Project Ko-TAG

Pedestrian Movement Classification with Inertial Sensor Data

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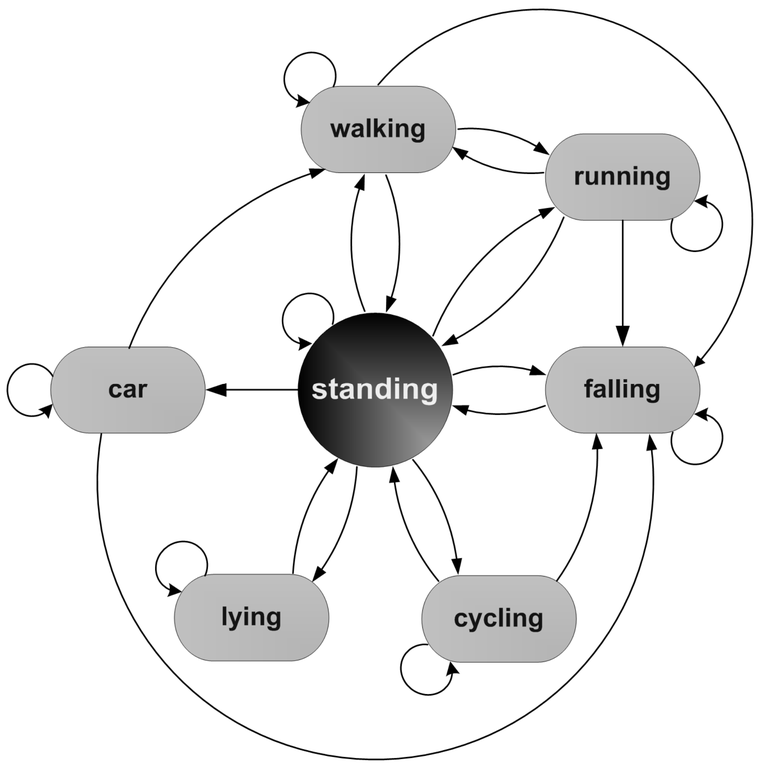
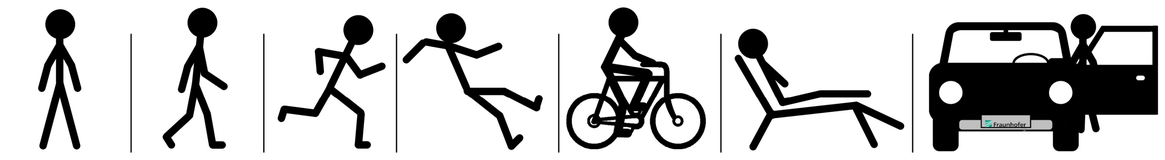
K O - F A S

Overview



- Reduction of severe accidents in road traffic situations by detection and recognition of vulnerable road users.
- The combination of movement classification data, distance and angle of arrival measurement enables the detection of hazardous situations.
- Detectable States:

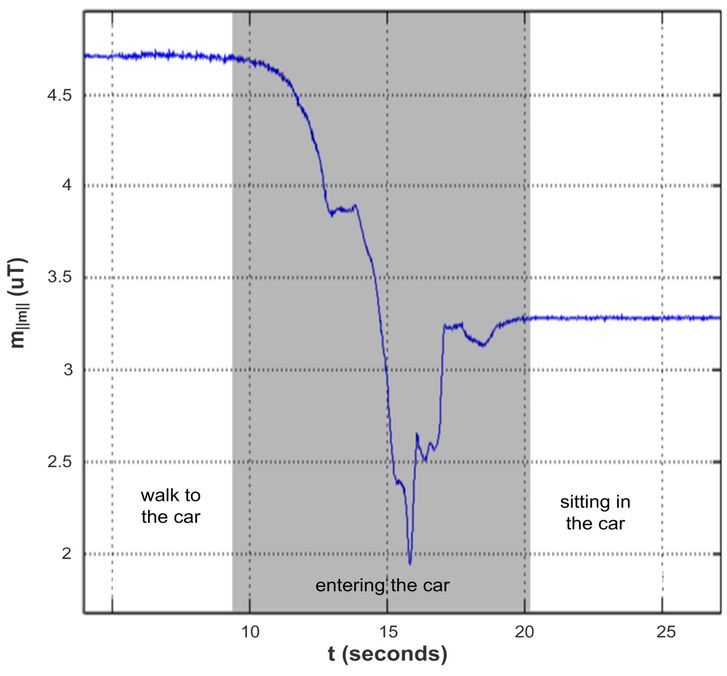


Description of Hardware

- The hardware is build as a low-cost system, based on the typical sensor technology (MEMS) used in regular smartphones.
- The hardware can be used as a stand alone system or integrated in the hip worn demonstrator.
- Size (component): 58 mm x 37 mm x 12 mm
- Size (stand alone): 117 mm x 73 mm x 28 mm

	Accelerometer	Gyroscope	Magnetic Field Sensor
Dimensions	3 Axis	3 Axis	3 Axis
Range	±2.0 / ±4.0 / ±8.0 g	±2000 °/s	±0.7 / ±4 Gauss
Sample Rate	1000 Hz	8 kHz	50 Hz

Explanation of the Classification



- The classification algorithm is fed with data from:
  - Gyroscopes
  - Accelerometers
  - Magnetometers
- Each movement generates characteristic signal data which are used as generic pattern for the classification.
- Example – Getting into a car:
  - Steel in car body causes an anomaly in earth's magnetic field
  - Typical patterns can be detected using hip worn sensors:
    - Rotations of a person while entering a car
    - Accelerations at the point of contact between body and car seat
  - Combinations of all typical patterns give information on person's movement

Results

values / percent		labeled data: standing	walking	running	entering a car	throwing	cycling	lying
classification	standing	92	0	0	24	0	7	0
	walking	8	100	0	0	0	21	0
	running	0	0	100	0	0	0	0
	entering a car	0	0	0	76	0	0	0
	throw	0	0	0	0	100	0	0
	cycling	0	0	0	0	0	72	0
	lying	0	0	0	0	0	0	100

Discussion of Results:

- Using the algorithm, all activities are classified correctly with an accuracy of 91 %.
- States "walking", "running" and lying can be classified without false-detection.
- "Entering a car" and "cycling" are the most challenging states:
  - Designs of cars (bikes) are different and lead to different patterns
  - An incorrect (e.g. loose) attachment of the sensor to the human body increases false classifications

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