

Integration of MEMS inertial sensors towards commercially-viable tracking devices

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Integration of MEMS Inertial Sensors towards Commercially-viable Tracking Devices

Facts about the Elderlies' Falls

- Every year, one-third to one-half of the population age 65 and over experience falls.
- Half of the elderly people who fall do so repeatedly.
- Falls are the leading cause of injury in older adults.
- 5% of falls lead to a fracture.
- Falls cause approximately 350,000 hip fractures annually.
- Among elderly patients with hip fracture, 25% make a full recovery, 40% will require nursing home admission, 50% will require a cane or walker for ambulation, and 20% died from their injuries.

How can we help?

Develop a prototype or wearable medical device for elderlies/ambulatory patients, that will be used for:

- Accurate detection and prediction of falls and differentiation of falls
- Tracking the physical movements in an enclosed environment.

Hardware



STEVAL-MKI062V1
STMicroelectronics
iNemo IMU
(for data acquisition)

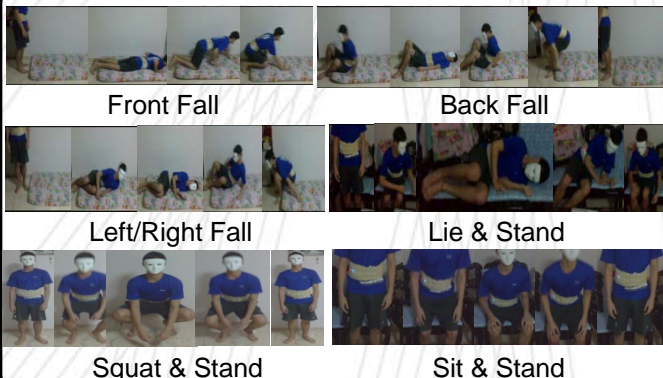


SEN-08454
Sparkfun IMU with
Bluetooth capability
(for prototype)

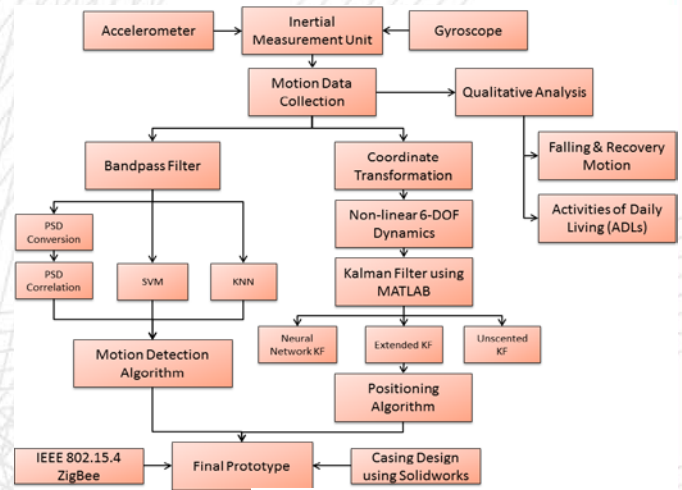


SEN-09184
Sparkfun IMU with
ZigBee capability
(for prototype)

Motion Sequence

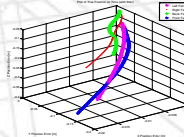


Project Framework



Results

Positioning using Kalman Filters

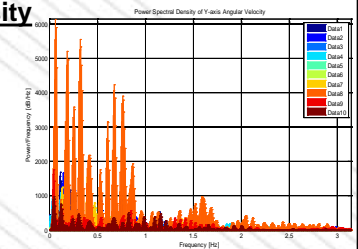


Position Error of Kalman Filter (m)

Neural Network KF	Extended KF	Unscented KF
0.043983365	0.00141	0.000084

Power Spectral Density

The sensor output has various high-frequency vibration noises with low power amplitudes, which can thus be removed using bandpass filter.



Pattern Recognition

	Correlation with PSD data	Support Vector Machine	k-Nearest Neighbour Method
% Detection (Best)	7.14%	14.29%	100%

Preliminary results show that KNN gives the best detection rate of 100% for all types of motion under study.

Conclusion

It is hoped that this device will be implemented in hospices and nursing homes, as well as studio apartments. This will not only help to reduce the incidence of falls among elderlies, but also encourage them to become more independent in self-care.