Bowling Assistant

Mechatronics Circus & Mechatronics Symposium 2020

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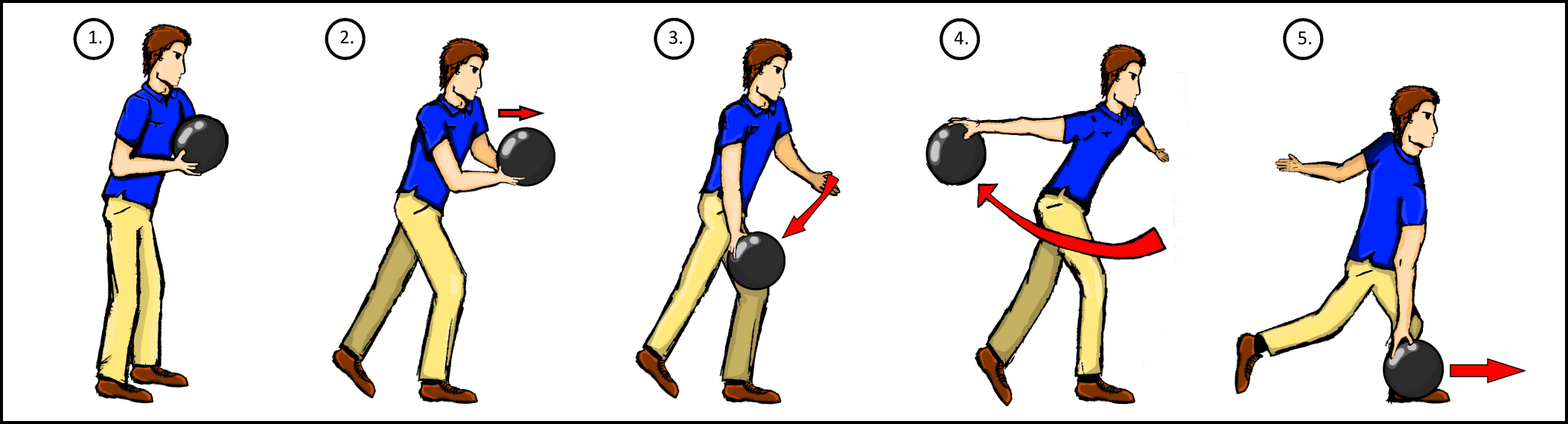
Contents

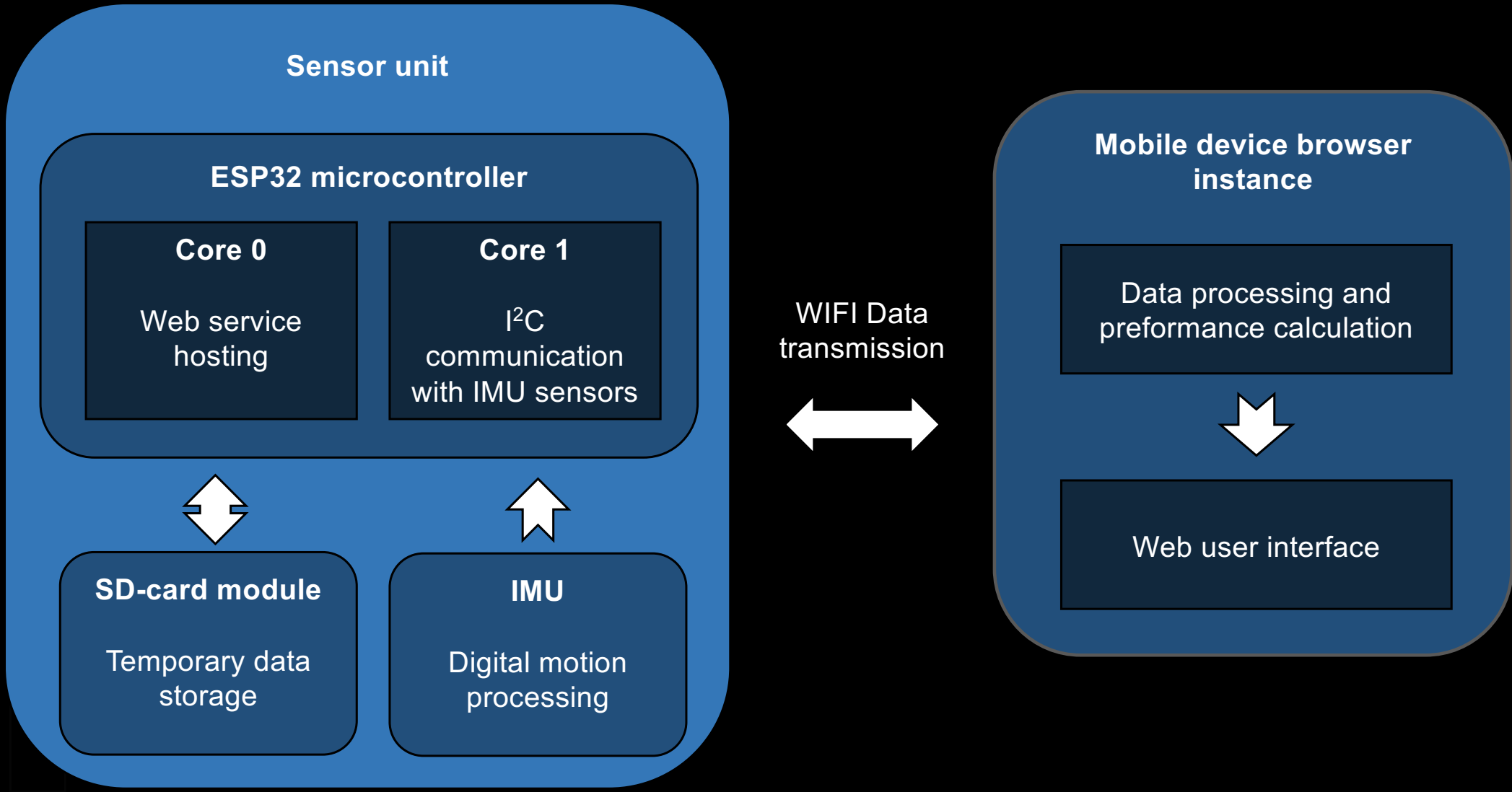
- How do we tell a good bowling performance? – Key points
- How does the system work? – IMU, Sensor fusion
- How do you receive feedback? – Web Interface
- How precise is the system? – Reference device, Validation
- What is the takeaway? - Discussion

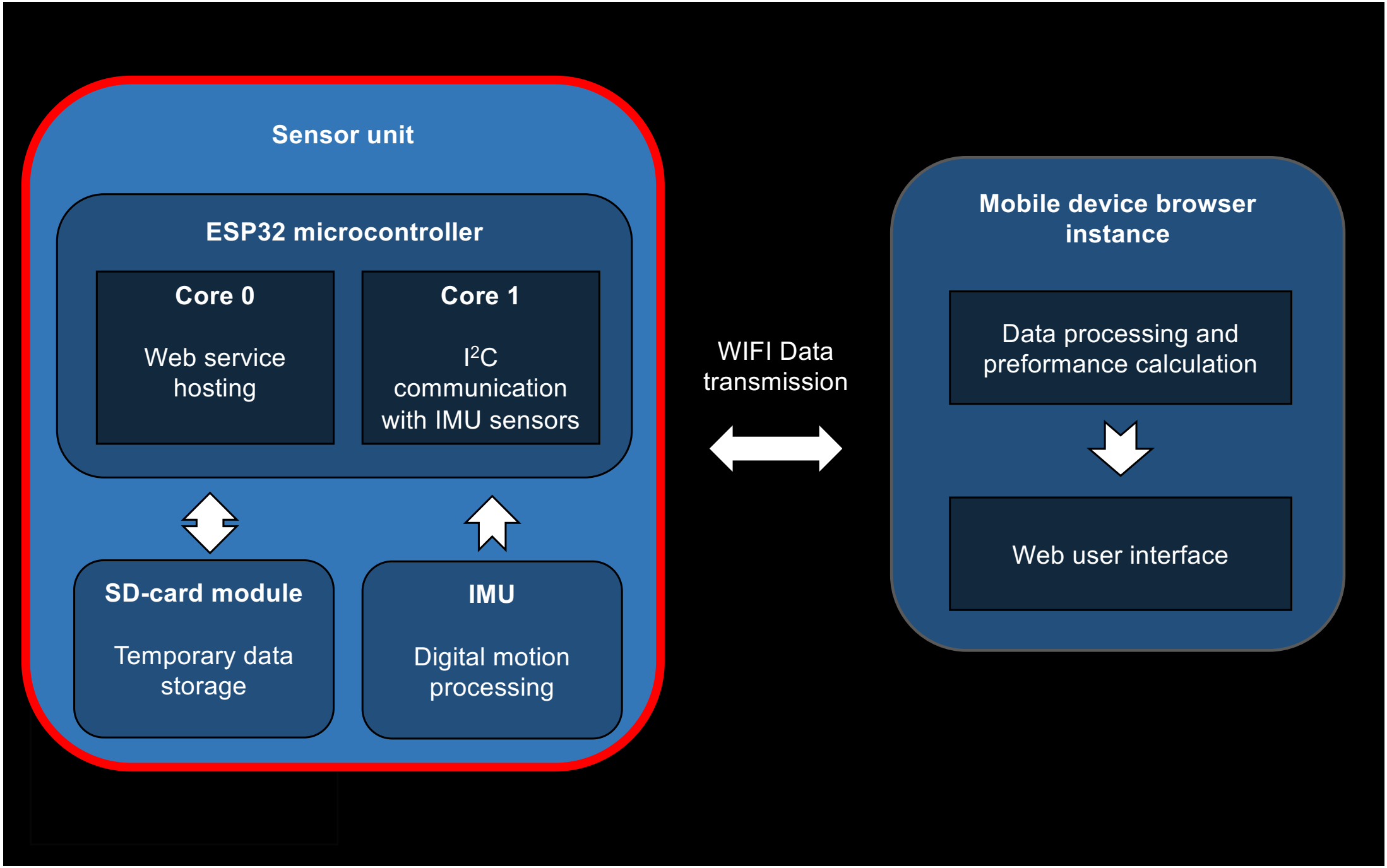
Some key aspects in bowling

- Swing plane
- Step timings
- Ball-Ankle distance



The application concept

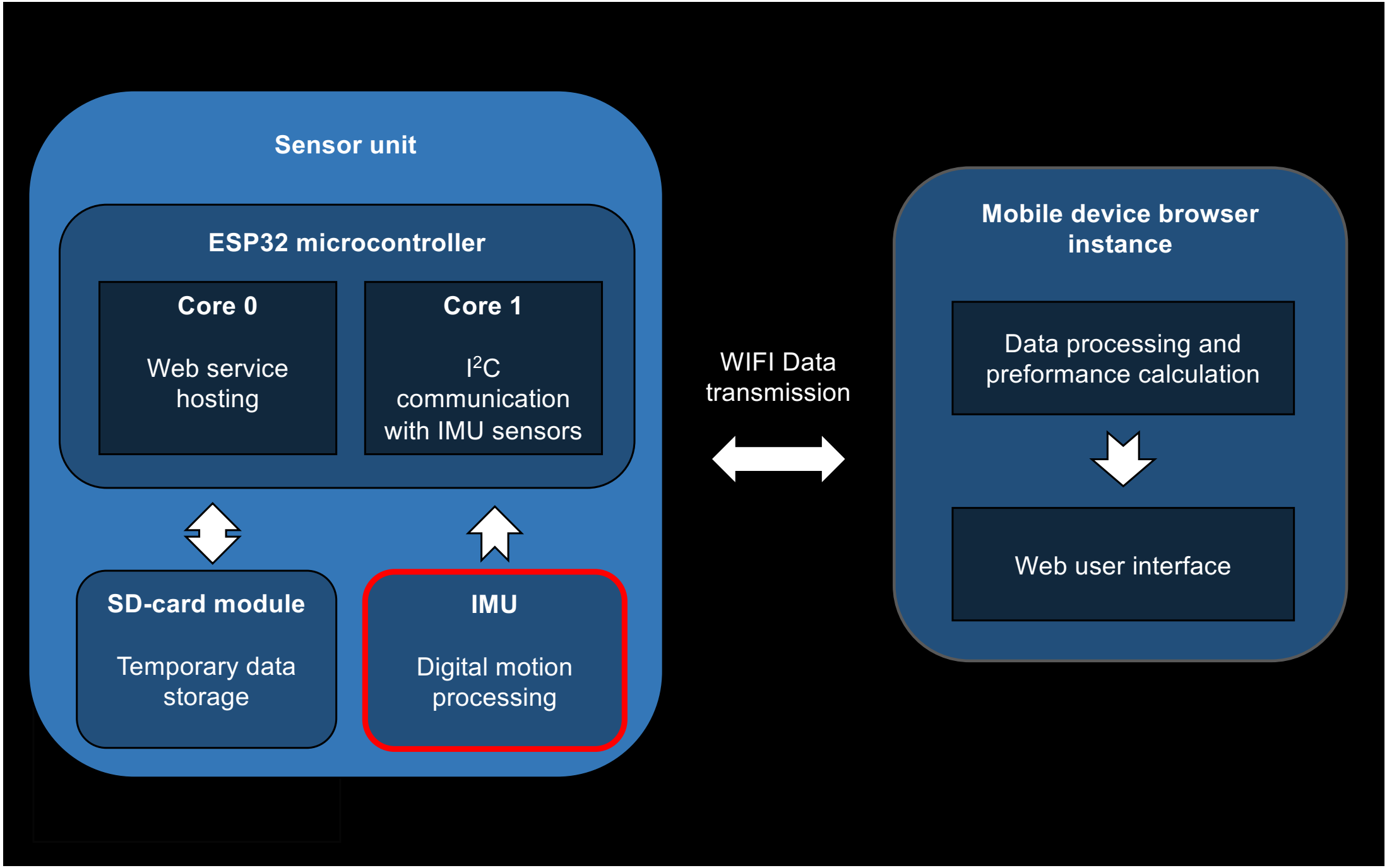



Sensor unit
ESP32 microcontroller
Core 0
Web service hosting
Core 1
I²C communication with IMU sensors
SD-card module
Temporary data storage
IMU
Digital motion processing
WIFI Data transmission
Mobile device browser instance
Data processing and preformance calculation
Web user interface

Wearable Sensor unit

Features:

- Components hidden inside small casing
- Wireless measurement
- Modular design allows for multiple configurations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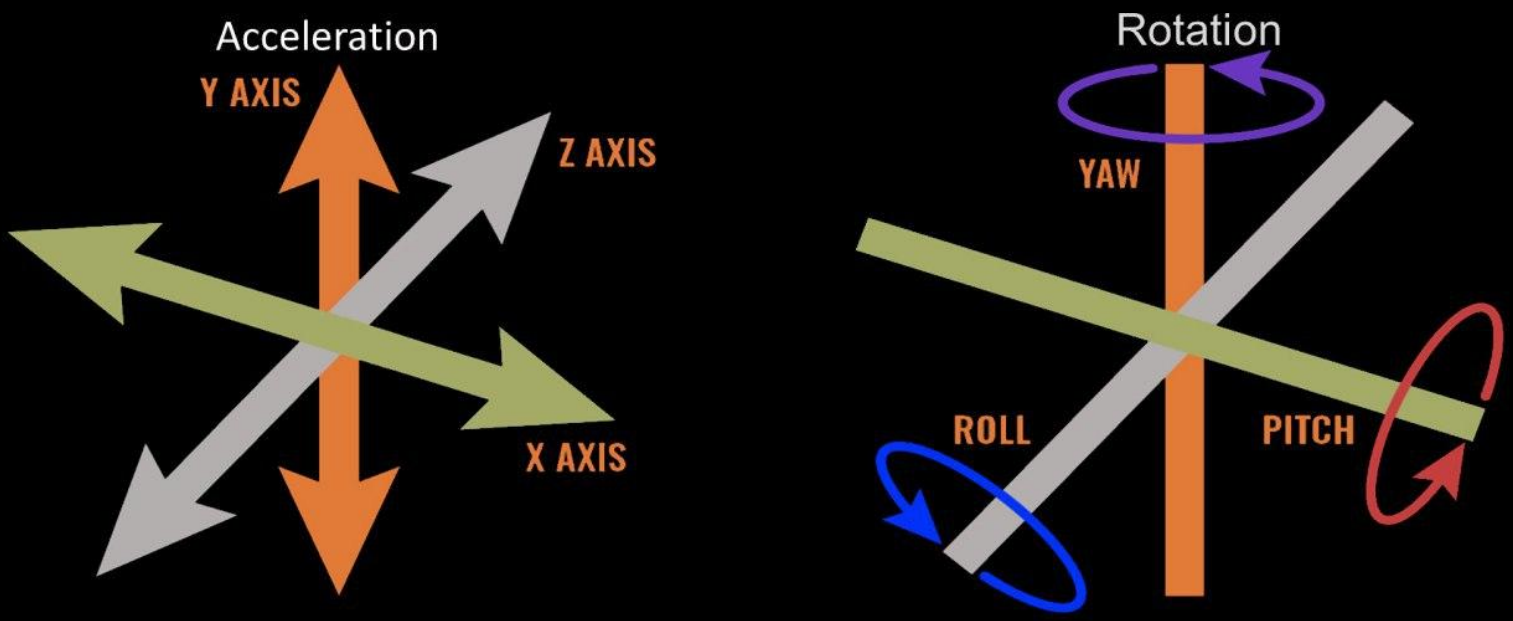
Inertial Measurement Unit

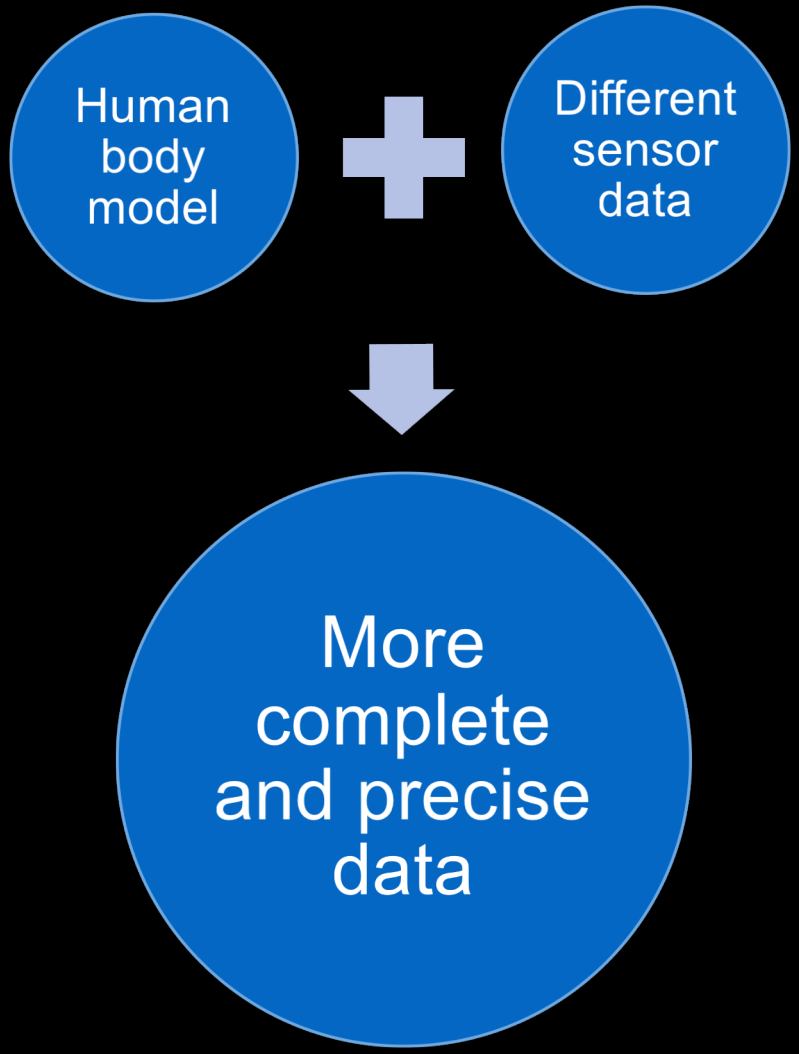


Things to worry about:

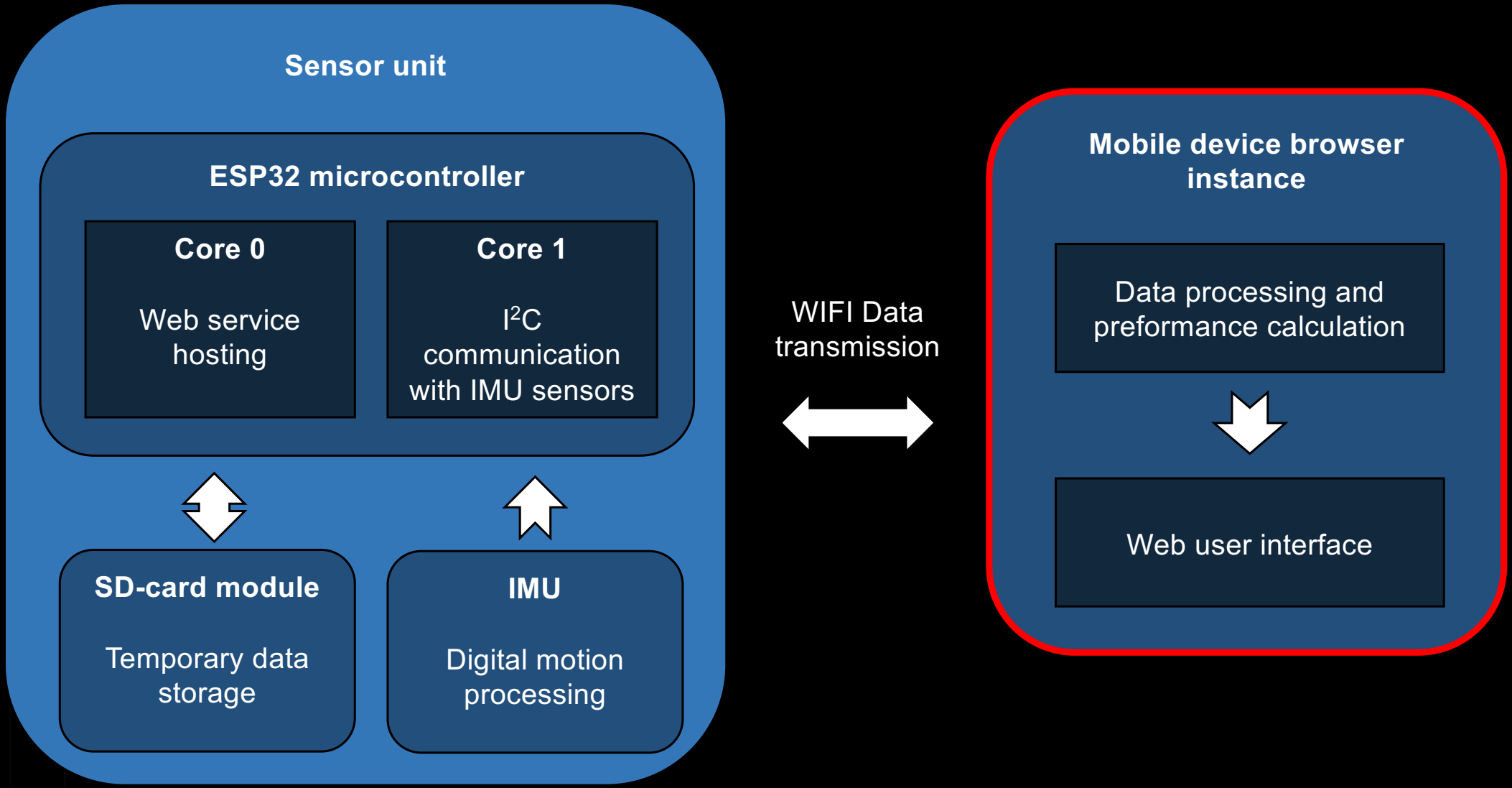
- Multiple sources of data
- Signal drifting
- Data accuracy

Sensor fusion

- The measurement data of from one sensor is insufficient to measure the orientation of the human body
- Combination of multiple sources of data is required

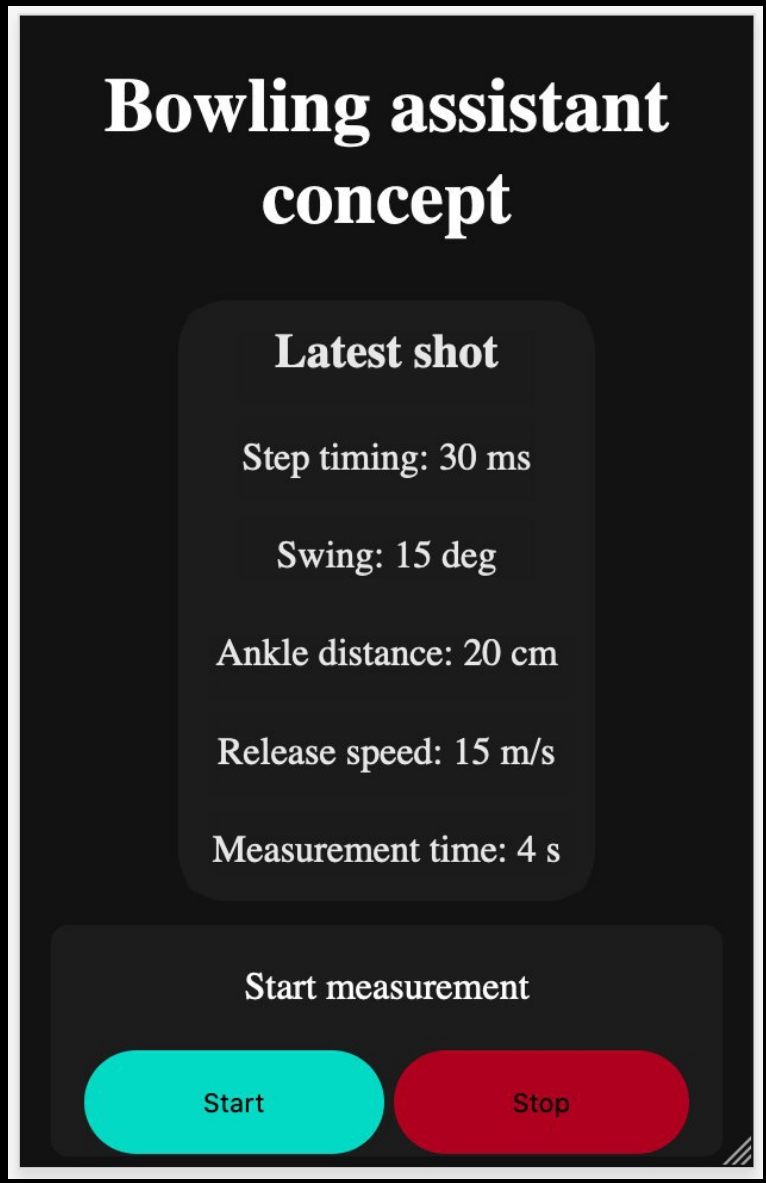


The application concept



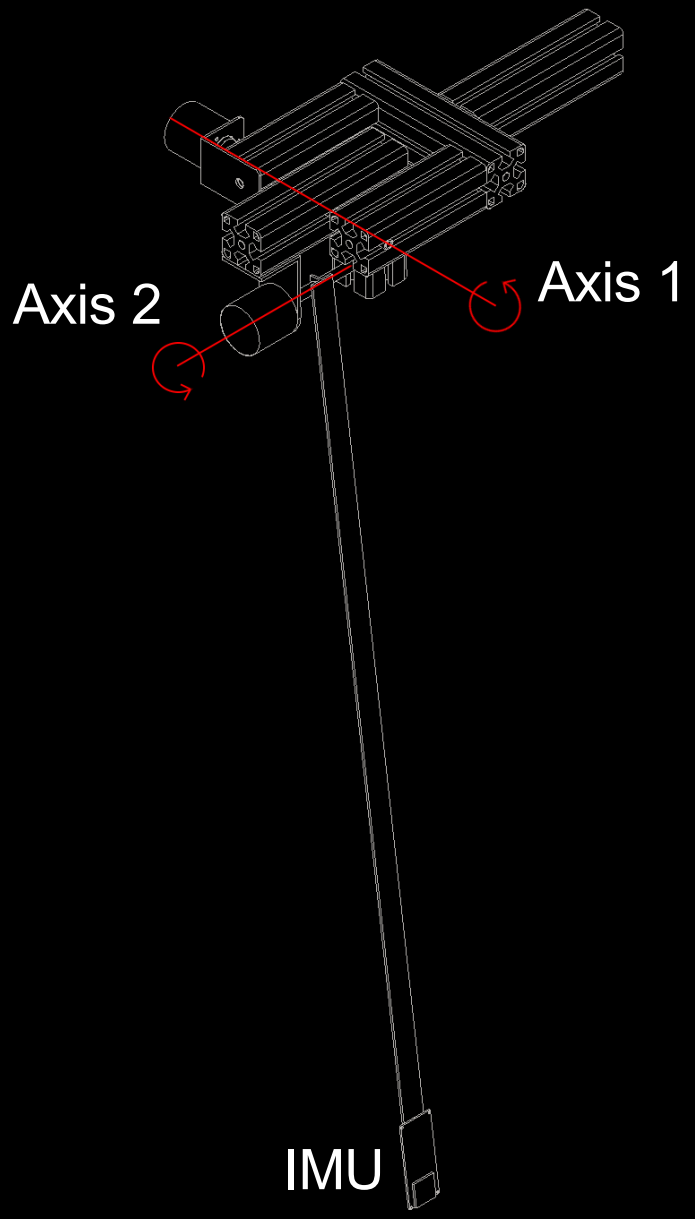
User Interface – Instant feedback

- Web user interface
- Performance consuming calculations can be done on the mobile device
- Data from bowling the performance is presented
- Multiple attempts can be stored



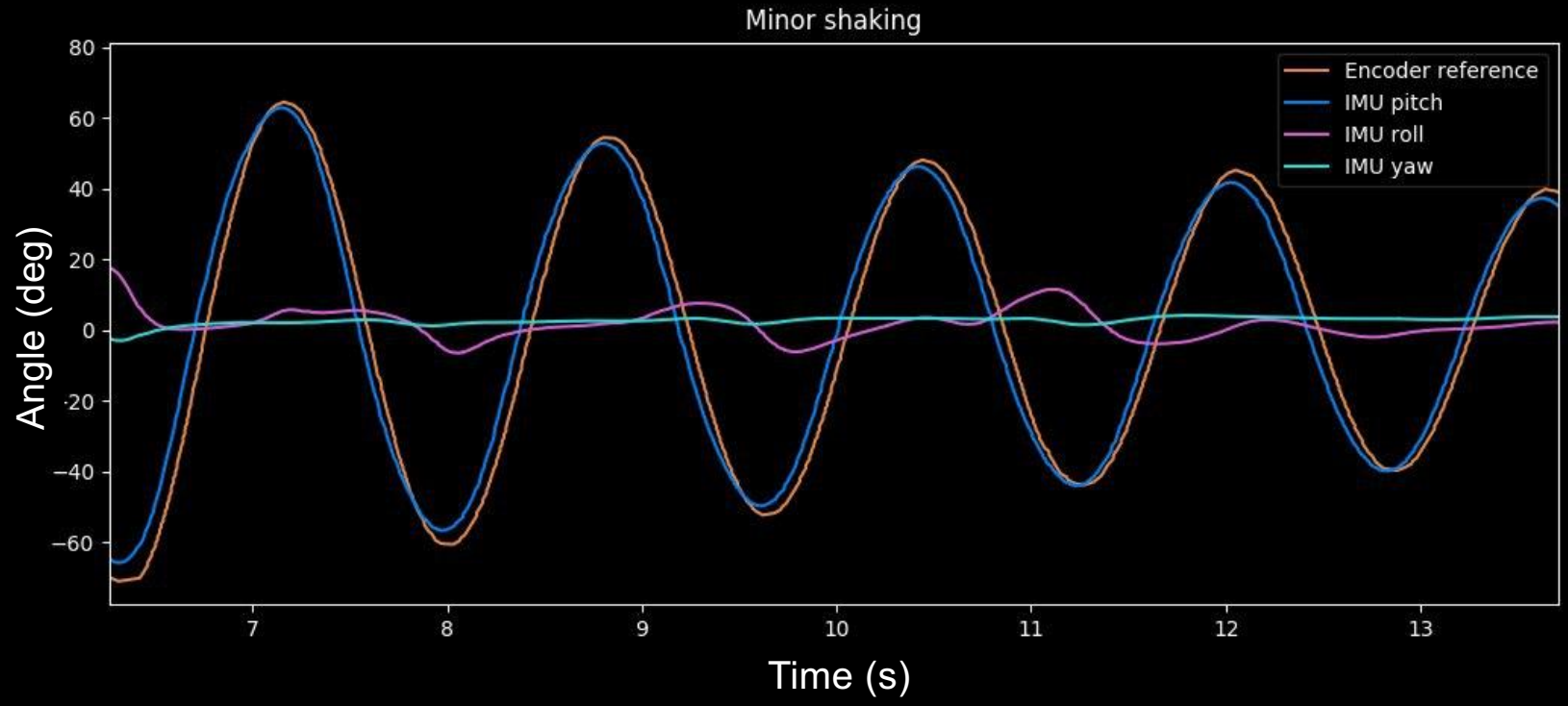
Reference Device

- Two degrees of freedom pendulum resembling the elbow joint of a person
- Two rotary encoders capture the reference position



Validation measurements

- Comparison between encoder and IMU rotation data shows good correlation

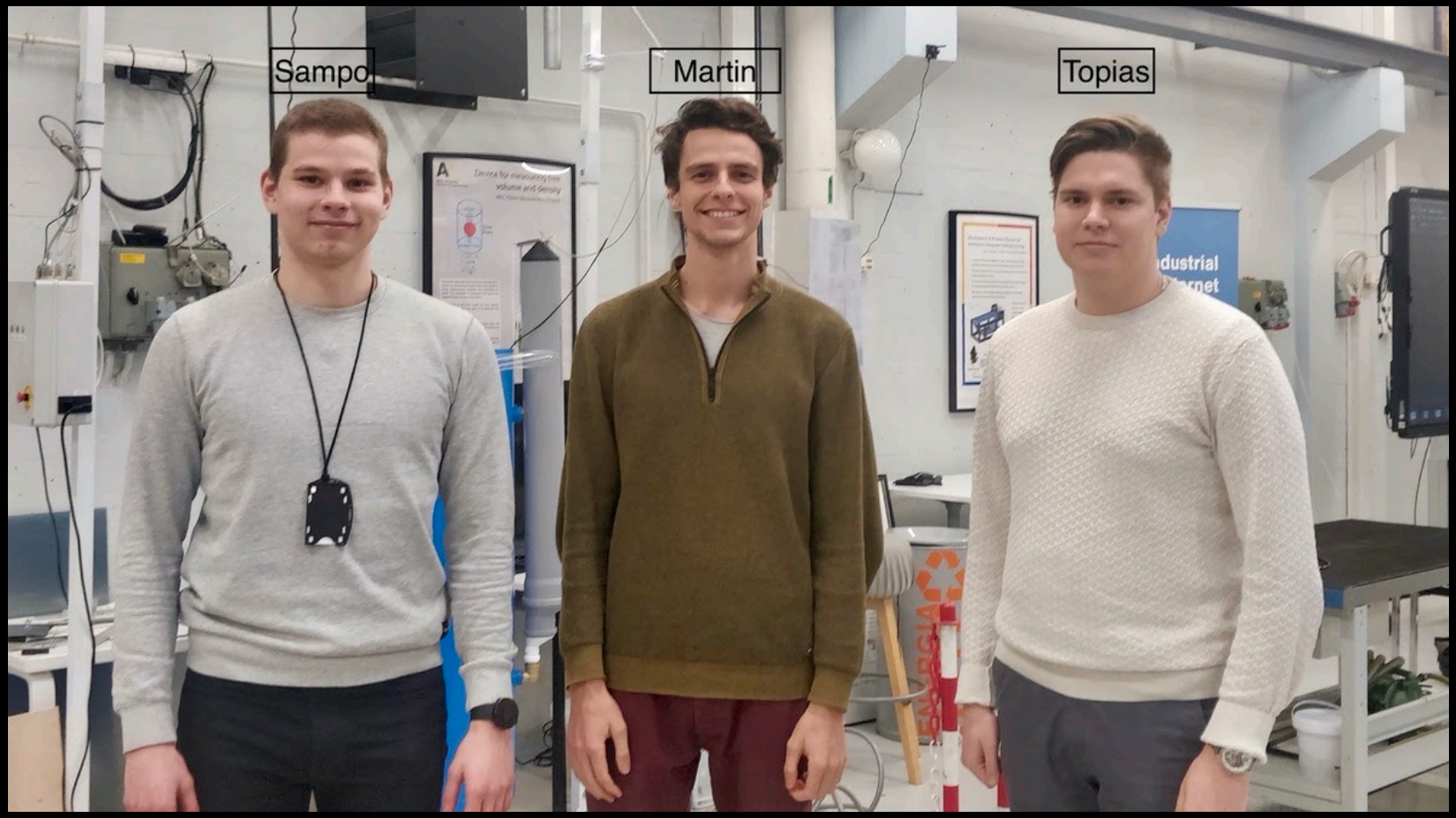


Discussion

- The system is accurate enough to determine the movement of a human body
- Various performance characteristics can be extracted
- Accurate feedback can be given to user
- More motion tracking use-cases are conceivable

Any Questions?

Thank you!



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