

Discussion

- True or False, a goal as game programmers is to eliminate the need for artist
- True or False, a goal as game programmers is to provide artists with tools to help them do their work effectively
- What is your goal as a game programmer?

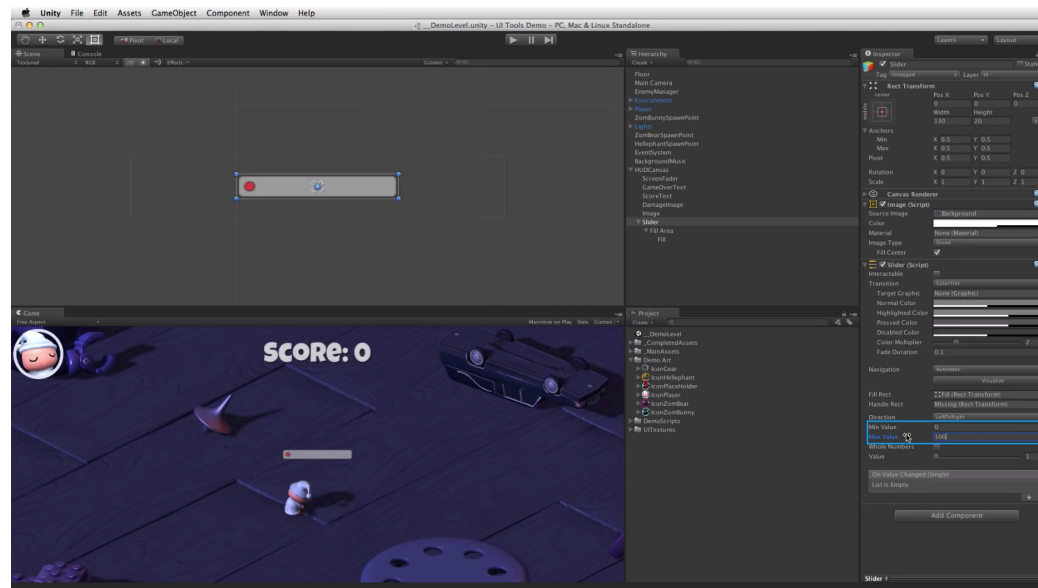
CS425 Game Programming

Human Interface Devices (HID)

Graphical User Interface

- What are the in-game user interfaces provided by
 - Unity

<https://unity3d.com/learn/tutorials/s/user-interface-ui>



- OGRE?

<https://ogrecave.github.io/ogre/api/latest/trays.html>

HIDs

- Joysticks
- Joypads
- Keyboards
- Mice
- Trackballs
- Wii remote
- Steering wheels
- Fishing rods
- Dance pads
- Electric guitars
- ...

What do we as programmers need to do to take advantage of them?



Specialized vs Adaptable

- Guitars, drum sets, and dance pads are rather specialized
- Wiimote is very flexible
 - Use in different orientations
 - Fit into steering wheel
 - Fit into gun

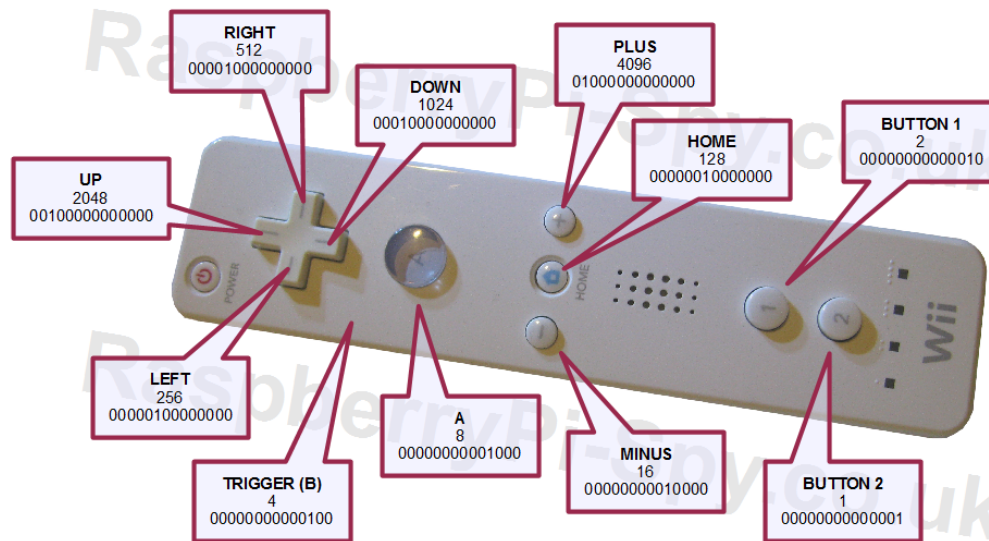


Interfacing with a HID

- All HIDs provide input to game software
- Some provide feedback from software to player
- Reads and writes by:
 - **Polling:** software asks hardware periodically (once per game loop)
 - Read hardware registers directly or I/O
 - Normally a software interface and protocol for this
 - **Interrupts:** HIDs send update to software when state of controller changes.
 - Hardware interrupt temporarily suspends CPU's operation to process interrupt
 - CPU processes interrupt and stores data for game loop to process
 - **Wireless Devices:**
 - Bluetooth protocol
 - Thread separate from main game loop to process
 - Looks to programmer like polled device

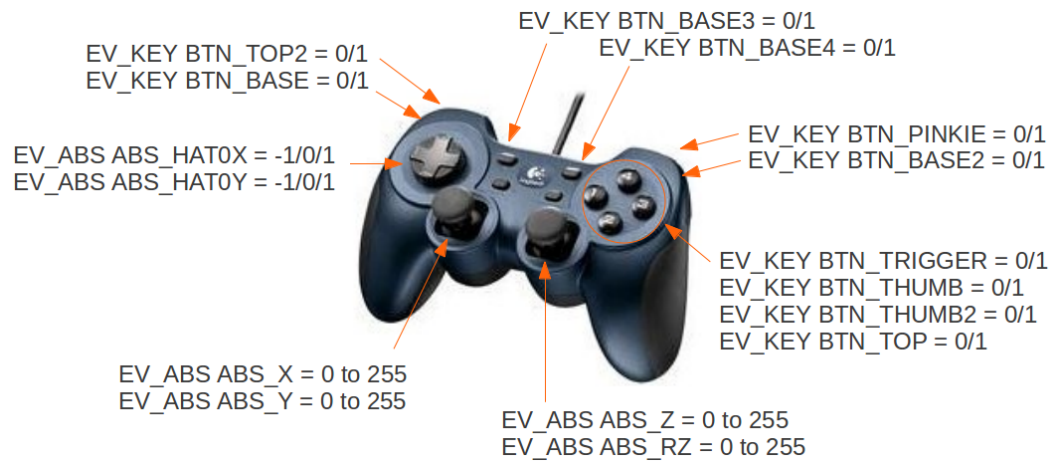
Types of Inputs: Buttons

- States: *pressed* and *not pressed* (down or up)
 - Represented by a single bit: 0 = up, 1 = down
 - States of all buttons packed into single unsigned integer
 - Types: WORD (16-bit unsigned int), BYTE, etc.
 - `#define XINPUT_GAMEPAD_DPAD_UP 0x0001 // bit 0`



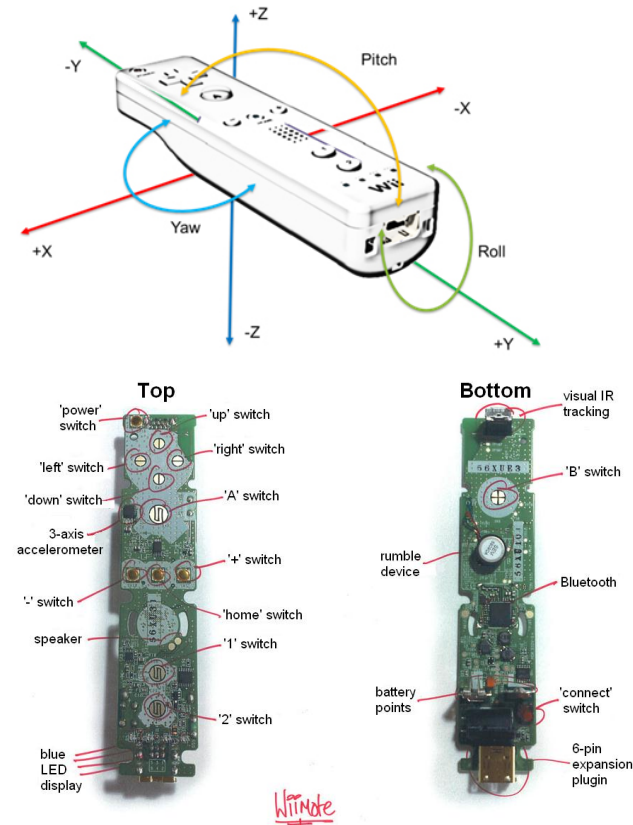
Types of Inputs: Analog Axes and Buttons

- Range of values, not just 0 and 1
- Amount of trigger or button press or position of joystick
- Analog signal normally digitized and represented with integer in software
- Might be converted to float between -1 and 1
- Might be converted to ints between 0 and 255
- Always trying to save space and time



Types of Inputs:

- Relative Axes:
 - Triggers and joysticks have absolute positions, including zero
 - Some input devices are relative: zero means the device hasn't moved.
 - Mice, mouse wheels, and trackballs
- Accelerometers
 - PS DualShock and Wiimote
 - Detect acceleration along x, y, and z axes
 - Relative analog inputs
 - Used to estimate the orientation of the controller
 - Would they work in space?
 - How accurate are they?



Types of Inputs: Cameras

- Wiimote has IR sensor (essentially low-res camera)
 - Records a 2D IR image of whatever it is pointing at
 - Sensor bar contains 2 IR light emitting diodes (LEDs)
 - 2 bright dots are picked up by the IR camera
 - Isolates location and size of dots and send info to console through Bluetooth
 - Yaw, pitch, and roll of Wiimote can be calculated from line segment
 - Length of line used to determine distance from bar
- PS3 Eye/Camera: high-res color camera
 - Web-cam, position, orientation, depth
 - Move controller
- MS Kinect system



Type of Outputs

- Rumble: vibrate in player's hands
 - Motors, each of which rotates a slightly unbalanced weight at various speeds
- Force-feedback:
 - Actuator is driven by a motor to slightly resist motion of human operator
 - Arcade driving games
- Audio: stand alone engine system
 - Wiimote: small, low-quality speaker
 - Headphone jacks
- Other inputs and outputs too...



<http://www.virtuix.com/>





https://youtu.be/7ubxcSS_GXc

<https://www.youtube.com/watch?v=7uO8Z34f0xE>

<https://youtu.be/fvu5FxKuqdQ?t=2m42s>


VIVE


oculus



Game Engine HID Systems

- Dead zones (0 isn't 0)
 - Dead Zone specifies a certain delta within which values get clamped down to Zero
- Analog signal filtering
 - get rid of noise
- Event detection
- Detection of **button sequences** and multi-button combos
- Gesture detection
- Management of multiple HIDs for multiple players
- Multiplatform HID support
- Controller input remapping
- Context-sensitive inputs
- Ability to disable certain inputs

- Just shiny objects?
- How much work is needed to get them to work?
 - Unity?
 - OGRE?