Chapter # 16

Punch-O-Meter

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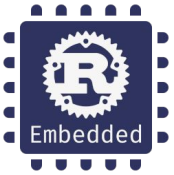
This meter calculates one's **punch** strength by throwing an air **punch** and shows the reading in newton/gravity.

Working of a punch-o-meter

It measures the power of your jabs. Actually the maximum acceleration that you can reach because acceleration is what accelerometers measure. Strength and acceleration are proportional though so it's a good approximation.

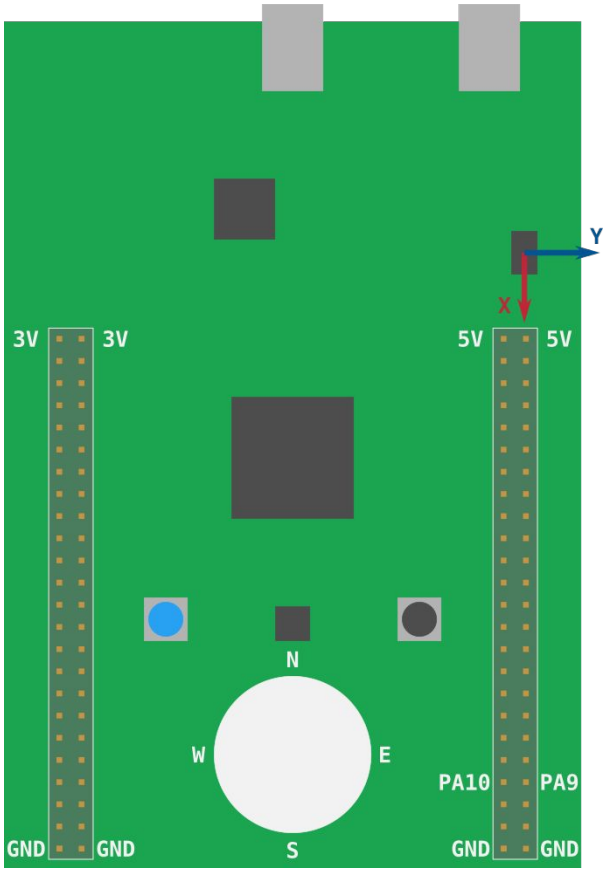


What's inside punch-o-meter?

Inside the ball, there is a force detecting sensor named accelerometer. When a person hits the ball acceleration produces in it. The accelerometer senses this change and the meter will show reading accordingly.

LSM303DLHC Package

The accelerometer is also built inside the LSM303DLHC package. And just like the magnetometer, it can also be accessed using the I2C bus. It also has the same coordinate system as the magnetometer



Gravity/Gravitational Force

Gravity is a force of attraction that exists between any two masses, any two bodies, any two particles. **Gravity** is like the Earth pulling on you and keeping you on the ground. Every object in the universe that has mass exerts a gravitational pull, or force, on every other mass. The size of the pull depends on the masses of the objects.

Gravity is up?

The starter code prints the X, Y and Z components of the acceleration measured by the accelerometer. The values have already been "scaled" and have units of gs. Where 1 g is equal to the acceleration of the gravity, about 9.8 meters per second squared.

```
#[entry]
fn main() -> ! {

 let (mut lsm303dlhc, mut delay, ,mut itm)=aux16::init();

    lsm303dlhc.set_accel_sensitivity(Sensitivity::G12).unwrap();

loop {
        const SENSITIVITY: f32 = 12. / (1 << 14) as f32;

        let I16x3 { x, y, z } = lsm303dlhc.accel().unwrap();

        let x = f32::from(x) * SENSITIVITY;
        let y = f32::from(y) * SENSITIVITY;
        let z = f32::from(z) * SENSITIVITY;

        iprintln!(&mut itm.stim[0], "{:?}", (x, y, z));

        delay.delay_ms(1_000_u16);
    }
}
```

Why this reading?

Because the board is not moving yet its acceleration is non-zero so the gravity only exerts in z-axis . The acceleration of gravity is 1 g.

```
$ # itmdump console
(..)
(0.0, 0.0, 1.078125)
(0.0, 0.0, 1.078125)
(0.0, 0.0, 1.171875)
(0.0, 0.0, 1.03125)
(0.0, 0.0, 1.078125)
```

What we are going to do?

We'll measure the acceleration only in the X axis to keep things simple while the board remains horizontal.

Here's what the punch-o-meter must do:

- When a significant acceleration in X-axis is detected, the app will start a new measurement.
- During that measurement interval, the app will keep track of the maximum acceleration observed.
- The app will report the maximum acceleration observed at the end of interval.