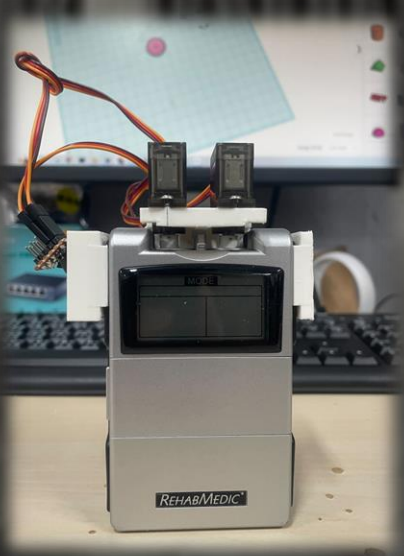


Servo-EMS for Unity

<https://github.com/BrianGodd/Servo-EMS-for-Unity>

Contributors

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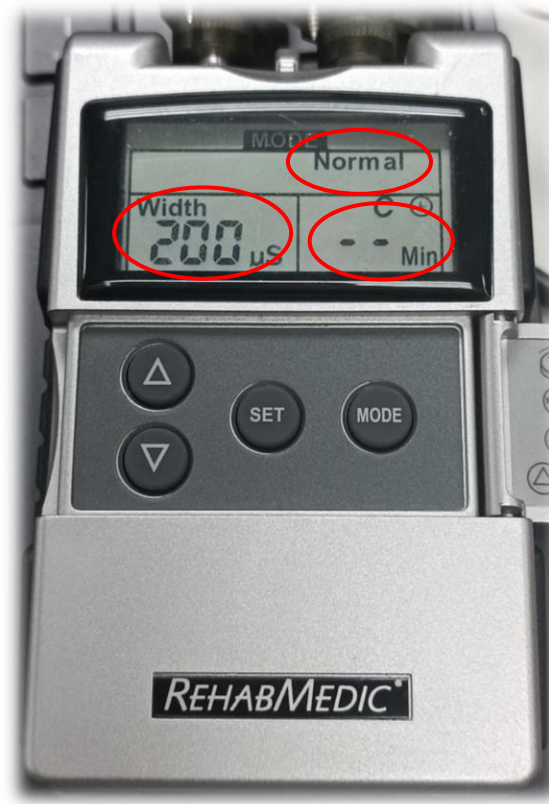
Introduce our Hardware

- EV-804 TENS
- MG90D Micro Servo*2
- Arduino Seeed (esp32-c3)



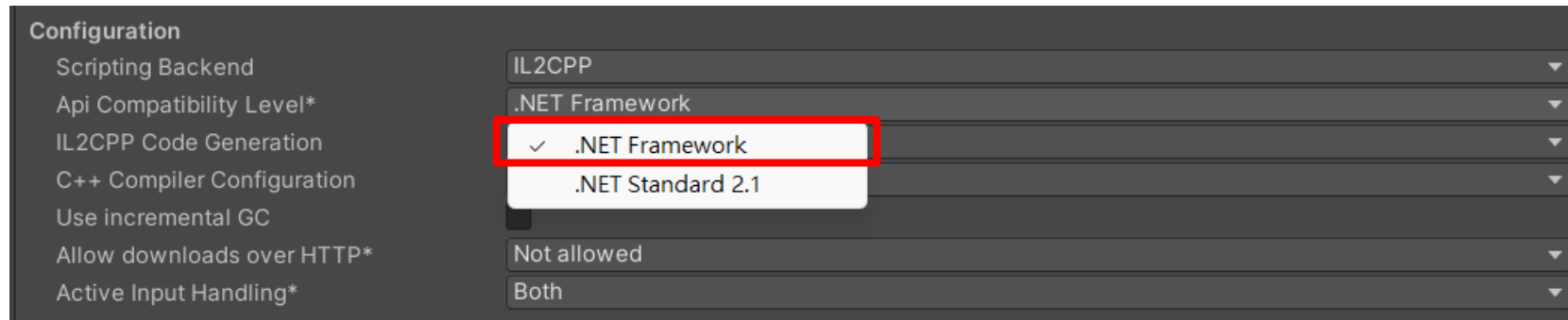
Setting the EV-804 TENS

- Switch to Normal Mode
- Width for 200 μ s (pulse duration)
- Rate for 90 ~ 100 Hz (frequency)
- Stimulate time to “- -”
(we will control by Unity)



Environment & Setting

- Unity 2022.3.xxf1 up
- Player Setting>Player>Other Settings>Configuration, Api set to “.Net Framework”



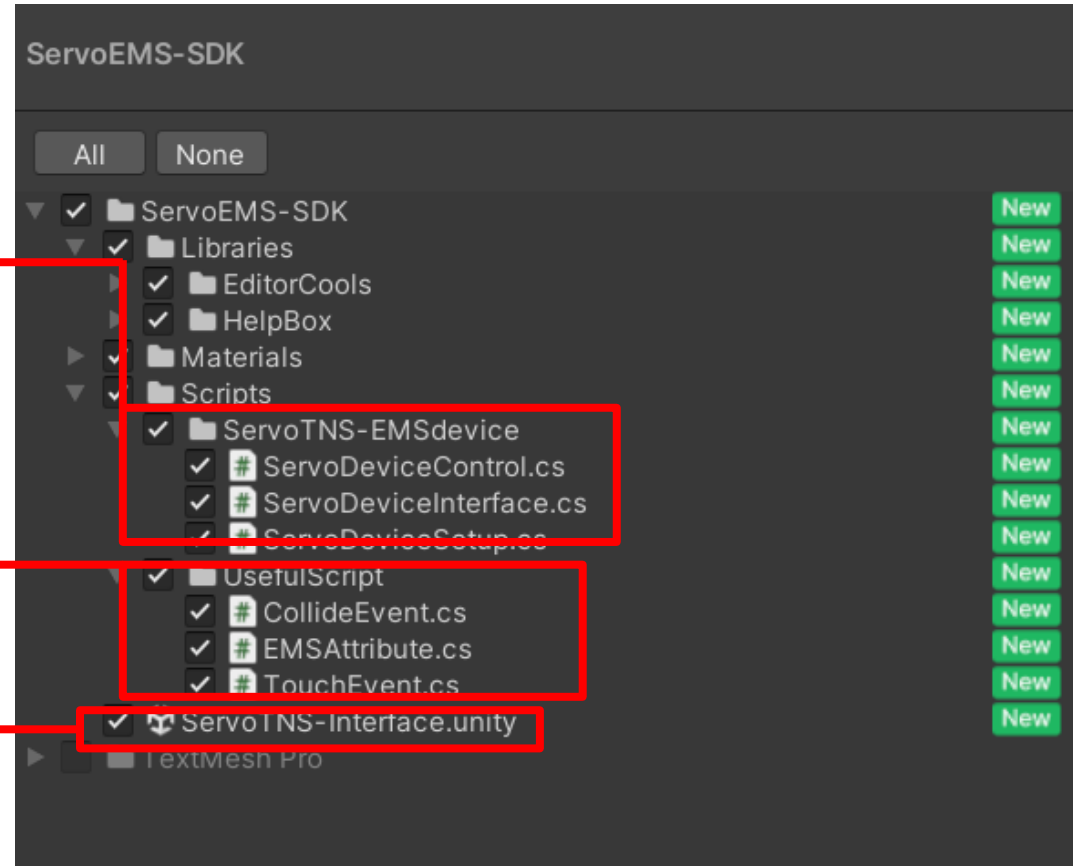
- Import Package: [ServoEMS-SDK.unitypackage](https://servoems.com/unitypackage)

Introduce our SDK : Package

EMS Control System Code
(include **Setup**, **Board Control**
and UI Interface)

Useful trigger example script
(UI, Collide, Touch)

Example UI-Control Scene



Introduce our SDK : *ServoDeviceSetup.cs*

1) Open serial when start running

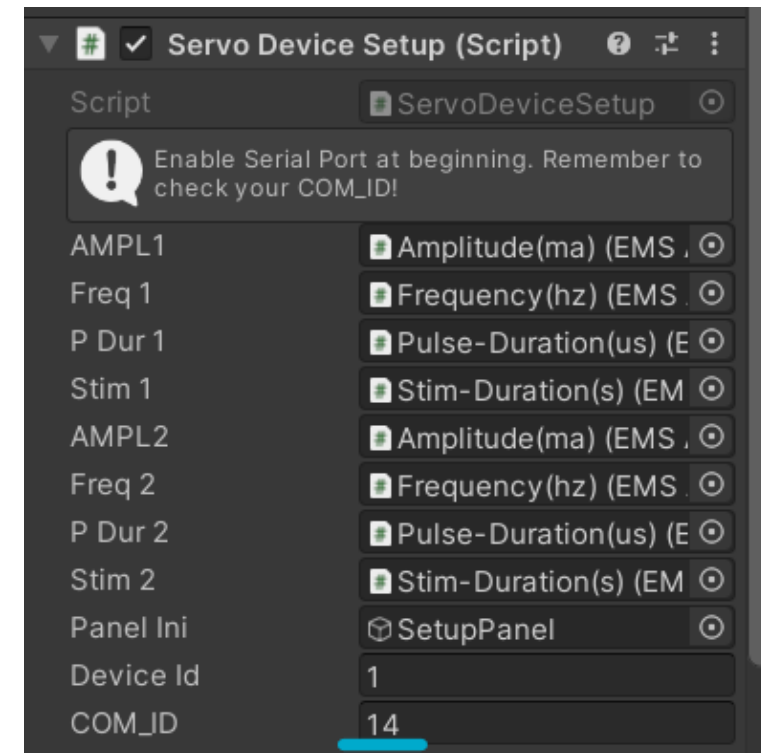
```
private void EnableDeviceSerialPort()
{
    this.DeviceSerialPort = new SerialPort("COM" + COM_ID.ToString(), baudRate, parity, dataBits, stopBits);
    try
    {
        DeviceSerialPort.Open();
        Debug.Log("System Open Device_" + deviceId.ToString() + " Serial Port Success.");
    }
    catch (Exception emsg) {
        Debug.LogWarning("Warning: " + emsg.Message);
    }
}
```

2) Set initial value when open success

```
//set Initial Channel1
AMPL1.SetNow(0);
Freq1.SetNow(90);
PDur1.SetNow(200);
Stim1.SetNow(0);
```

```
//set Initial Channel2
AMPL2.SetNow(0);
Freq2.SetNow(90);
PDur2.SetNow(200);
Stim2.SetNow(0);
```

3) Remember to check the COM_ID
(at Device Management)



Introduce our SDK : *ServoDeviceControl.cs*

- Stimulation Mechanism

Value Kind

- 1) IncreaseIntense()
- 2) DecreaseIntense()
- 3) DirectSetIntense()
- 4) DirectSetBothIntense()
- 5) SetValue()

Stimulate Kind

- 1) StartStim()
- 2) StartStimBoth()
- 3) StopStim()

Cluster Kind - IEnumerator Function

- 1) StimWholeAction(ampl, time, ampl2, time2)
- 2) StimWithTimeGap(channel, minAmpl, maxAmpl, degree, time_gap)

Introduce our SDK : *ServoDeviceControl.cs*

- Stimulation Function Example
 - 1) StimElectro() : Short-time stimulate (Touch Pikachu kind)
 - 2) StimFootUp() : Long-time stimulate (Walk on the Slope kind)
 - 3) StimPickUpL() : Increasing stimulate with time gap (Pick up Box kind)

***** Remember the limit of stimulate time !!!**

Servo turn 1 degree, the stimulate time will be at least 0.00268s.

For example:

Turn to **100ma/202 degree** , which is the **maximum AMPL**

$\Rightarrow 202 * 0.00268 = 0.54136(s)$

$\Rightarrow 0.54136 * 2 = 1.08272(s)$, includes **turn back**

Example Trigger : *TouchEvent.cs*

- StimElectro() Example at Touching the Pikachu
 - 1) isTouch: Switch of touch state
 - 2) master: SerialDeviceContorl.cs
 - 3) Layer == 13: Hand layer(13)



In the Demo, we use TouchEvent to stimulate User when touching the Pikachu.

```
void OnTriggerEnter(Collider other)
{
    if(other.gameObject.layer == 13 && !isTouch)
    {
        isTouch = true;
        master.StimElectro();
        if(!sound.isPlaying) sound.Play();
    }
}

void OnTriggerExit(Collider other)
{
    if(other.gameObject.layer == 13)
    {
        isTouch = false;
    }
}
```

Example UI-Control Scene

Command: Set Channel 2 Intense - 0

The UI is divided into two main sections: Channel 1 (blue background) and Channel 2 (brown background). Each section has a 'Now' value, a 'Set' value, and a 'Set' button. Channel 1's 'Set' value for Amplitude is 30, and its 'Set' value for Stim-Duration is 0.3248. Channel 2's 'Set' value for Amplitude is 50, and its 'Set' value for Stim-Duration is 2. Red circles highlight the 'Set' value for Amplitude in Channel 1 (30), the 'Set' button for Amplitude in Channel 1, the 'Set' value for Stim-Duration in Channel 1 (0.3248), the 'Start' button for Channel 1, the 'Start' button for Channel 2, and the 'Test' button for Channel 2. Blue boxes highlight the 'StartStimBoth()' label, the 'Start' button for Channel 1, and the 'StimWithTimeGap() to test the comfortable AMPL' label. A red box highlights the 'would auto setting to the smallest duration' label.

Channel 1

Amplitude (ma) Now 30 Set 30 Set

Frequency (hz) Now 90 Set Set

Pulse-Duration(us) Now 200 Set Set

Stim-Duration(s) Now 0 Set 0.3248 Set

Test Start

Channel 2

Amplitude (ma) Now 50 Set 50 Set

Frequency (hz) Now 90 Set Set

Pulse-Duration(us) Now 200 Set Set

Stim-Duration(s) Now 2 Set 2 Set

Start

Test

StartStimBoth()

Start

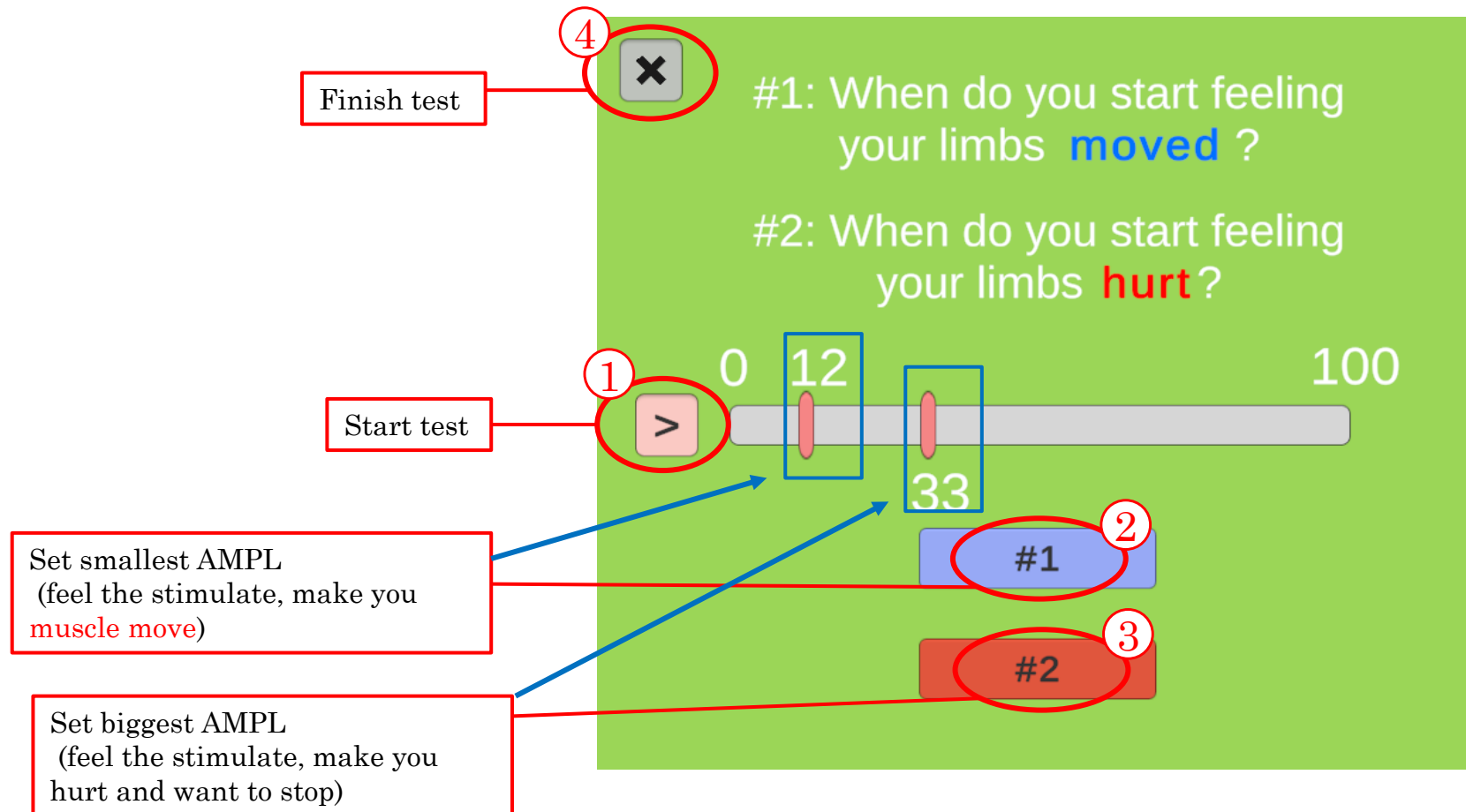
StartStim(ch)

StimWithTimeGap() to test the comfortable AMPL

would auto setting to the smallest duration

Example UI-Control Scene

- Test Panel





Thanks for reading!

Create your own trigger event to stimulate!

Create your own stimulate behavior!

Create feedback and fun in your design!

QA Contact information: brianbaby0409@gmail.com