

Indoor Positioning using UltraWideBand – UWB & BluetoothLowEnergy – BLE

Degree programme: BSc in Electrical- and Communication Engineering | Specialisation: Communication Technologies as Management

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For training analyses in several sports, we developed a 3D body model for motion data visualization. An IP camera, acting as a further measurement instrument, tracks and records moving players or athletes on a defined area. An optimized hardware is used for a more accurate position measurement.

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Overview

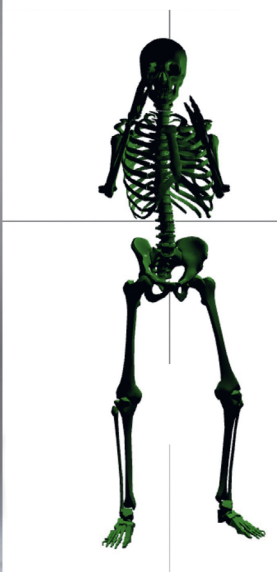
Motion and position measurements are already available: A 9-axis sensor (3-axis gyroscope, 3-axis accelerometer and 3-axis compass) provides motion and absolute orientation data, while Ultra-wideband – Time difference of Arrival measurements provide position data. We have greatly enhanced such a 2D measurement system by extending it to 3D by developing a spatial body model, by using an IP camera tracking, and by optimizing its hardware.

3D Body Model

The 3D body model consists of skeleton segments. These are driven by multiple 9-axis sensors, each attached to the main parts of the athlete's body (fig. 1). A C++ software processes the sensor data enabling the visualization (position and rotation) of each skeleton segment.



fig.1: Reality vs. Simulation



IP Camera Tracking

With the aid of the positioning system it is possible to track and record the positions of athletes without manual operation. The recorded videos can be used for further training analyses.

Hardware Optimization

The target of the optimization is to reduce the size and the power consumption of the existing hardware and to improve its measuring precision. The sensing electronics (6-Layer PCB) and the UWB module (4-Layer PCB) have been integrated into a 6-Layer PCB (fig. 2). The antenna connector has been re-designed allowing for increased radiation efficiency. To achieve a more accurate position measurement we use a temperature compensated crystal oscillator.

Conclusion

The outcome of this bachelor thesis is an enhanced measurement and visualization system to be used for performance analysis and indoor positioning in sports.

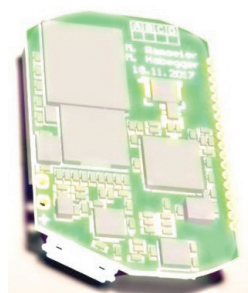


fig.2: The optimized hardware



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