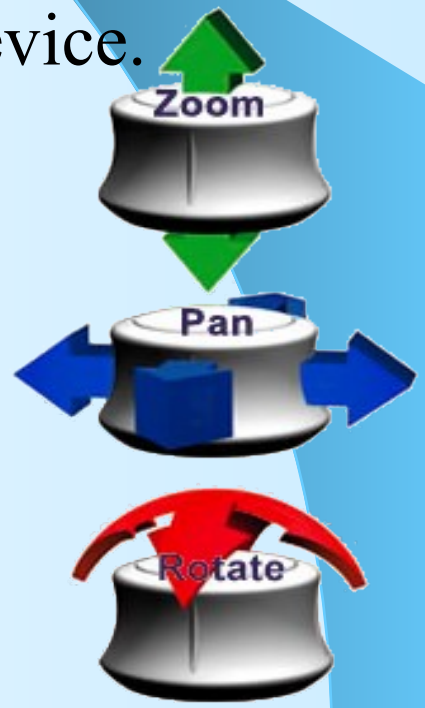
- **Touchpad** - replaces the mouse. It is mainly used in laptops and mobile phones. Capacitive technology is most used.
- The **tablet** and **digitizer** serve to record the position of the points. They most often use the principle of electromagnetic induction and resonance.



3D controller

It was first used by *NASA* to manipulate the Columbia shuttle arm. Now it is made by *3Dconnexion*.

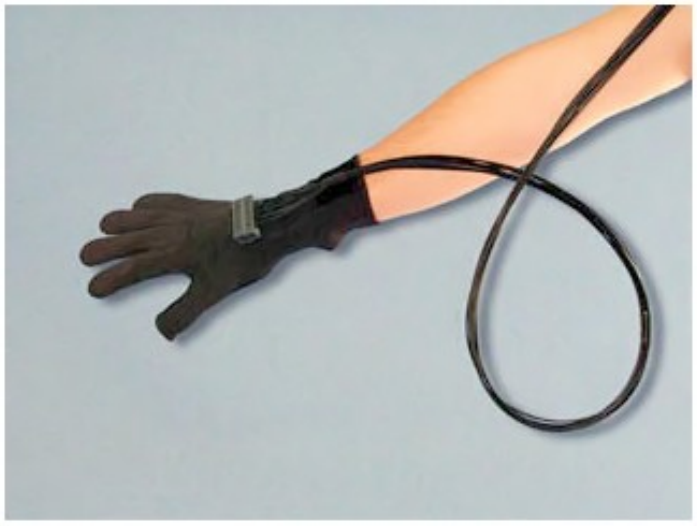
- Replaces the mouse. Used in modeling programs and in CAD/CAM, GIS applications.
- The device uses a sensor that is sensitive to the force the user is pushing on the surface of the device.



3D data glove

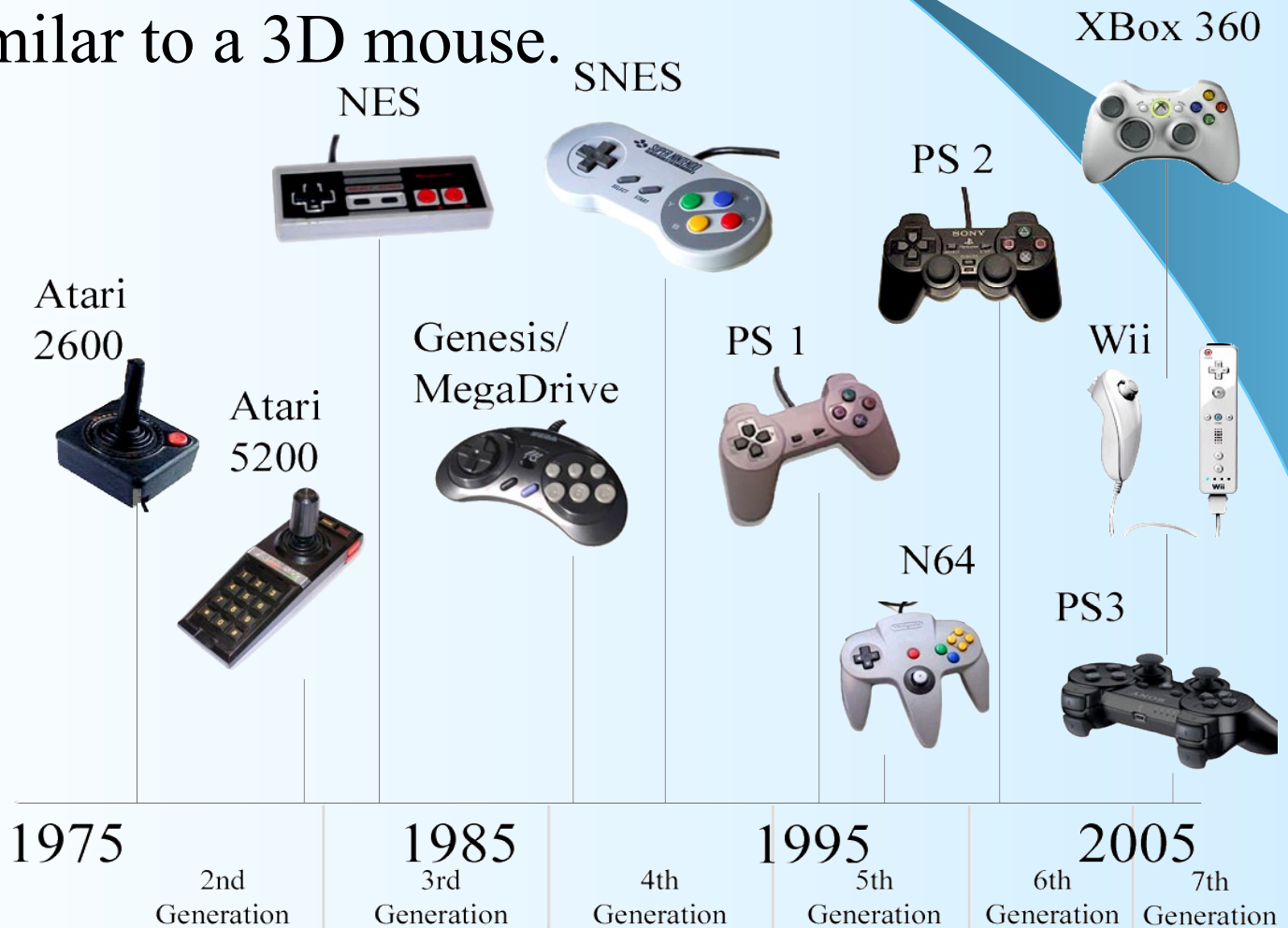
It's a *virtual reality* device (along with HMD). They are currently being manufactured at *5DT*.

- The device uses a series of sensors that respond to fingers bending in the glove. They often include inertial trackers to determine the position of the glove.
- Significantly more expensive types also allow feedback - simulation of touch.



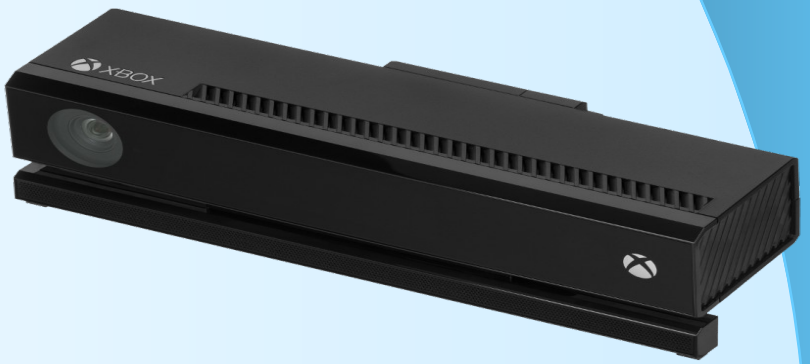
Game consoles

- They often use the same technologies as joysticks.
- The *Wii* console also uses a tracker and something similar to a 3D mouse.



Microsoft Kinect

- Motion (*mocap*) and sound recording device.
- It is used to control the application (games) using motion gestures and voice.
- It started selling in autumn 2010.
- Since 2014, the second version is selling.
- It was powered by *PrimeSense* technology (Israel).
- The Microsoft Kinect is no longer in production. RIP.



Kinect v1

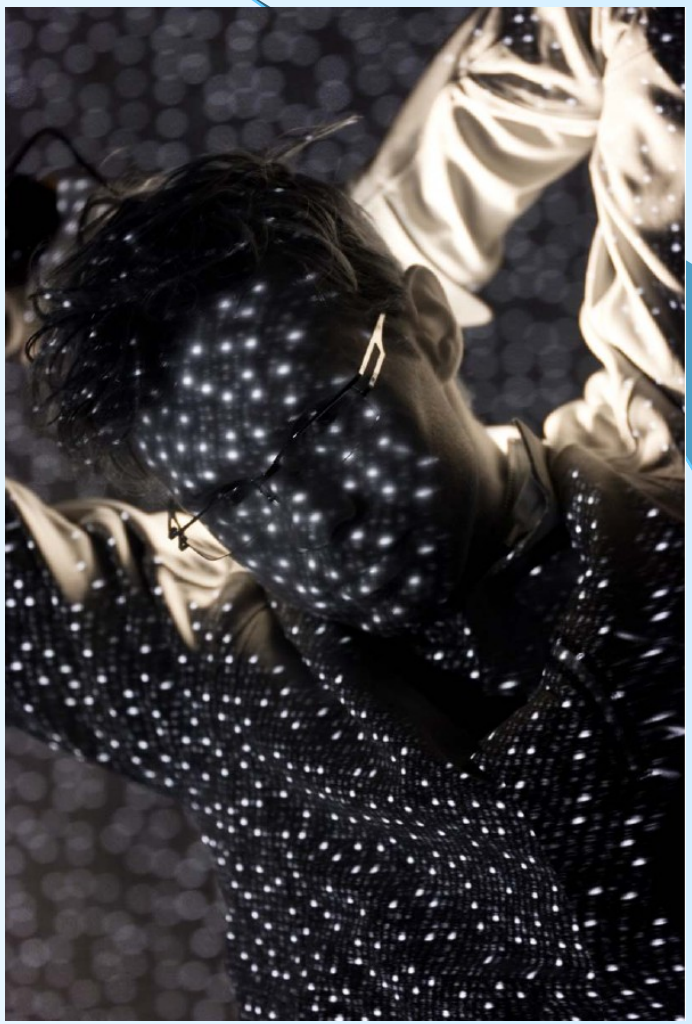
- VGA cam, RGB 32 bit CMOS 640 x 480 / 30fps
- IR cam, monochrom 16 bit 320 x 240 / 30fps
- 4 microphones
- Working range 1.2 – 3.5m
- Camera controlled by motors. ±27°
- Field of view H: ±57° V: ±43°
- Recognizes 6 people in field of view, two active players.
- Ability to track 20 joints per active player and map active players to Live Avatars.
- USB 2.0

Kinect v1 principle

- It uses a random structural pattern to create a depth map.
- The IR transmitter has an astigmatic lens – the pattern changes with respect to the position.
- It uses three kinds of patterns for three different depth ranges.
- The IR camera senses the reflected structural pattern.
- The processor determines the distance of individual structural points according to pattern deformation using a pre-calibrated map.

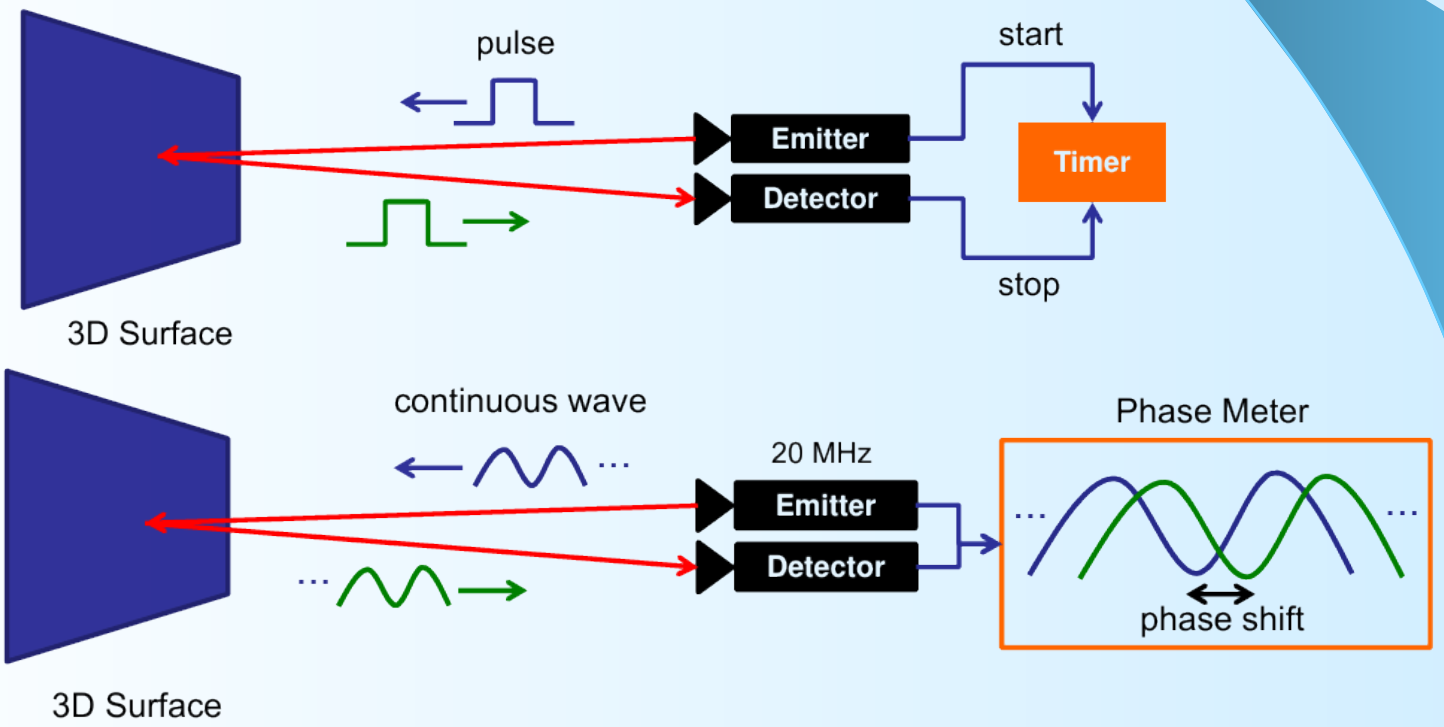
Kinect v1 principle

- It uses a random structural pattern to create a depth map.
- Region 1. up to 1.2m
- Region 2. 1.2 – 2.0m
- Region 3. 2.0 – 3.5m.



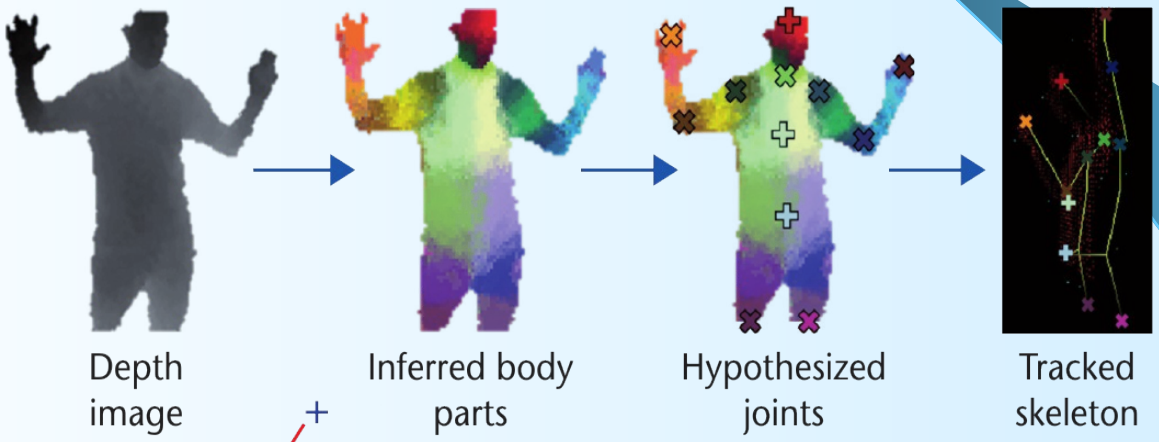
Kinect v2 principle

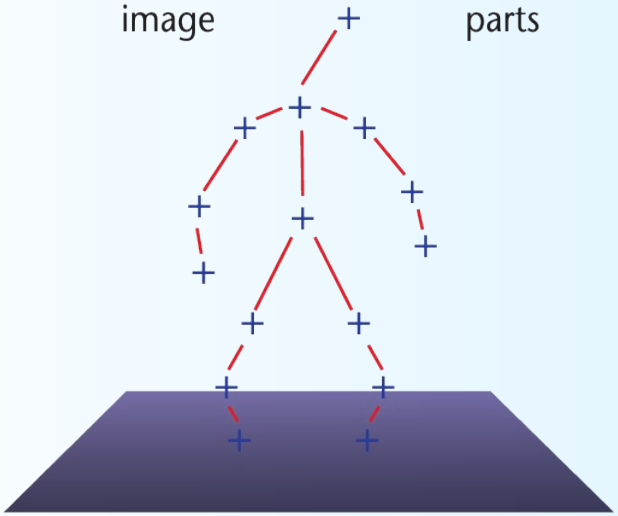
- It uses the Time-Of-Flight technique to create a depth map.
- A series of fast and short pulses and precisely modulated waves are used.

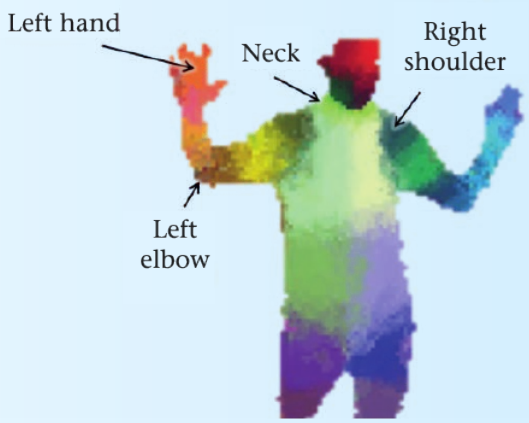


Kinect

- Using skeleton tracking, it creates a skeleton and tracks the moving player.







Kinect

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