A Rollator-Mounted Wayfinding System for the Elderly: Proof-of-Concept Design and Preliminary Technical Evaluation

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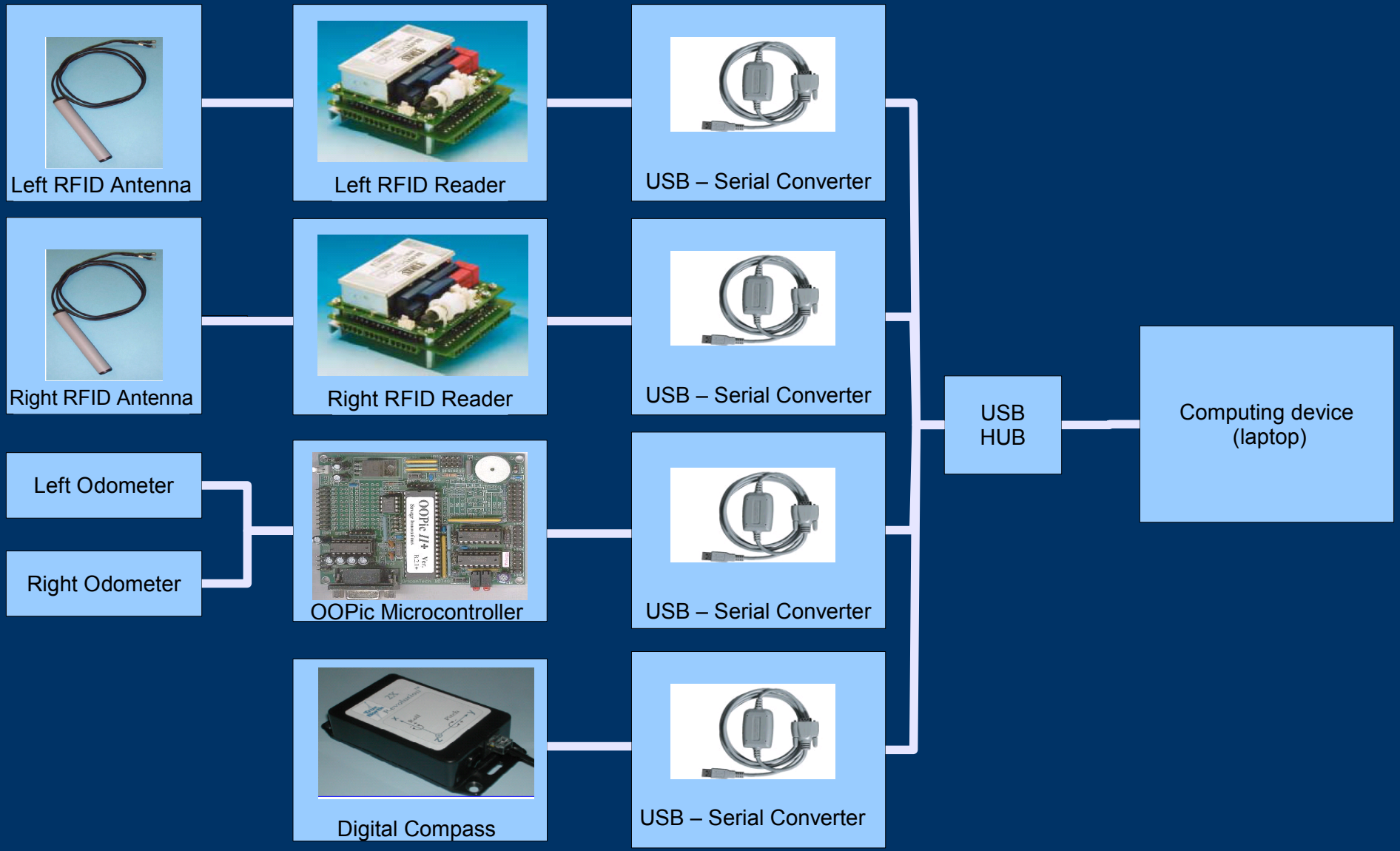
Motivation

- Currently 12% of US residents are of age 65 years or older
- By 2030 this number will increase to 22%
- Primary concern for aging adults is a decline in their sensory-motor abilities
- A great number of US residents would like to maintain their independent status in their homes and communities as long as possible

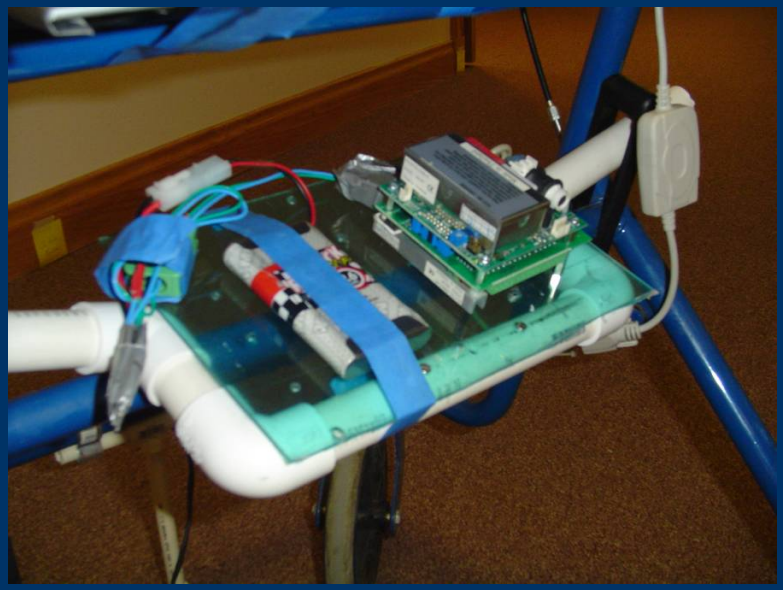
The iWalker

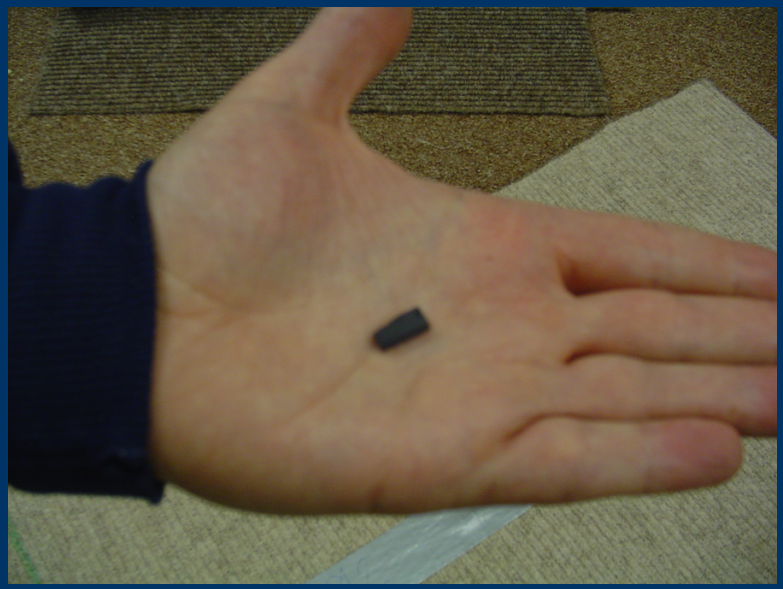
- Standard Rollator
- Provides current location and heading
- Can be used to provide directions and reminders
- Speech or graphical output
- Low cost

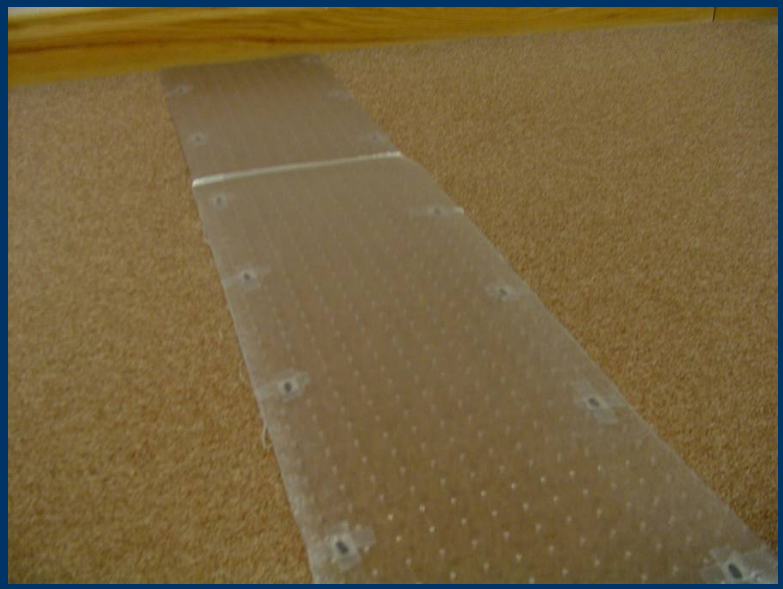
How is this done?



Islands of Certainty



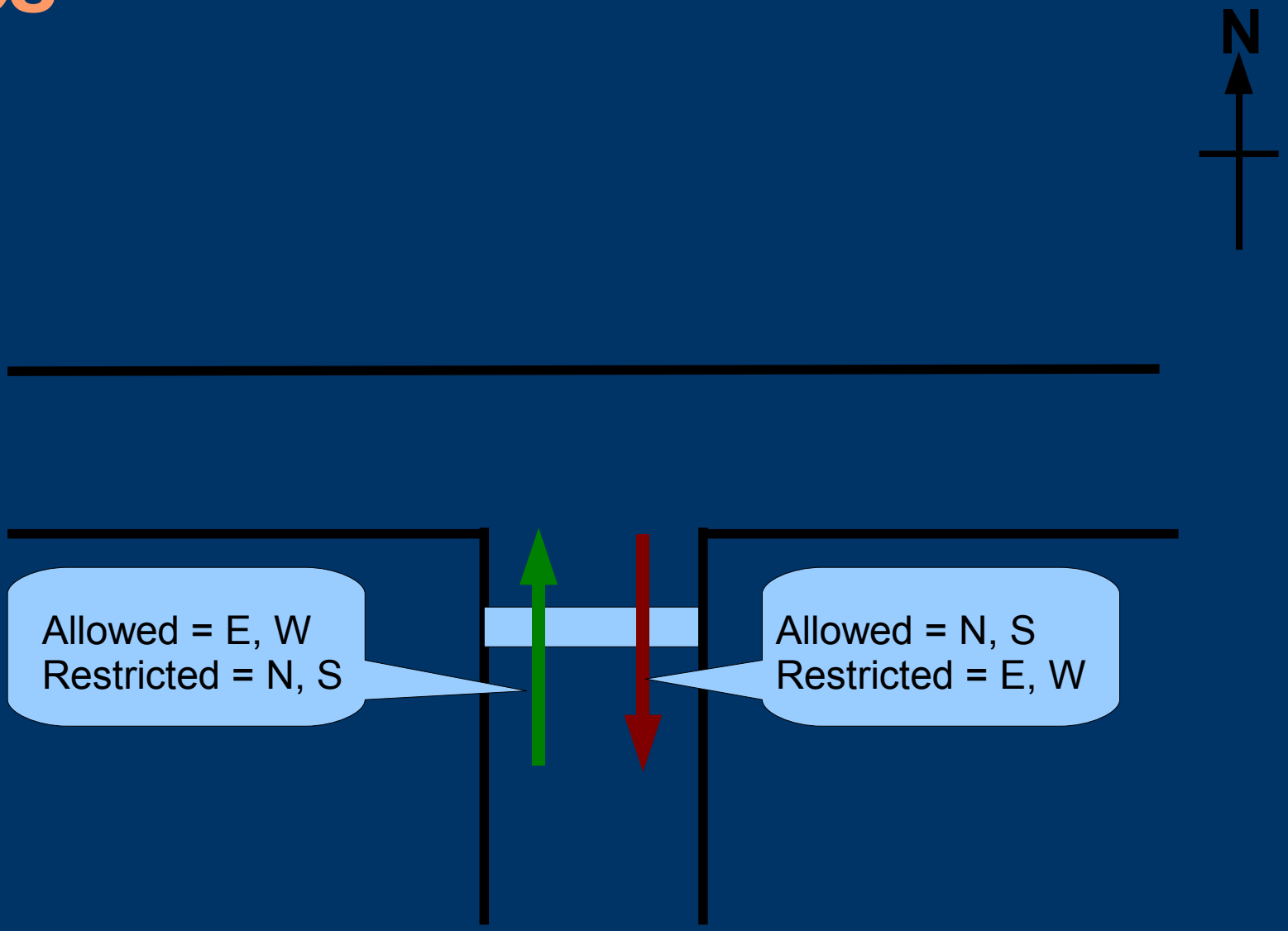




Kepler's Theorem

In his book *De Nive Sexangula* (On the Six-Sided Snowflake), Kepler asserted that in the 3D space, face-centered cubic packing, e.g., apples on a fruit stand, was the tightest possible.

Dynamic discretization of compass angles



Localization algorithm

When reading a tag on a rfid mat:

$$x = x_{tag}$$

$$y = y_{tag}$$

update discretization rules

$$\theta = \text{discretize}(\theta_{compass})$$

Otherwise:

$$\theta = \text{discretize}(\theta_{compass})$$

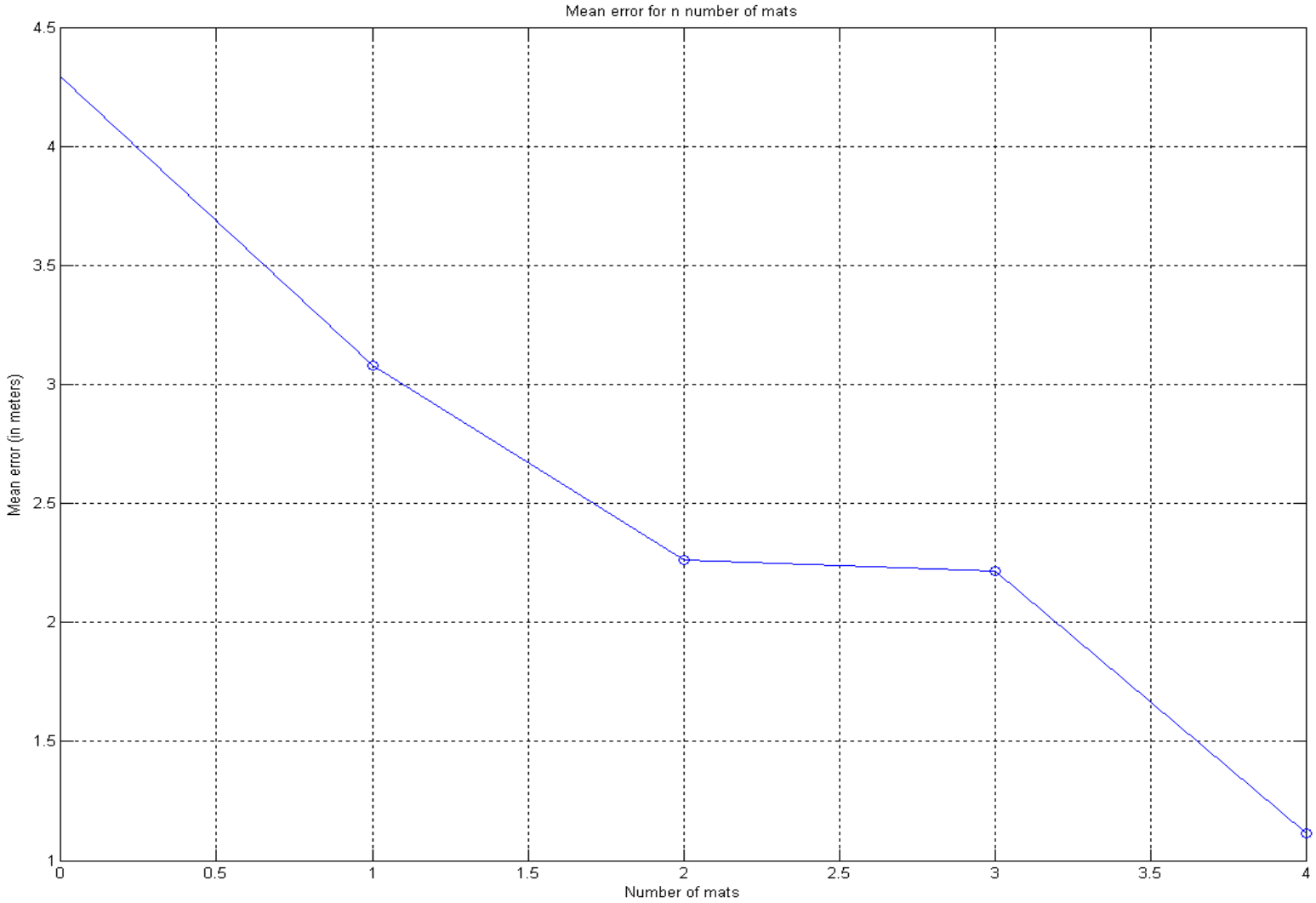
$$x = x_{prev} + \text{distance} * \cos(\theta)$$

$$y = y_{prev} + \text{distance} * \sin(\theta)$$

Experiments

- Tested on the fourth floor of Old Main
- Route length approximately 40 meters
- 4 configurations – no mat, 1 mat, 2 mats, 3 mats, 4 mats with dynamic discretization of compass angles
- Over 30 runs for each configuration

Results


Mean error for n number of mats
Mean error (in meters)
Number of mats
4.5
4
3.5
3
2.5
2
1.5
1
0
0.5
1
1.5
2
2.5
3
3.5
4

Conclusion

- We have shown that localization error can be contained to just over a meter using low cost components and dynamic discretization of compass angles.
- We are conducting tests to test the effectiveness of the iWalker in helping elderly people maintain their independent status.

Vote of thanks

Thank You

Any questions?