AN OPEN BIOMECHANICS SYSTEM USING COMMODITY HARDWARE

MADUSHAN ADHIKARI

CHATHURANGA BAMUNUSINGHE

PUMUDIKA DISSANAYAKE

A PRACTICAL ISSUE






OBJECTIVE

- Existing movement capturing systems (Vicon, Qualisys etc.) are expensive(> 10000 USD)
- Need specially trained personnel and specially equipped laboratories in marker based systems
- This approach will introduce a low cost markerless movement capturing and analysis system which has reasonable accuracy like in marker based systems

PROCESS OVERVIEW

Kinect skeleton tracking and data capturing

Matlab calculations

Filtering

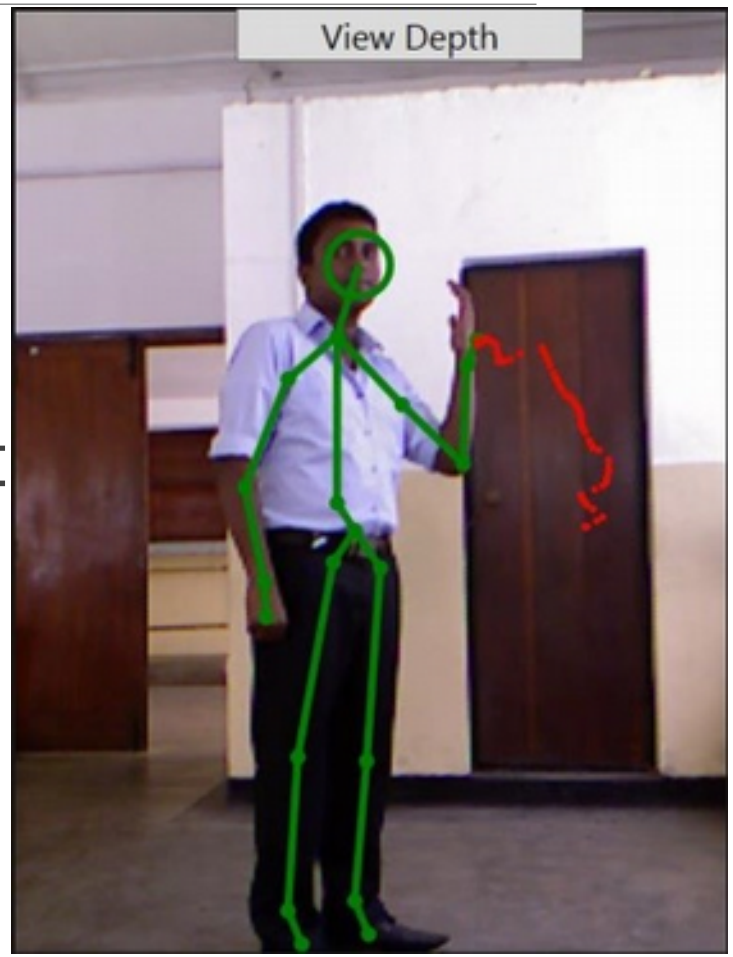
Acceleration calculation

Angle calculation

Create .mot file to feed motion data into OpenSim and visualization

MICROSOFT KINECT DEVICE

- Sensor system designed to be used with Xbox 360.
- Less expensive compared to existing marker based systems.
- Less computational processing to extract data compared to existing marker less systems.
- Can get 3D coordinates of 25 different human joints at a time.

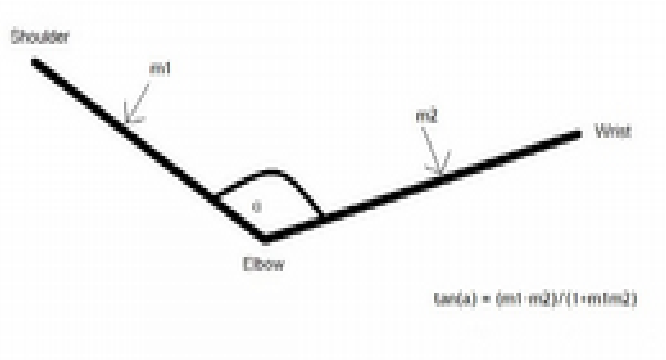


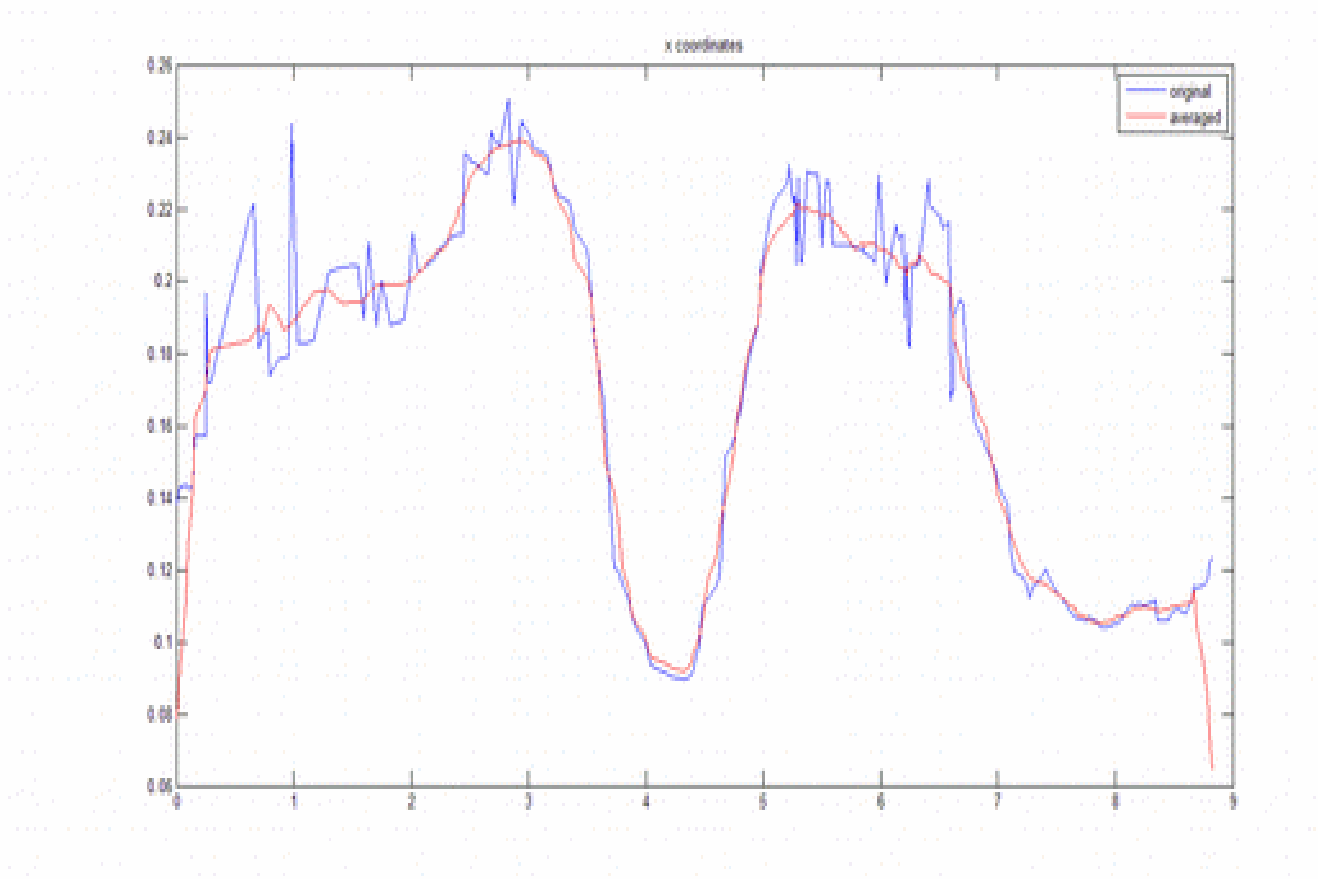
PRE PROCESSING

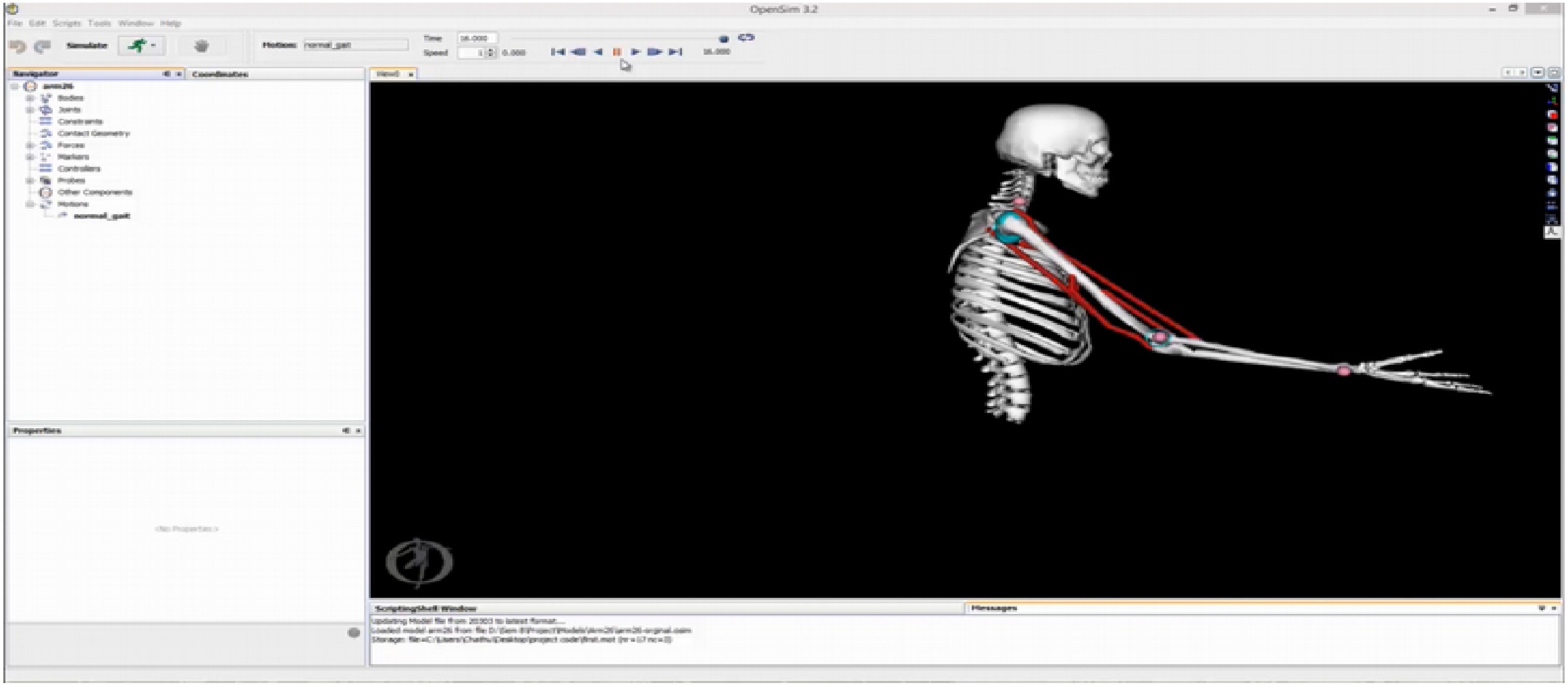
Filtering - Moving average filter

Acceleration calculation - Interpolatic and differentiation for acceleration calculation

Angle calculation - Angle between tw straight lines in 3D coordinate space

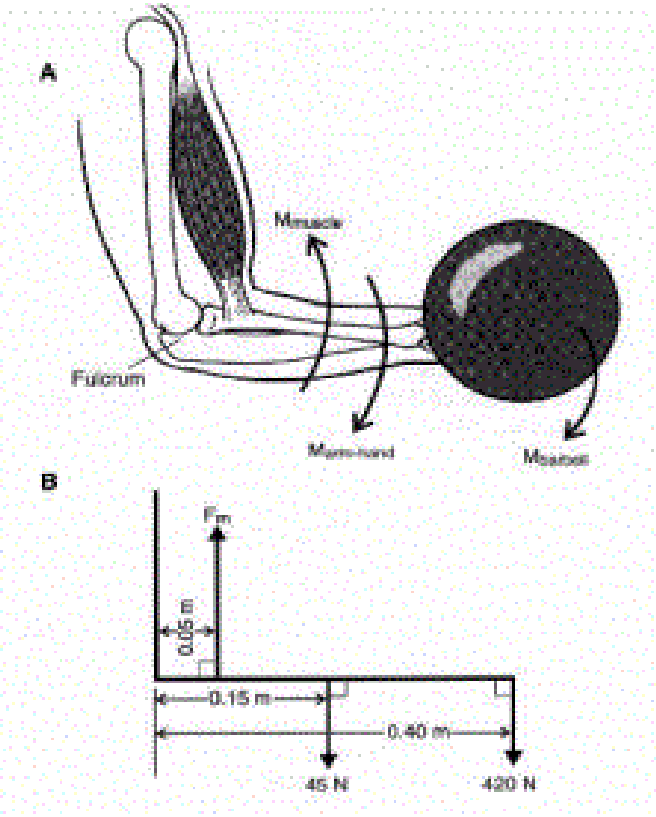





OpenSim 3.2
File Edit Scripts Tools Window Help
Simulate
Motions
normal_gait
Time
Speed
Navigator
Coordinates
arm26
Bodies
Joints
Constraints
Contact Geometry
Forces
Markers
Controllers
Probes
Other Components
Motions
normal_gait
Properties
ScriptingShell Window
Messages

FORCE CALCULATION

- Arm is considered as a rigid body
- Standard free body diagrams & mass acceleration diagrams are used to calculate forces
- Acceleration data and standard values of approximating the mass of the arm and center of mass



POTENTIAL APPLICATIONS

- Force analysis using OpenSim
- Validate results by comparing with rigid body analysis
- Full body analysis using a complete model

THANK YOU


Q&A