Build an Xbox Controller Abstraction Layer in Python Using XInput API

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In the previous part of the tutorial, you've made Python to detect gamepad input. So far, so good. In this one, you will:

- Write a stub of a wrapper class.
- Add a configuration file.

Let's start, shall we?

The Wrapper

Start with creating an XInput class of your own. We need a way to tell the script which gamepad is connected and what settings to use:

```python
from configparser import ConfigParser


class XInput:
    def __init__(self, config_file, gamepad_number=0):
        self.gamepad_number = gamepad_number
        self.state = XInputState()
        self.gamepad = self.state.Gamepad
        config = ConfigParser()
        config.read(config_file)
        self.config = config['gamepad']
```

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- Pass configuration (a path to an `ini` file; more on it in a while) file and gamepad number to initialize method. Despite the variable appearance, I won't cover handling multiple input devices, but the option's there if you need it.
- Init the state.
- Read the config ad assign the `gamepad` section to the class variable `config`.

Next, some constants need to get defined:

```python
class XInput:
    API = ctypes.windll.xinput1_4
    TRIGGERS = {
        'LEFT_TRIGGER': 'bLeftTrigger',
        'RIGHT_TRIGGER': 'bRightTrigger',
    }
    THUMBS = {
        'LEFT_THUMB_X': 'sThumbLX',
        'LEFT_THUMB_-X': 'sThumbLX',
        'LEFT_THUMB_Y': 'sThumbLY',
        'LEFT_THUMB_-Y': 'sThumbLY',
        'RIGHT_THUMB_X': 'sThumbRX',
        'RIGHT_THUMB_-X': 'sThumbRX',
        'RIGHT_THUMB_Y': 'sThumbRY',
        'RIGHT_THUMB_-Y': 'sThumbRY',
    }
    AXES = {
        **TRIGGERS,
        **THUMBS
    }
    BUTTONS = {
        'DPAD_UP': 0x0001,
        'DPAD_DOWN': 0x0002,
        'DPAD_LEFT': 0x0004,
        'DPAD_RIGHT': 0x0008,
        'START': 0x0010,
        'BACK': 0x0020,
        'LEFT_THUMB': 0x0040,
        'RIGHT_THUMB': 0x0080,
        'LEFT_SHOULDER': 0x0100,
        'RIGHT_SHOULDER': 0x0200,
        'A': 0x1000,
        'B': 0x2000,
        'X': 0x4000,
        'Y': 0x8000
    }
    TRIGGER_MAGNITUDE = 256
    THUMB_MAGNITUDE = 32768
    MOTOR_MAGNITUDE = 65535
    ERROR_SUCCESS = 0
```

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Lots of stuff, but it's mostly just mapping:

- Import `xinput1_4` library. It's the latest version dedicated for Windows 10. If you wish to support other versions as well, you can check the docs for reference.

- Define `TRIGGERS` and `THUMBS` mapping. They directly correspond with `XInputGamepad` structure fields, just without the `XINPUT_GAMEPAD_` prefix. Using mapped values is just more convenient. Besides, you need a way to determine which set of buttons have been pressed.
- Merge `TRIGGERS` and `THUMBS` in `AXES` dictionary. Technically triggers are both buttons and axes, but because they are pressure-sensitive, it would be more logical to treat them as the axes.
- `BUTTONS` mapping. Reference.
- Set maximum `TRIGGER`, `MOTOR` and `THUMB_MAGNITUDE`. The values are suggested by XInputGamepad and XInputVibration documentation pages.
- `ERROR_SUCCESS` is an error code you get when successfully fetching the state of the controller. If selected controller is unplugged, you'd get different code.

Configuration

There are no settings at the moment, so let's create the `ini` file now. In the future, you could put buttons mappings in there. Name the file `default.ini` and set the

```
THUMB_DEAD_ZONE = 0.2
TRIGGER_DEAD_ZONE = 0.2
THUMB_SENSITIVITY = 1
TRIGGER_SENSITIVITY = 1
```

- Only one section: `[gamepad]`.
- Axes dead zone and sensitivity.

And that's it. That's everything that can (and needs to) be adjusted.

Get State

Now, we can fetch the state:

```python
def get_state(self):
    previous_state = self.state.dwPacketNumber
    error_code = self.API.XInputGetState(
        ctypes.wintypes.WORD(self.gamepad_number),
        ctypes.pointer(self.state)
    )
    if error_code != self.ERROR_SUCCESS:
        raise Exception('Gamepad number {} is not connected'.format(self.gamepad_number))
    return previous_state != self.state.dwPacketNumber
```

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- It looks similar to the code you've written in the previous part of the tutorial, the only real difference being that it's now a method.
- There is only a single XInput API method for both obtaining the controller state and checking if the gamepad's connected, meaning that you have to implement both of these features in a single function.

That's everything for this part of the tutorial. In the last one, you will interact with the gamepad more heavily. It's going to be meaty, I promise.

Final words (for now)

Thanks for reading!

You can find the full code on my GitHub.

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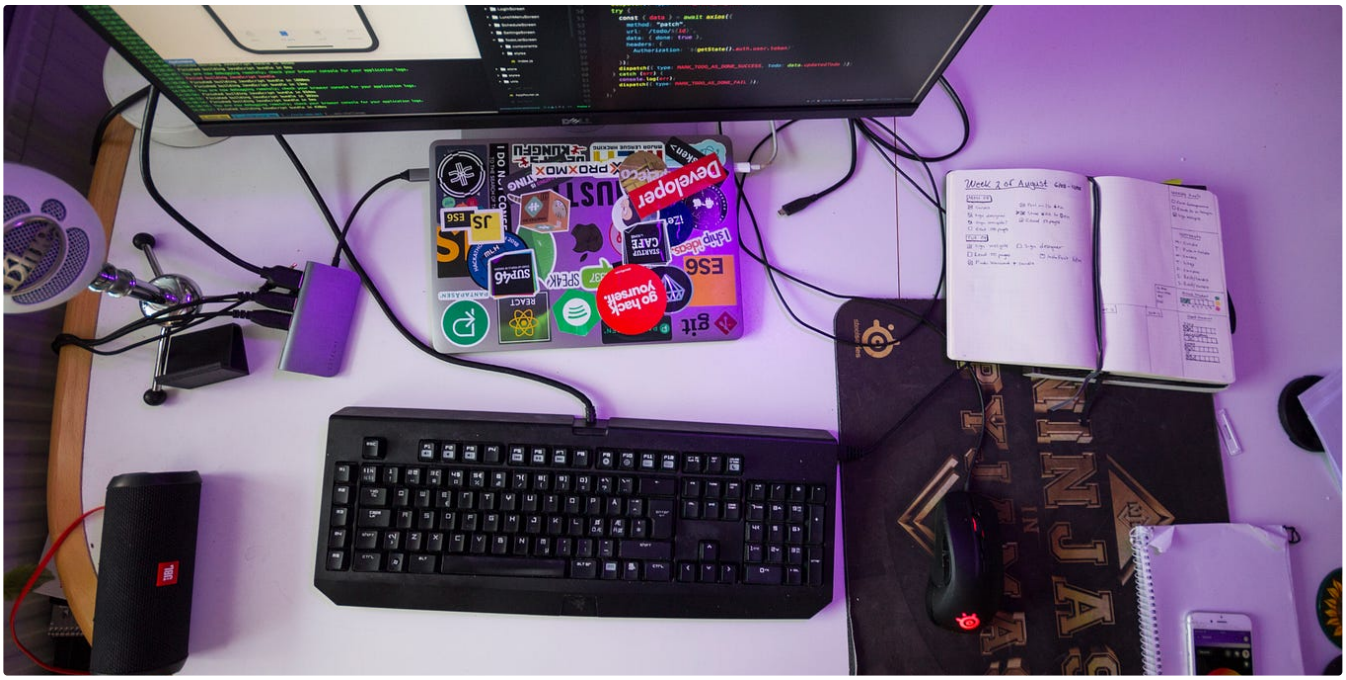

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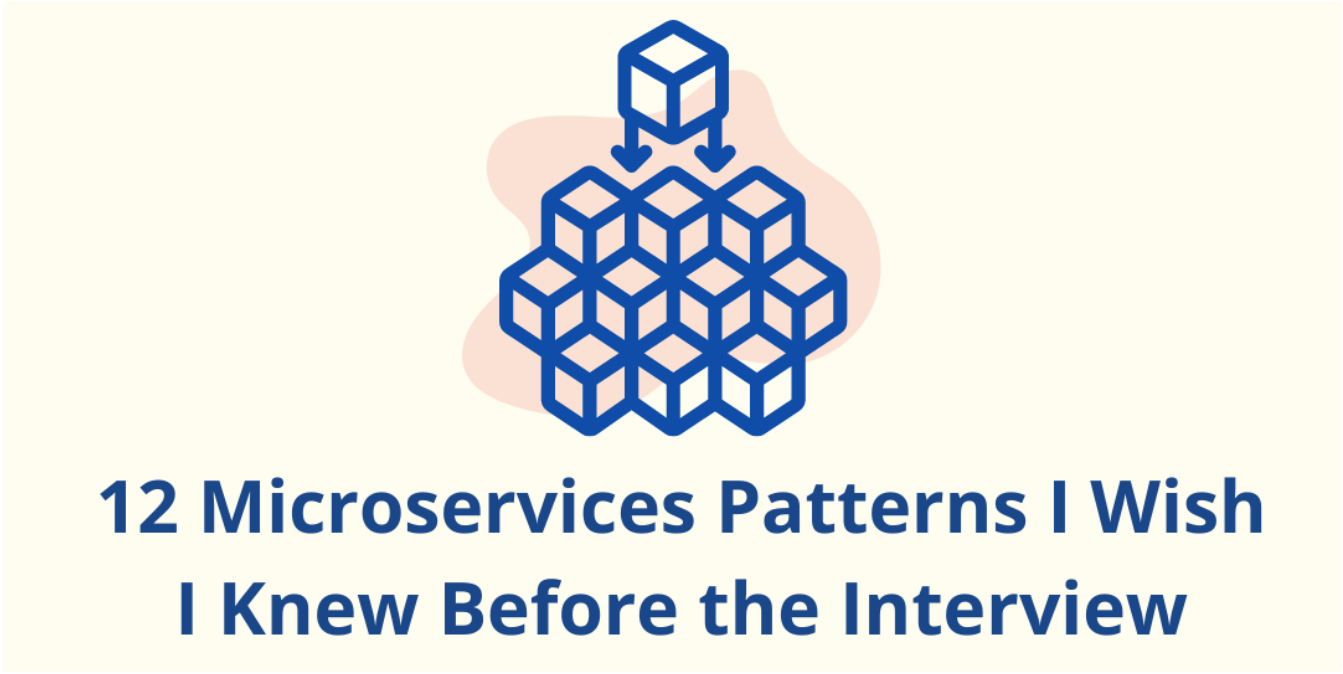

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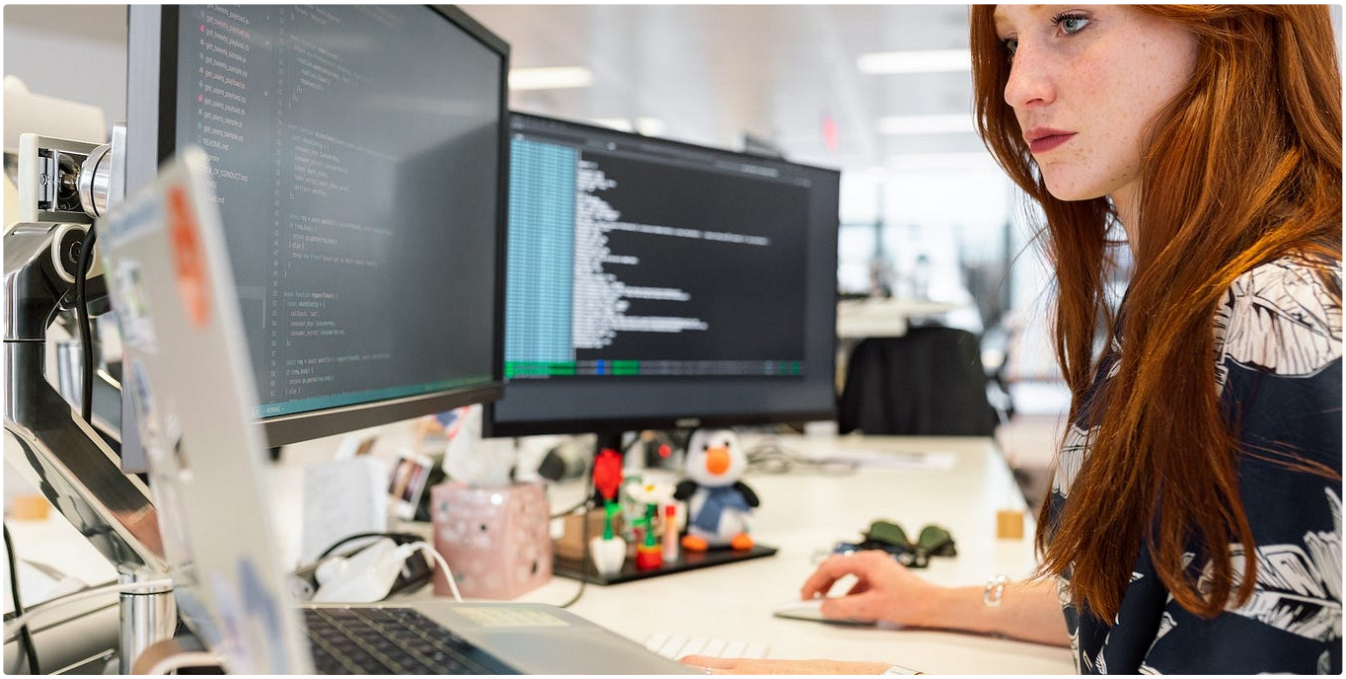

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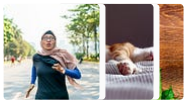

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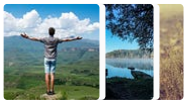

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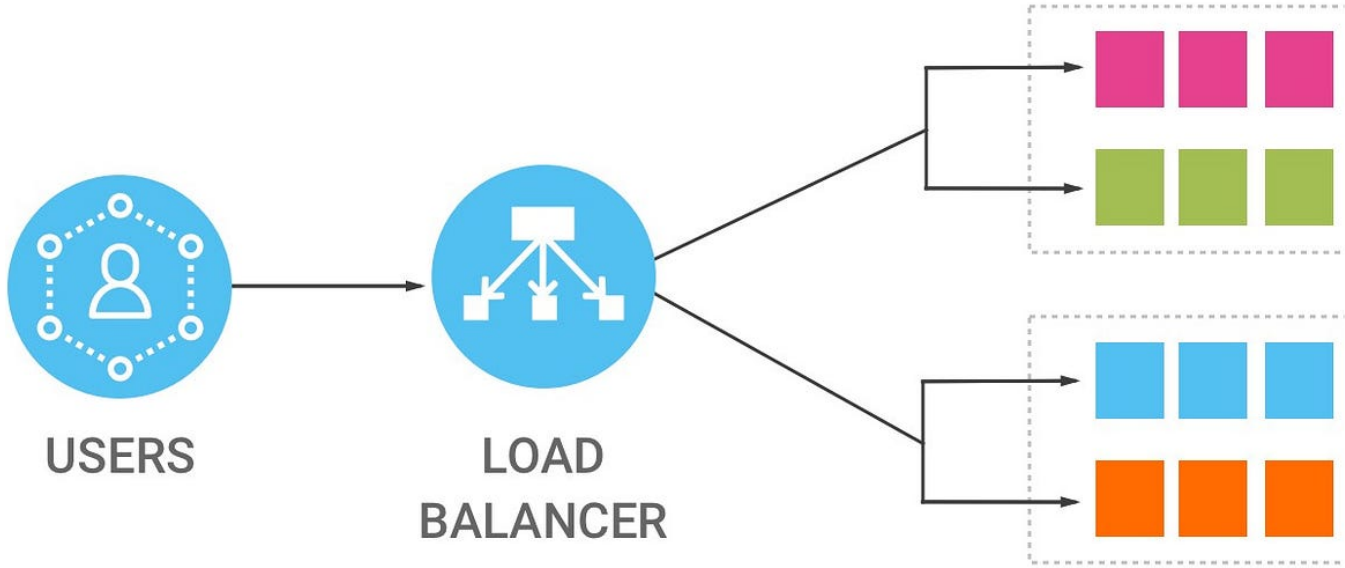

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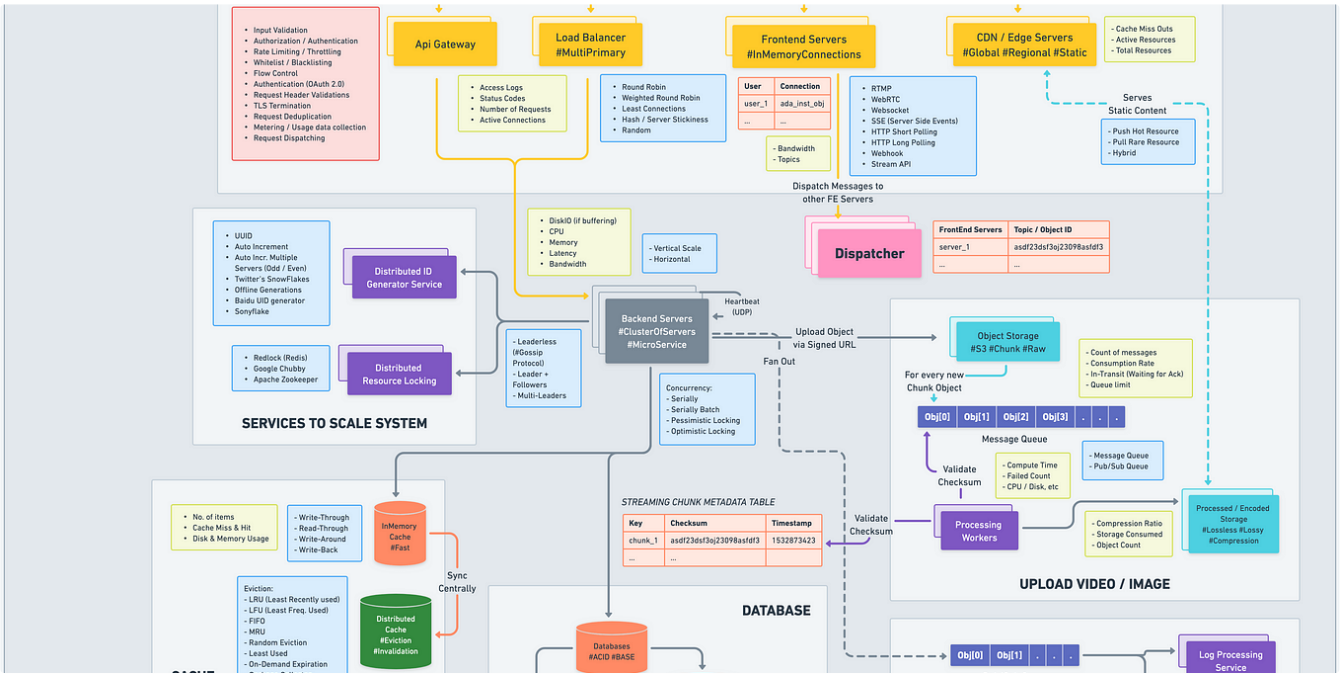

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