



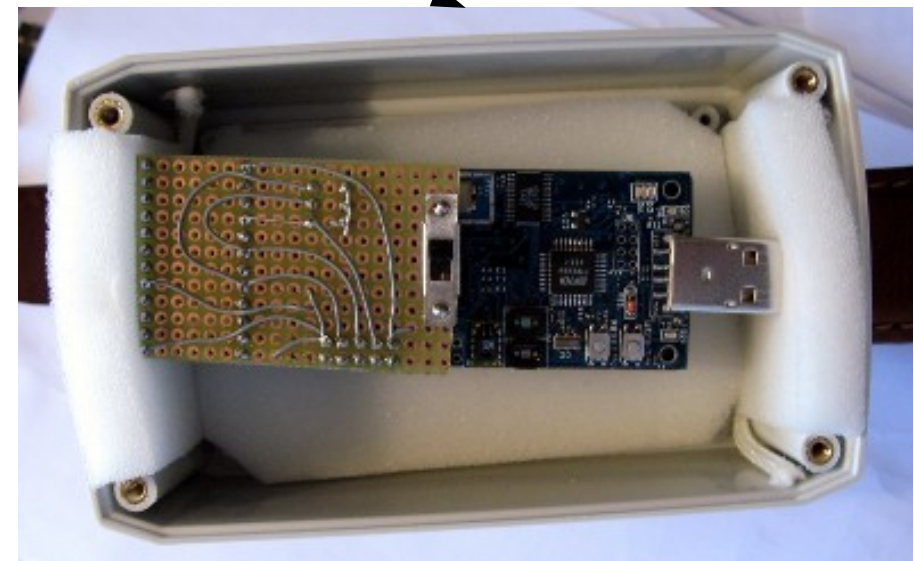
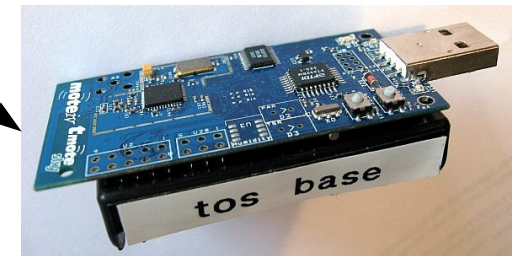
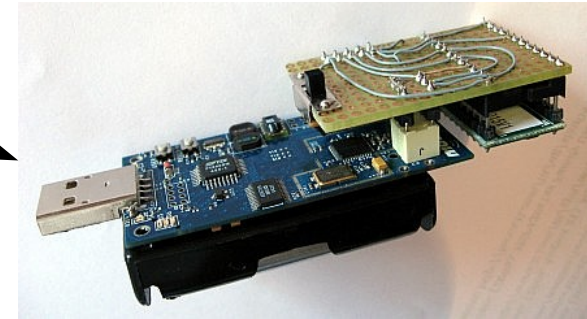
Fall Detection System - *Abstract*

- **Fall Detection System** *by Guglielmo Cola*
- Recent progress in ICT and sensor miniaturization have provided the foundation for the development of systems concerned with the remote supervision of home-based physiological monitoring.
- Driving forces are:
 - Limited funding for public health care services
 - Ageing population
- The ability to record and classify the movements of an individual is essential when attempting to determine his or her degree of functional ability and general level of activity.
- **The focus** of this project is the development of **fall detection system**.



Fall Detection System – *Building blocks*

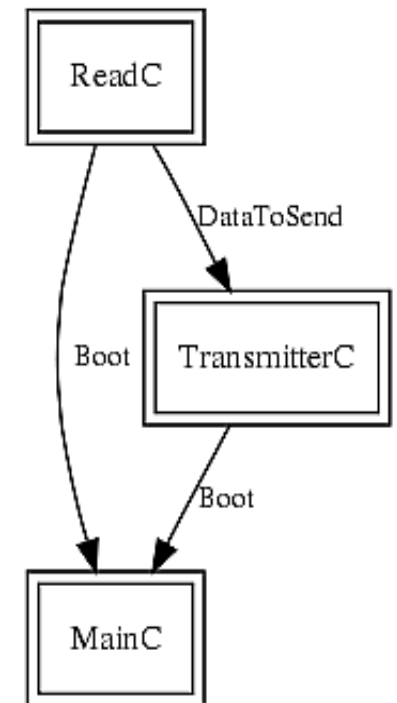
- **A Tmote Sky enhanced** with ST-MEMS triaxial accelerometer.
- **A Tmote Sky** used to transform a PC into a base station
- **A box** which protects the mote. It can be waist-mounted to test the behaviour of the system during real-life activities like walking and sitting as well as after a fall.
- **Three applications:**
 - Fall detection (remote node)
 - Base station (base node)
 - Processing on the PC





Fall Detection System - *FallDetectionApp*

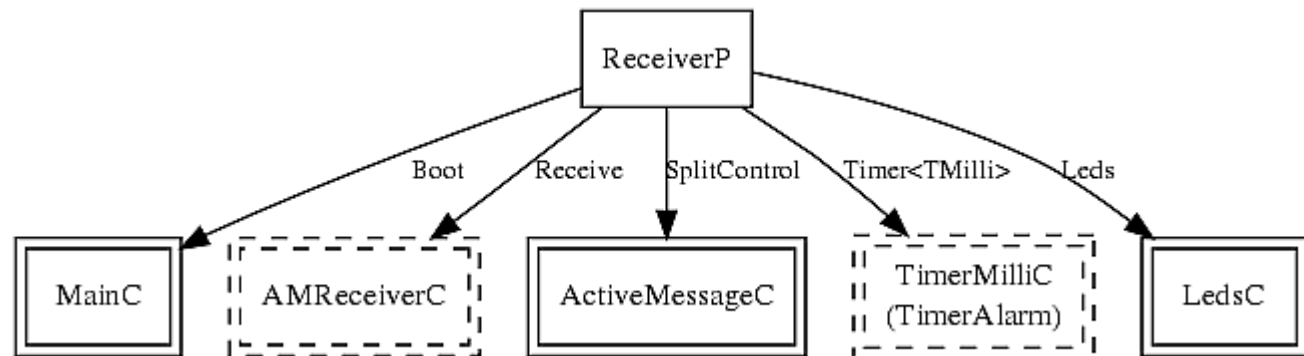
- **FallDetectionApp** is installed in the remote node, which should be waist-mounted.
- Every `SAMPLE_PERIOD` a sample is read from the accelerometer in order to:
 - Save samples collected in the last `BACKUP_PERIOD` seconds.
 - Check if the module of acceleration is above the `ALARM_THRESHOLD` (Fall Detected).
- If a fall have been detected, the remote node turns the radio on and start transmitting to the base for the next `ALARM_DURATION` seconds:
 - Real-time collected samples (information about patient after-fall activity).
 - Samples saved up to `BACKUP_PERIOD` seconds before the fall.
 - Radio is used only when needed to save battery life!





Fall Detection System – *BaseApp*

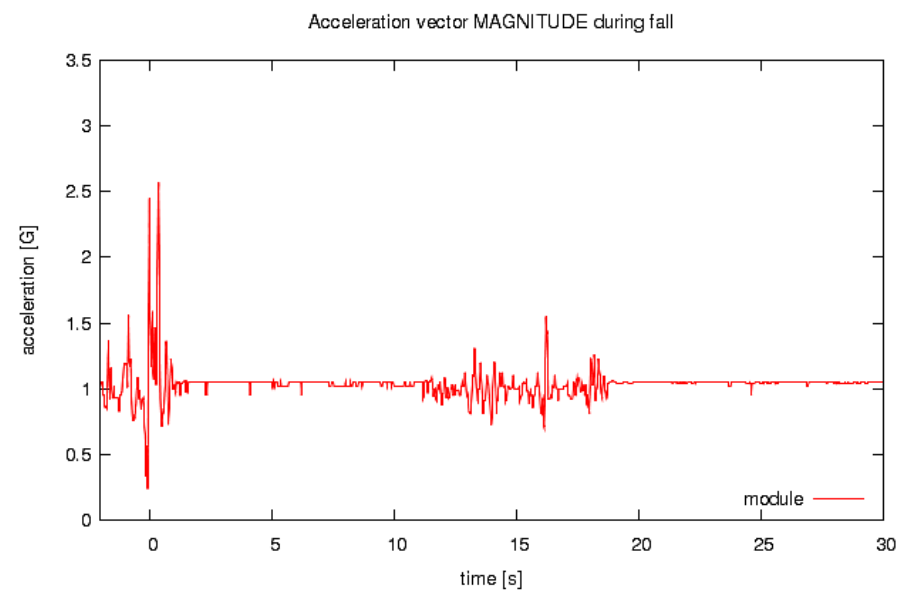
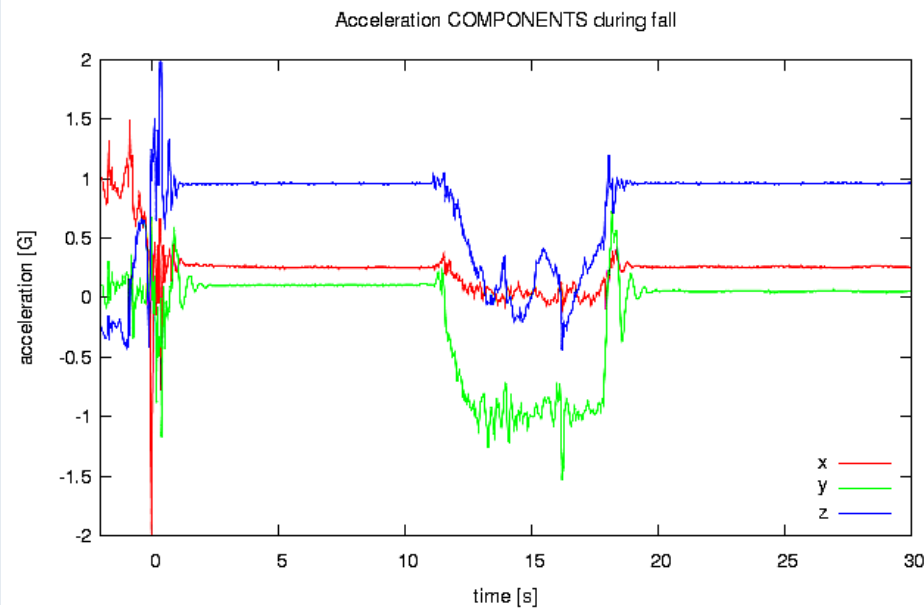
- **BaseApp** is installed in the mote connected to the PC.
- The base node just has to:
 - Receive packets from the remote node
 - Extract the relevant fields: x, y, z accelerations.
 - Print out messages using printf library:
 - “ALARM” when a new fall has been detected
 - “X Y Z” values for each sample received
 - “END ALARM” ALARM_PERIOD seconds after the fall detection.





Fall Detection System – *PC processing*

- Script **start.sh** just redirects the output of BaseApp to the script process.php
- Script **process.php** does:
 - Alert the user when a fall has been detected printing out a message and playing an alarm sound.
 - Visualizes real-time information received about x,y,z acceleration components
 - After ALARM_DURATION seconds saves all the data received in a log file and displays plots to the user.





Fall Detection System – Bibliography

- Dean M. Karantonis, Michael R. Narayanan, Merryn Mathie, Nigel H. Lovell, Branko G. Celler, “Implementation of a Real-Time Human Movement Classifier Using a Triaxial Accelerometer for Ambulatory Monitoring”, IEEE TRANSACTIONS ON INFORMATION TECHNOLOGY IN BIOMEDICINE, VOL.10, NO.1, Jan. 2006