



Detailed Component Specifications

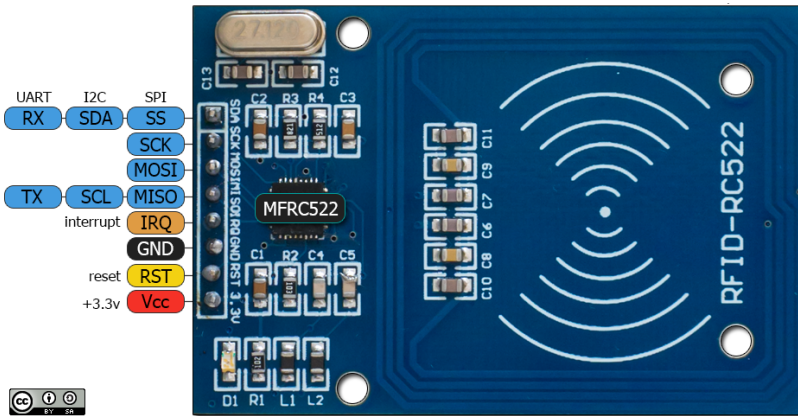
Project Details

Project Acronym	Fitolo
Project Full Title	Fitness Data Acquisition System in a Gym-Based Environment
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Type of Document	Report on Component Specifications
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RFID Scanner



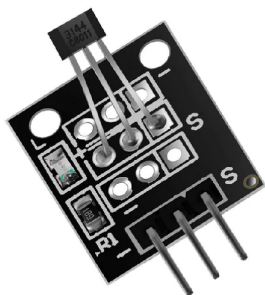
Model Name	MFRC522
Voltage Requirements	2.5V Minimum, 3.3V Typical, and 3.6V Maximum
Current Requirements	6.5 to 10 mA
Data Output Protocol	Serial UART, SPI, or I2C Bus
Datasheet:	MFRC522_Datasheet

RFID tags



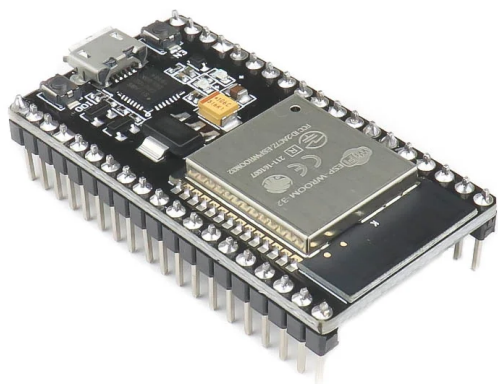
Material	ABS
Chip Type	EM4305
Response Frequency	125KHz
Datasheet	EM4305_Datasheet

Hall Sensor



Operating Voltage (VDC)	5V
Power Consumption at Rest	3mA
Power Consumption when Switched	8mA
Output Data	Digital or Analog
Datasheet	A3144_Datasheet

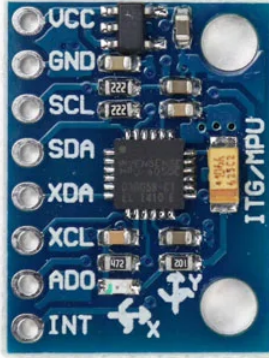
Microcontroller (ESP32)**



Processor	Dual core Tensilica Xtensa 32-bit LX6
Operating voltage	2.3 - 3.6V
Operating current	80mA
Clock Frequency	80 - 240 MHz
Flash memory	4 MB
Data Rate	54 Mbps
SRAM Memory	512 KB
Datasheet	ESP32 Datasheet

** This is applicable only for initial POC, may change with the revised (single board) architecture

Accelerometer and Gyroscope Module



Selection of Accelerometer and Gyroscope Module

MPU6000	MPU6050 (Currently used)	MPU6500
1. A sampling rate of 8 kHz.	1. A sampling rate of 8 kHz.	1. A sampling rate of 32 kHz.
2. Supports SPI and I2C interface. But I2C is too slow to handle 8 kHz gyro update.	2. Supports I2C interface communication protocol.	2. Supports both I2C and SPI interface.
3. Vibration Sensitivity is better than MPU6500.	3. Vibration Sensitivity is better than MPU6500 but the speed of operation is less than MPU6000.	3. It is more susceptible to vibrations, so the need for some vibration isolation methods. It is faster than both MPU.

Operating Voltage (VDC)	3 - 5V
Data Output Protocol	I2C
Gyro range	$\hat{A} \pm 250, 500, 1000, 2000 \hat{A}^\circ/s$
Acceleration range	$\hat{A} \pm 2 \hat{A} \pm 4 \hat{A} \pm 8 \hat{A} \pm 16 g$
Datasheet	MPU6050_Datasheet

The Complementary Filter

Orientation data from gyroscope sensors are prone to drift significantly over time, so gyroscopic sensors are frequently combined with additional sensors, such as accelerometers or magnetometers to correct for this effect. (In this case, it is an accelerometer). The standard method of combining these two inputs is with a Kalman Filter, which is quite a complex methodology. Fortunately, there is a simpler approximation for combining these two data types, called a Complementary Filter. Also, the gyroscope gives readings in degrees per second, so we'll have to measure the angular velocity (ω) around the X, Y, and Z axes at measured intervals (Δt) and then multiply it with the interval.

$$\text{Filtered Angle} = \alpha \times (\text{Gyroscope Angle}) + (1 - \alpha) \times (\text{Accelerometer Angle})$$

$$\text{Gyroscope Angle} = (\text{Last Measured Filtered Angle}) + \omega \times \Delta t$$

Where,

$$\alpha = \tau / (\tau + \Delta t)$$

Δt = sampling rate

τ = time constant greater than the timescale of typical accelerometer noise

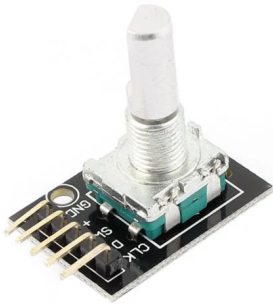
ω = Gyroscope reading in degrees/second (dps)

Tactile Switches



Operating Voltage (VDC)	12V
Max. Operating Current	50mA
On/Off Function	Push to ON
Switch Type	Momentary
Contact Type	Through-hole
Contact Material	Brass
Contact Resistance	50mΩ
Insulation Resistance	100 MΩ
Operating Temperature Range	-20 to 70 °C
Operation Force	About 3-5N
Operation Stroke	1.05mm
Mech. & Electrical Lifecycle	≈ 300,000
Protection Standard	IP65

Rotary Encoder



Model	KY-040
Encoder Type	Incremental
Cycles Per Revolution	20
Operating Voltage (VDC)	5V
User Manual	Rotary Encoder Datasheet

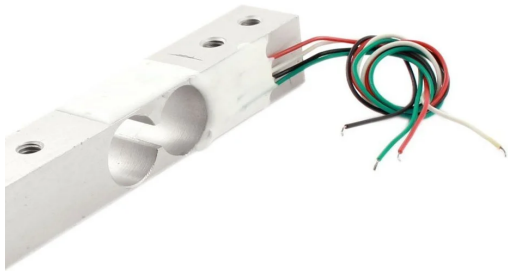
IR Sensor



Operating Voltage	5V
Diode forward Current	60mA
Output	Analog or digital data

Transistor collector current	100mA (maximum)
Operating temperature	-25°C to +85°C
Datasheet	TCRT_5000_Datasheet

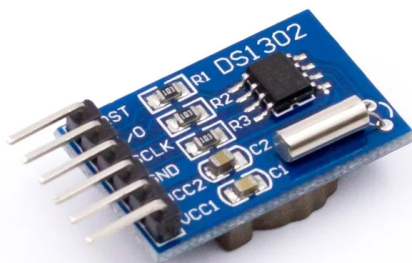
Load Cell



Type	Single Point Load Cell
Total Precision	C3 class
Material	Aluminum Alloy
Surface	Anodized Treatment
Protection	IP65
Rated Load	200 Kg. Max
Rated Output	2.0mV/V+/- 5%
Zero Balance	+/- 1% Full Scale
Input Resistance	405 +/- 6 Ohm
Output Resistance	350 +/- 3 Ohm
Excitation Voltage	5-12V DC
Nonlinearity	0.017% Full Scale
Hysteresis	0.02% Full Scale
Repeatability	0.01% Full Scale

Creep(30min)	0.015% Full Scale
Operating Temperature	-20 °C to +65 °C
Temperature Effect on Zero	0.017% Full Scale / 10 °C
Temperature Effect on Span	0.014% Full Scale / 10 °C
Insulation Resistance	5000 Mega Ohm(50V DC)
Safe Overload	150% Full Scale
Ultimate Overload	200% Full Scale
Cable	420mm(3mm dia 4 wire shielding cable)

Real-time Clock



Model Number	DS1302
Supply Voltage	2.0 – 5.5 V
Supply Current	< 300 nA @ 2.0 V
Interface Type	2 Wire Serial
Datasheet	DS1302 Datasheet

RGB LED



Forward voltage	Red: 1.9V to 2.5V, Green and blue: 2.9V to 3.5V
Reverse voltage	5V
Forward current	30mA
Reverse current	10μA
Viewing angle	40 to 50°
Datasheet	RGB_LED_Datasheet