Overview

BodySense is a real time full body motion capture system using individual 10DOF wireless PicoA,B or M sensor nodes. PicoA or B return raw data to the desktop while PicoM is capable of processing the raw data into roll, pitch and yaw and returning only the processed data reducing overhead on the desktop. Each Pico wirelessly sends the data back to the desktop, laptop or tablet. With up to 126 RF channels entire teams can be captured. Using a long distance RF module players motion on a football field can be captured. By adding a GPS module real time position data can also be captured.

Features:

BodySense Sensor Nodes:
 - Each Pico acts as a 10DOF sensor node
 - PicoA or PicoB return raw sensor data
 - PicoM returns raw or processed data
 - Up to 25 Picos can be accessed in one system
 - Up to 126 RF channels are available
 - Lithium battery powered with onboard charging
 - OLED display for local device status (optional)
 - Additional data can be acquired on each Pico such as wrist angle using a FemtoB sensor or heart rate

BodySense Desktop Application:
 - Windows based desktop application
 - Real time display of hand/finger orientation
 - Data logging of all raw and processed motion data with playback
 - Wireless receivers based on NanoMP

Each individual Pico sends motion data back to the desktop wirelessly. No wires connect individual Picos allowing them to be attached wherever they need to be using wrist straps or leg straps.

Wireless Connection

Off the shelf RF modules are used to keep costs low and the system as open as possible. There are two wireless options – WiFi or RF24L01 – both third party modules.

Open, Modular and Extendable

The software running on each Pico is open and can be modified, enhanced or extended to suit individual applications. The RF link is also open allowing customer optimization for special applications such as returning additional sensor data such as heart rate along with the motion data. Closed systems aren't able to do that.
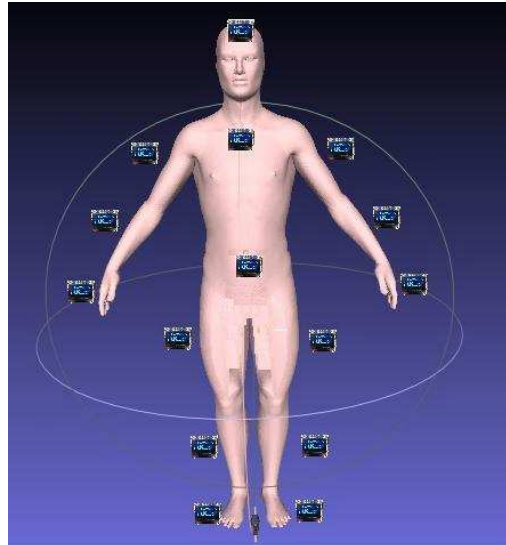
15 PicoA,B or M Wireless Sensors for full body motion capture

RF Modules

RF24L01   ESP8266 WiFi

BodySense Performance Metrics

Each Pico sensor node is capable of acquiring 10DOF sensor data extremely quickly. Getting that data back to the desktop or laptop wirelessly as quickly and reliably as possible is the job of the RF link. By using standard RF24L01 modules (available from multiple sources and at very little cost) the task of getting data from the sensors becomes a known quantity.   The RF24L01 operates in the 2.4GHz band with three different transmission rates – 250KHz, 1M and 2Mbits/sec and 126 channels to choose from. By mixing channels, transmission rates and on air protocols it's possible to reliably transmit sensor data from fifteen to twenty sensors in real time with acceptable throughput and latency.   This allows the number of sensors in a system to change based on the application. Capturing a rowing application verse hockey requires a different number of sensors per player.

By using the more powerful PicoM running a sensor fusion application such as an Extended Kalman Filter (EKF) processed data such as roll, pitch and yaw can be returned by the sensor reducing host processing load. The PicoM easily cycles the EKF in under 2mseconds ensuring accurate sensor fusion.

The desktop runs an inverse kinematics application to convert the roll, pitch, yaw information returned by each Pico into a bvh file format so the motion can be played by any number of bvh players such as Blender. All returned data is time stamped and logged along with raw data if that is included in the data stream. The RF link has the bandwidth to return both raw and processed data allowing post capture data massaging.

By making all the sensor nodes wireless and self powered the number of sensors in any given application can vary. The practical limit is determined more by the number of receivers than the transmitters. That one of the advantages of an open system – you can change system configuration easily.

As the RF link is completely bi-directional it's also possible to send data to a sensor node. Now why would you want to do that? Well the RF link has the bandwidth to allow audio streaming and the PicoM is fast enough for audio playback and record and supports an I2S link so adding a small speaker or microphone is possible.