Overview

HandSense is a real time hand/finger tracking system that monitors the position of the hand and each finger digit. The system consists of a PicoM305 processing unit and fifteen FemtoB 6DOF sensors arranged as five FemtoFlex chains with three sensors each – one chain for each finger. The orientation of the hand is also monitored in real time. The collected data is wireless relayed back to a desktop application that displays and records the finger movement in real time for later playback. A second system can be used to capture the motion of both hands.

Features:

Hand Processor PicoM305:

 - Fast 72MHz 32bit ARM7 STM32F303 processor
 - All the features of a PicoM plus five I2C connections
 - Wireless link to desktop (WiFi or RF24L01) for complete mobility
 - Five I2C communication connectors to collect data from the five FemtoFlex sensor chains tracking the position of each finger digit
 - Lithium battery powered with onboard charging
 - OLED display for local device status
 - Digital and Analog IO brought to connectors
 - Expansion connectors for additional sensorintegration
 - Real time data acquisition application communicating PicoM305 sensor data wirelessly back to the desktop
 - MPU-9150 9DOF motion sensor for complete hand orientation
 - BMP180 barometric pressure sensor for height determination

Finger Sensors FemtoFlex Chain:

 - Five FemtoFlex chains with 3 FemtoB sensors
 - Each FemtoB is a 6DOF sensor, 3-axis acceleration, 3-axis magnetometer
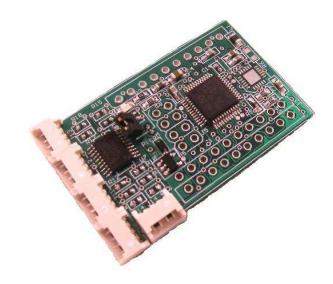
HandSense Desktop Application:

 - Windows based desktop application
 - Real time display of hand/finger orientation
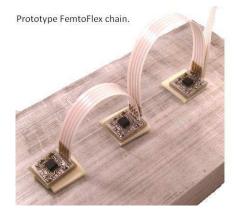 - Data logging of all raw and processed motion data with playback

The PicoM305 acquires the onboard 10DOF hand orientation data and all fifteen attached 6DOF sensors in not more than 7 mseconds. Additional processing on the desktop converts that motion data into finger position data which is then displayed in real time.

Wireless Connection

There are two wireless options – WiFi or RF24L01 – both third party modules.

Prototype FemtoFlex chain.

FemtoB 6DOF Sensor

FemtoB uses the Freescale FXOS8700 6DOF sensor -
3-axis accelerometer
3-axis magnetometer
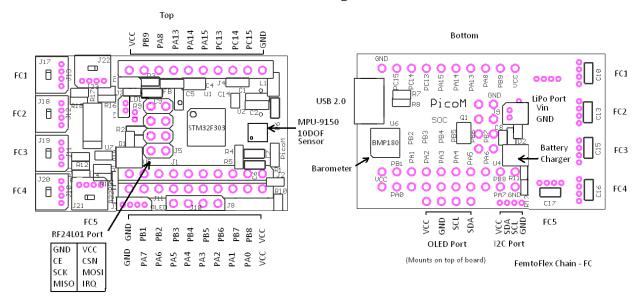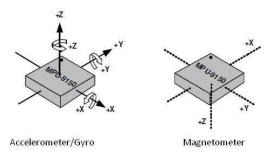
RF Modules

RF24L01   ESP8266 WiFi

HandSense PicoM305 Performance Metrics

PicoM305 is an expanded version of the PicoM with a four channel I2C multiplexor to handle the large number of FemtoB 6DOF sensors (15 in total). The PicoM305 overclocks the I2C bus at 800KHz and acquires all the FemtoB MEMs data and on board 10DOF data in approximately 5-7mseconds in single buffered polled mode. Data transfer the desktop can be done via the USB connection or the preferred wirelessly method. Approximately 190 bytes of data is transferred every 7-10mseconds yielding a throughput rate of at least 100Hz. With DMA, double buffering and RF streaming the expected throughput rate will drop to 5msecond or 200Hz. Data is received at the desktop using a PicoMP receiver.
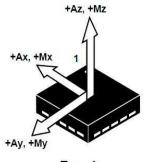
PicoM Connector Pin Assignment

MPU-9150 Sensor Orientation

Orientation of the accelerometer, gyro and magnetometer on the PicoM305. The small dot on the package above corresponds

Orientation of the accelerometer and magnetometer on the FemtoB. Pin 1 of the package above corresponds to the small notch in the picture above.