



Use of GPS and Sensors in Studies of Activity and Participation

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Aim:

To develop a research tool that can obtain accurate quantitative results when monitoring peoples' daily activities.

Specific research questions were:

How do subjects participate in community life?
How do subjects use special wheelchair features?
How active are subjects in their wheelchairs?

Background:

Passive sensor-based monitoring and GPS monitoring has been shown to be very effective in the ambulatory population, but has seen little testing in the wheelchair community.

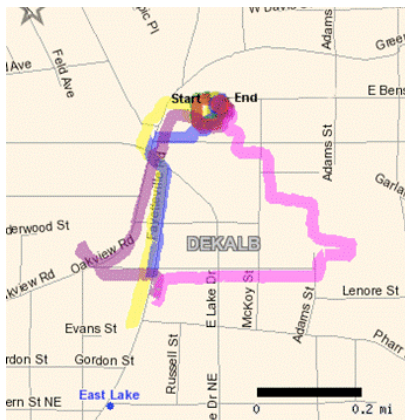
Methods:

A Wheelchair Activity Monitoring Instrument (WhAMI) was designed and programmed to collect and record information about subjects activity.

Sensors include wheel revolution counters, tilt sensors, seat occupancy sensor, and a GPS receiver. Subject data was recorded for two-week periods.

Results:

Community Participation. GPS data is used to create a map of destinations and travel. In addition, the GPS data logger obtained information on the time, duration, speed, and mode of travel.



Activity Types During Trips Away from Home

Social 15%
Entertainment 44%
Daily Living Task 32%
Undefined 9%

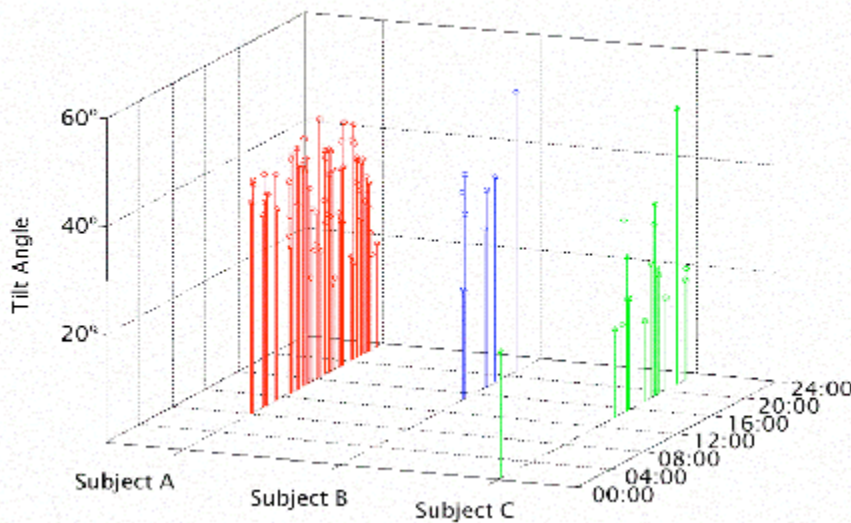
A GPS/GIS-based prompted recall survey added supplemental information about trip purpose.

Wheelchair Activity. By monitoring distance traveled and when the subject was seated, understanding about subject activity was gained. In this analysis, bouts were defined as groups of movement that are separated by short periods of inactivity.

Subject	A	B	C	D	E	F
Bouts Per Day	47.1	136.1	281.6	69.0	211.6	77.5
Avg. Distance Per Day (ft.)	1741	3030	4744	18239	4092	3869
Avg. Bout Duration (min.)	0.30	0.69	0.29	1.29	0.40	0.88
Avg. Bout Distance (ft.)	27.6	20.1	16.2	252.6	19.6	48.2
Avg. Time Moving Per Day (min.)	16.9	78.5	73.9	87.9	77.1	67.9
Avg. Tilts Per Day	24.0	3.3	15.3	2.4	1.0	0.5

Special Feature Use. Accelerometer-based tilt sensors measure when and how much subjects tilt. Half of tilt durations were less than twenty minutes. Note the variability of tilt within and across subjects.

Daily Tilts of Three Subjects over Five Days



Discussion:

GPS data can help subjects boost recall in interviews. Also, the raw data is far more detailed than what can be gathered using self report methods.

WhAMI data validates self report measures and helps overcome challenges such as forgetting and miscalculation when using self-report alone.

These devices are costly and complex to setup, design, and test. Also, they can never give motivation or importance of an action.

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