AFFECTIVE COMPUTING AND INTERACTION IN VR

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WITH UNITY V2022.3.5

AFFECTIVE COMPUTING

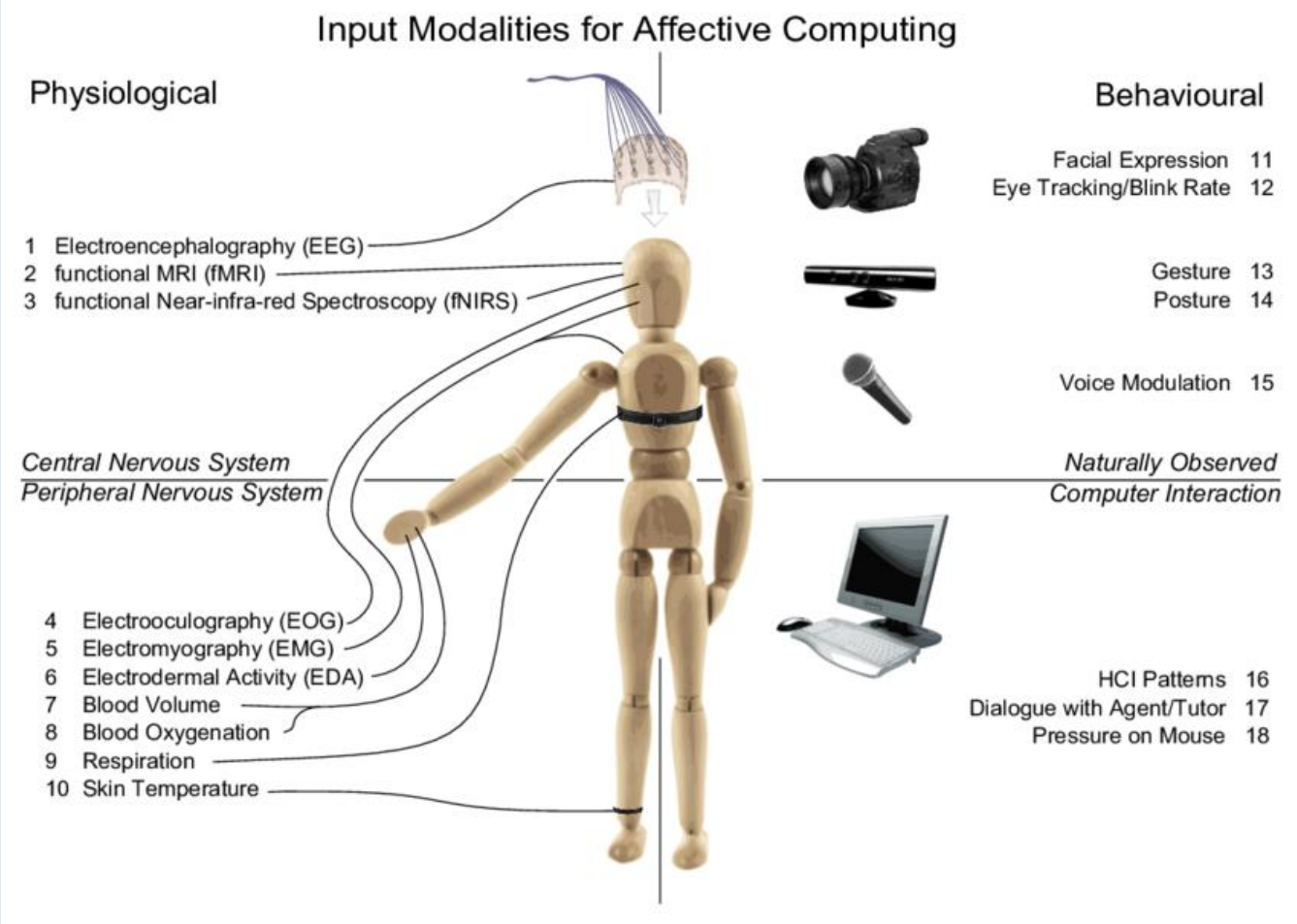
AFFECTIVE COMPUTING (AC)

Picard R. (1995)

Affective Computing (AC) aims at developing systems which can automatically recognize emotions to give adequate responses

Standard methods:

- Face tracking via cameras
- Voice tracking via microphones
- Physiological signals via sensors
- …



AC APPLICATION

- **Education:** cameras or microphones can be used to understand students' emotional states during lessons helping teachers to adapt themselves to tailor class load
- **Healthcare:** bots can monitor physical and emotional well-being of patiens or help doctors in counseling sessions
- **Marketing**: AC can analyze what makes customers engaged or their reactions to new products and companies could organize accordingly
- **Entertainement:** gaming companies can use AC for testing their games monitoring players' satisfaction level, but AC can be also useful to support the game adaptation to players' mental state
- …

AC TECHNIQUES IN VR

- Face tracking
- Eye tracking
- Voice signal
- Motion-behavioral data
- …

OVRInput

OVR INPUT

With OVRInput it is possible to track input features that you can take advantage of when you design user interactions

Data:

- Positions
- Rotations
- Touch
- Buttons
- Joysticks

Control	Enumerates
`OVRInput.Button`	Traditional buttons found on gamepads, controllers, and back button.
`OVRInput.Touch`	Capacitive-sensitive control surfaces found on the controller.
`OVRInput.NearTouch`	Proximity-sensitive control surfaces found on the controller.
`OVRInput.Axis1D`	One-dimensional controls such as triggers that report a floating point state.
`OVRInput.Axis2D`	Two-dimensional controls including thumbsticks. Reports a Vector2 state.

Map Controllers | Oculus Developers

OVR INPUT USAGE

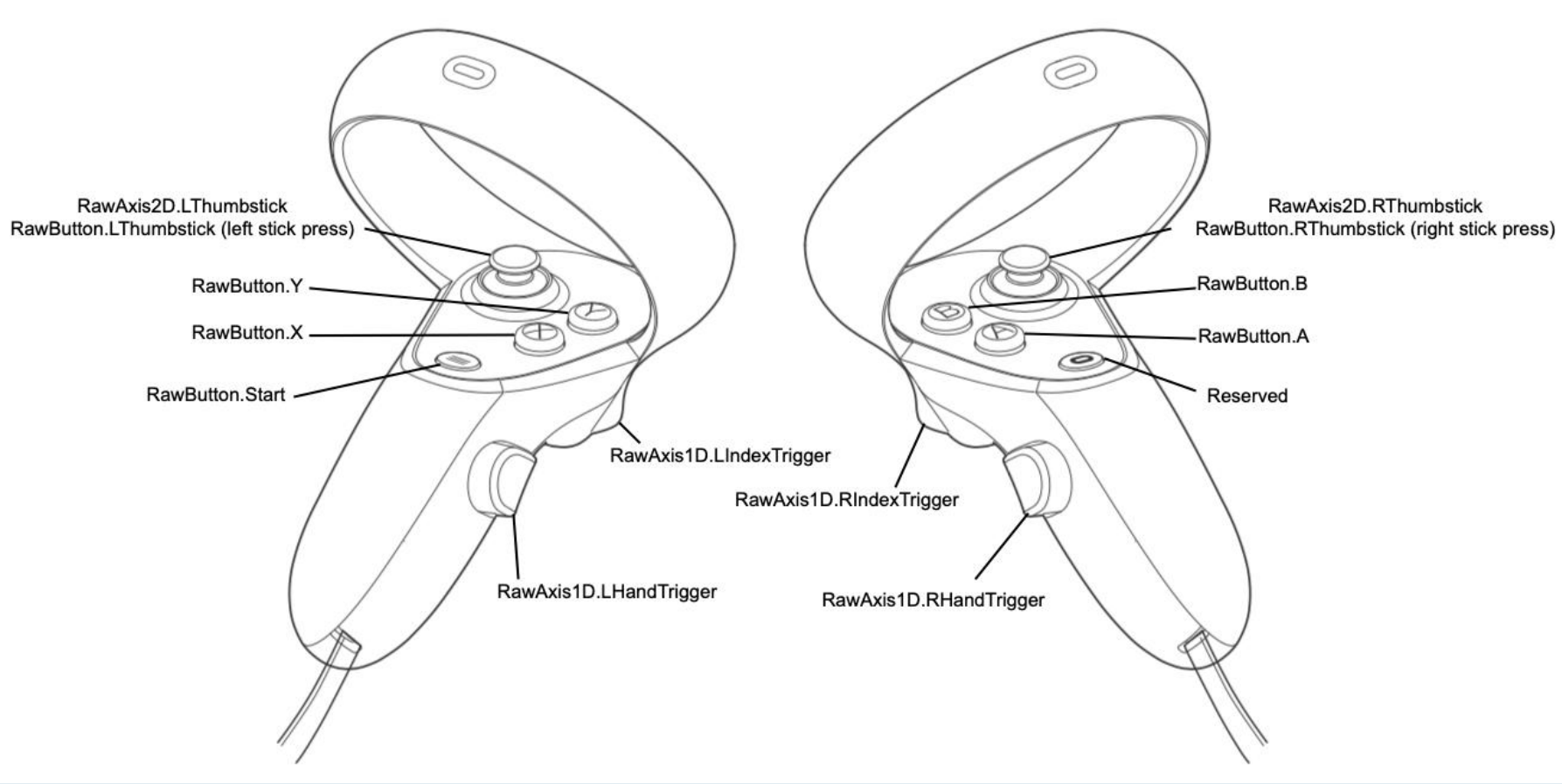
The primary usage of OVRInput is to access controller input state through:

- **Get()** queries the current state of a controller
- **GetDown()** queries if a controller was pressed this frame
- **GetUp()** queries if a controller was released this frame

You can access:

- Virtual mapping: provides a virtualized input mapping (smoothed)
- Raw mapping: directly exposes the controllers

RAW CONTROLLER MAPPING



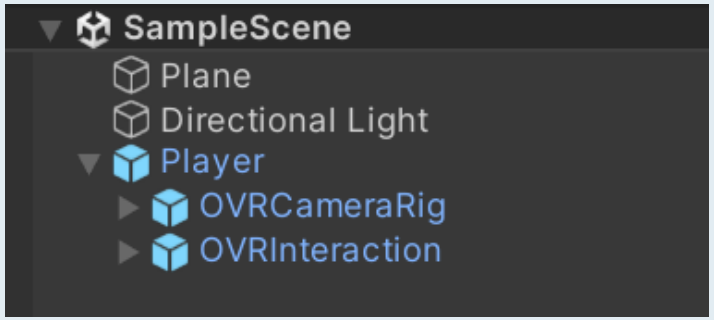
INITIALIZATION 1/2

1. Download the ‘Ex05-01’ folder from github and open the OVRInput_Demo Unity project

Create a scene without camera and with a plane

2. Drag the **Player prefab** in the Hierarchy

3. Create a script and call it ‘**OVRInput_tracker**’



INITIALIZATION 2/2

We need a function to save the timestamp:

```
public static string GetTimestamp()
{
    return DateTime.UtcNow.ToString(format: "yyyy-MM-dd' 'HH:mm:ss.fff");
}
```

We need to check the presence of the controllers (both left and right) and the head:

- If left/right controller/head found -> data are valid
- If left/right controller/head not found -> data are not valid

```
if (OVRInput.IsControllerConnected(OVRInput.Controller.RTouch) && OVRInput.IsControllerConnected(OVRInput.Controller.LTouch))
```

```
if (OVRPlugin.GetNodePositionTracked( OVRPlugin.Node.Head ))
```

Put them in the FixedUpdate()

FEATURES

Different values from controllers:

- Position, velocities -> Vector3
- Orientation -> Quaternion
- Button pressure -> float (range 0-1)
- Button pressed -> int [0-1]
- Thumbstick position -> Vector2

Different values from HMD:

- Position, velocities -> Vector3
- Orientation -> Quaternion

HEAD

In order to take the reference of the player's head:

```
OVRPlugin.Node.Head
```

In order to take the head position, orientation, and velocities:

```
OVRPose pose = OVRPlugin.GetNodePose(node, OVRPlugin.Step.Render).ToOVRPose();
Vector3 position = pose.position;
Vector3 velocity = OVRPlugin.GetNodeVelocity(node, OVRPlugin.Step.Render).FromVector3f();
Vector3 angVelocity = OVRPlugin.GetNodeAngularVelocity(node, OVRPlugin.Step.Render).FromVector3f();
Quaternion orientation = pose.orientation;
```

CONTROLLERS

In order to reference, e.g., the left controller of the Quest Pro:

```
OVRInput.Controller.LTouch
```

In order to take the controller position, orientation, and velocities:

```
Vector3 position = OVRInput.GetLocalControllerPosition(controller);
Vector3 velocity = OVRInput.GetLocalControllerVelocity(controller);
Vector3 angVelocity = OVRInput.GetLocalControllerAngularVelocity(controller);
Quaternion orientation = OVRInput.GetLocalControllerRotation(controller);
```

BUTTONS

```
/// Raw button mappings that can be used to directly query the state of a controller.
public enum RawButton
{
    None                    = 0,          ///< Maps to Physical Button: [Gamepad, Touch, LTouch, RTouch, Remote: None]
    A                       = 0x00000001, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: A], [LTouch, Remote: None]
    B                       = 0x00000002, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: B], [LTouch, Remote: None]
    X                       = 0x00000100, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: X], [RTouch, Remote: None]
    Y                       = 0x00000200, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: Y], [RTouch, Remote: None]
    Start                   = 0x00100000, ///< Maps to Physical Button: [Gamepad, Touch, LTouch, Remote: Start], [RTouch: None]
    Back                    = 0x00200000, ///< Maps to Physical Button: [Gamepad, Remote: Back], [Touch, LTouch, RTouch: None]
    LShoulder               = 0x00000800, ///< Maps to Physical Button: [Gamepad: LShoulder], [Touch, LTouch, RTouch, Remote: None]
    LIndexTrigger           = 0x10000000, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LIndexTrigger], [RTouch, Remote: None]
    LHandTrigger            = 0x20000000, ///< Maps to Physical Button: [Touch, LTouch: LHandTrigger], [Gamepad, RTouch, Remote: None]
    LThumbstick             = 0x00000400, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LThumbstick], [RTouch, Remote: None]
    LThumbstickUp           = 0x00000010, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LThumbstickUp], [RTouch, Remote: None]
    LThumbstickDown         = 0x00000020, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LThumbstickDown], [RTouch, Remote: None]
    LThumbstickLeft         = 0x00000040, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LThumbstickLeft], [RTouch, Remote: None]
    LThumbstickRight        = 0x00000080, ///< Maps to Physical Button: [Gamepad, Touch, LTouch: LThumbstickRight], [RTouch, Remote: None]
    LTouchpad               = 0x40000000, ///< Maps to Physical Button: [Gamepad, Touch, LTouch, RTouch, Remote: None]
    RShoulder               = 0x00000008, ///< Maps to Physical Button: [Gamepad: RShoulder], [Touch, LTouch, RTouch, Remote: None]
    RIndexTrigger           = 0x04000000, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RIndexTrigger], [LTouch, Remote: None]
    RHandTrigger            = 0x08000000, ///< Maps to Physical Button: [Touch, RTouch: RHandTrigger], [Gamepad, LTouch, Remote: None]
    RThumbstick             = 0x00000004, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RThumbstick], [LTouch, Remote: None]
    RThumbstickUp           = 0x00001000, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RThumbstickUp], [LTouch, Remote: None]
    RThumbstickDown         = 0x00002000, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RThumbstickDown], [LTouch, Remote: None]
    RThumbstickLeft         = 0x00004000, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RThumbstickLeft], [LTouch, Remote: None]
    RThumbstickRight        = 0x00008000, ///< Maps to Physical Button: [Gamepad, Touch, RTouch: RThumbstickRight], [LTouch, Remote: None]
    RTouchpad  = unchecked((int)0x80000000),///< Maps to Physical Button: [Gamepad, Touch, LTouch, RTouch, Remote: None]
    DpadUp                  = 0x00010000, ///< Maps to Physical Button: [Gamepad, Remote: DpadUp], [Touch, LTouch, RTouch: None]
    DpadDown                = 0x00020000, ///< Maps to Physical Button: [Gamepad, Remote: DpadDown], [Touch, LTouch, RTouch: None]
    DpadLeft                = 0x00040000, ///< Maps to Physical Button: [Gamepad, Remote: DpadLeft], [Touch, LTouch, RTouch: None]
    DpadRight               = 0x00080000, ///< Maps to Physical Button: [Gamepad, Remote: DpadRight], [Touch, LTouch, RTouch: None]
    Any                     = ~None,      ///< Maps to Physical Button: [Gamepad, Touch, LTouch, RTouch, Remote: Any]
}
```

You can reference a specific button of your controller, by accessing controllers mapping

For example, if you want have a reference of the left trigger:

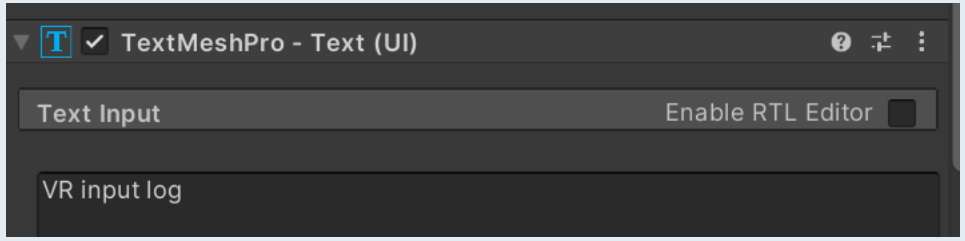
```
(OVRInput.RawButton.LIndexTrigger)
```

OVR INPUT CONSOLE

For example, if we want to get the float value of the pressure on the left controller trigger:

```
OVRInput.RawAxis1D.LIndexTrigger
```

1. In your scene, create a new UI with right mouse click in the Hierarchy > Canvas and set its render mode to World Space
2. Select the Canvas object and right mouse click > UI > TextMeshPro, when promped click Import TMP Essentials
3. Scale the Canvas and the Text and place them in front of the Player prefab
4. Select the Text object and, in TextMeshPro - Text component, change ‘New Text’ into ‘VR input log’



LOGS

1. You need two fields:
    1. A public TextMeshProUGUI which defines the area where we want to display logs
    2. A private int to define the max num of lines allowed

2. You need also a function to print the logs and a function to clear the lines where the maximum allowed is reached:

```
2 riferimenti
public static string GetTimestamp()
{
    return DateTime.UtcNow.ToString(format: "yyyy-MM-dd' 'HH:mm:ss.fff");
}

1 riferimento
private void LogInfo(string message)
{
    ClearLines();
    logsArea.text += $"{GetTimestamp()} {message}\n";
}

1 riferimento
private void ClearLines()
{
    if (logsArea.text.Split('\n').Count() >= maxLines)
    {
        logsArea.text = string.Empty;
    }
}
```

PRINT LEFT CONTROLLER LOGS

1. In the FixedUpdate() function, we need to call the CollectOVRInputControllerButtonData() function

```
CollectOVRInputControllerButtonData();
```

2. We will print the logs calling the LogInfo() function and giving it as input the triggerValue

```
private void CollectOVRInputControllerButtonData()
{
    float triggerValue = OVRInput.Get( OVRInput.RawAxis1D.LIndexTrigger );

    LogInfo(triggerValue.ToString());
}
```

N.B. we call the functions only if the target device has been found

RESULTS

- In the Hierarchy, create a new empty GO with: right mouse click > Create Empty and call it ‘Input Manager’
- Attach the ‘OVRInput_tracker’ script to the Input Manager GO by dragging it to the GO
- Assign the ‘Text (TMP)’ object (children of Canvas) to the ‘Log Area’ variable
- Press Play