

Context aware Navigation Model supporting way-finding of Vision impaired people in indoor Environments



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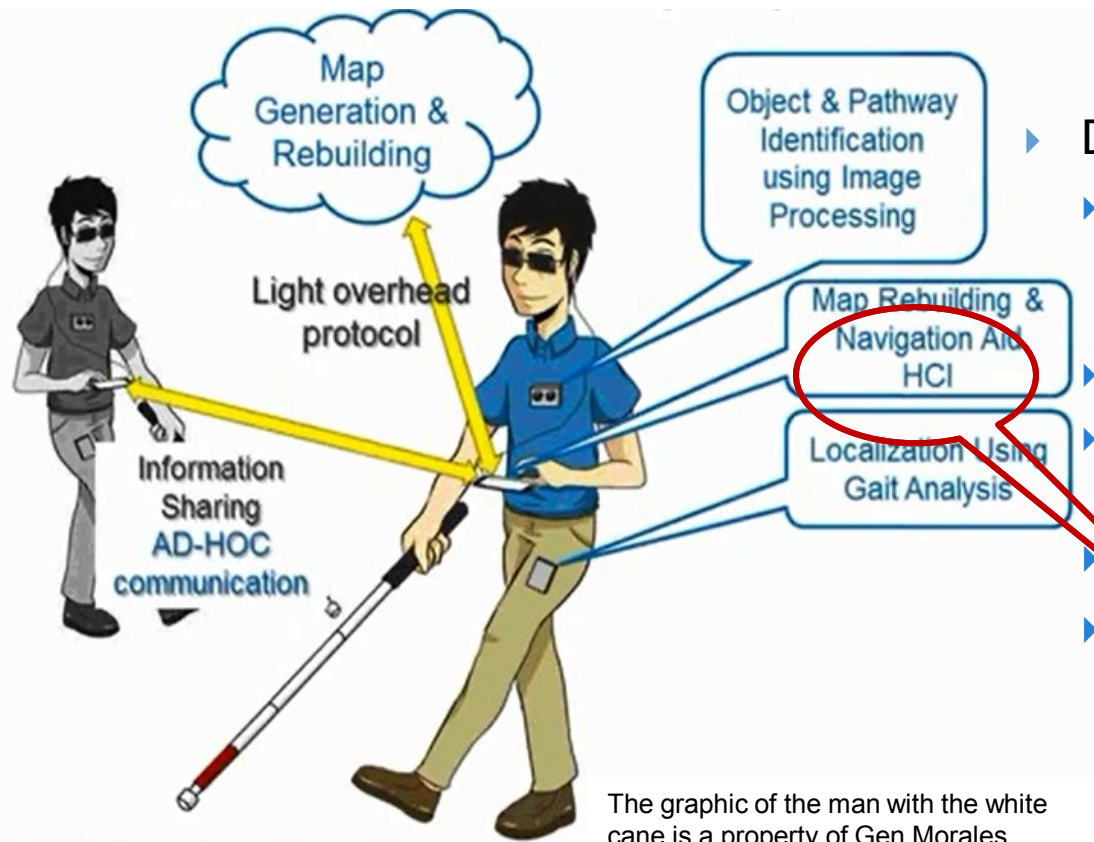
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A navigation model based on the perspective of VI people

Image source: <http://dsq-sds.org/article/view/3757/3280>

Background

- ▶ Main project – **ETA for VI people**: Aiming at supporting Vision Impaired people navigating inside a building



- ▶ Different aspects
 - ▶ Extract the building features using image processing techniques
 - ▶ Locating the position of person
 - ▶ Developing building maps based on available information
 - ▶ ...
 - ▶ ..

Path Planning

The graphic of the man with the white cane is a property of Gen Morales

Path planning for VI people : Main observations

- ▶ Less consideration for path planning in existing INSs for VI people [1][2]
- ▶ When considered, use A* and shortest path algorithms , with distance, time minimization; some consider avoiding stairs etc.[2], visibility graph for path planning[1]
- ▶ Integrating tactile landmarks and support for adjusting veering to make path planning more smarter are suggested[2]
- ▶ Optimization goal : **Distance or time minimization Vs safety or convenience**
Ex: the path with open spaces would be shorter but more difficult for a VI person

1



2



Image source : <http://rmhtwincities.org/what-we-do/ronald-mcdonald-house-childrens-minneapolis/>

Path planning for VI people : Main observations

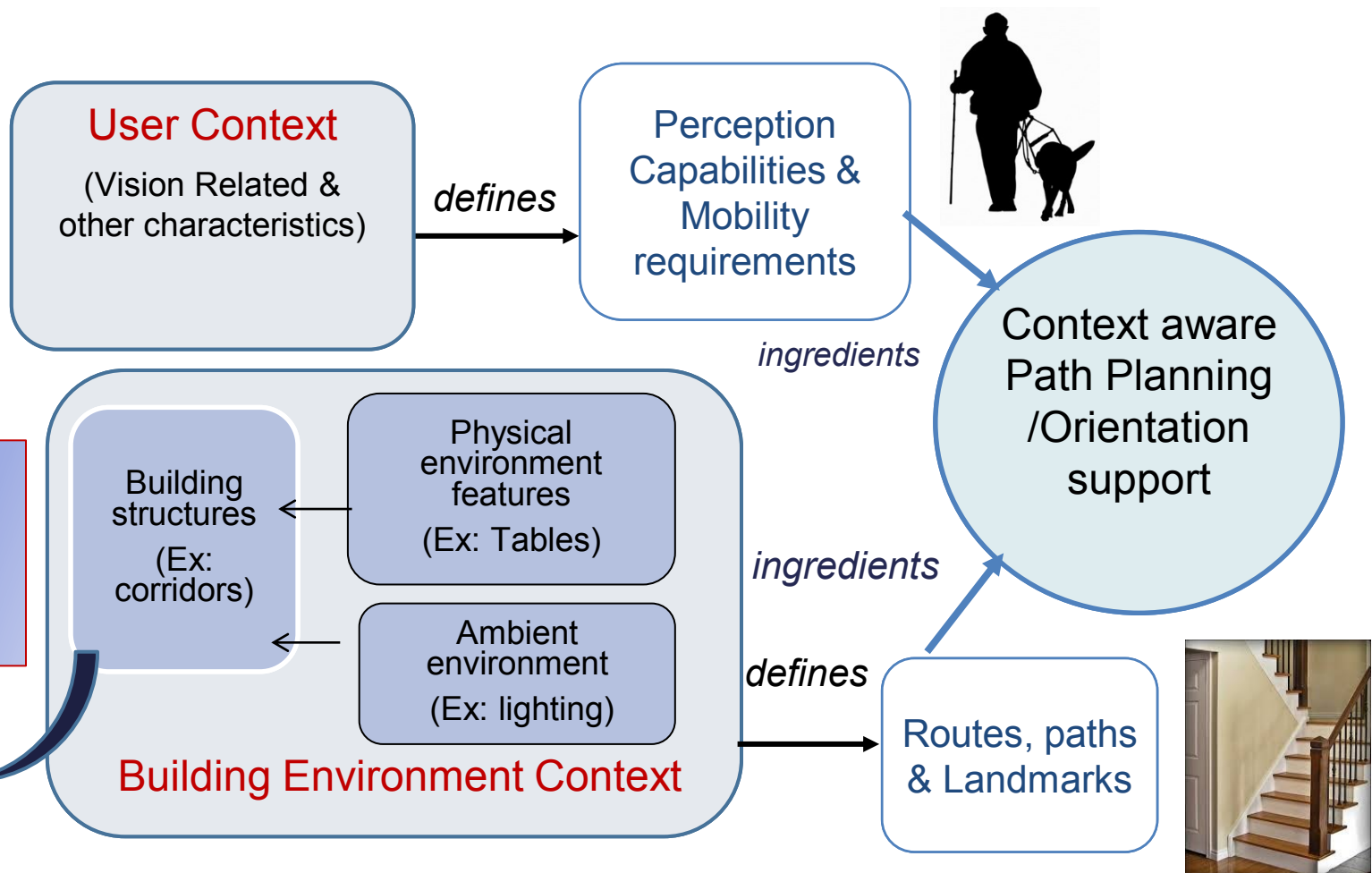
- ▶ Majority of **clues** used by non VI (NVI) people are **visual &** are intrinsically picked up to establish the orientation
- ▶ They are not available in the same way for VI people; limited vision make the navigation different [3] : *Looking, Listening, Touching, Walking, Feeling of Wind* [4]
different perspective
- ▶ Individual characteristics of VI people vary very much and based on that the navigation capabilities of them vary [5] ; Vision impairment cannot be reduced to a single stereotype.
- ▶ When moving around in an environment **structural features of the environment** are useful in sensing the surrounding and thereby navigation [4]

Our Approach : user centric with context awareness

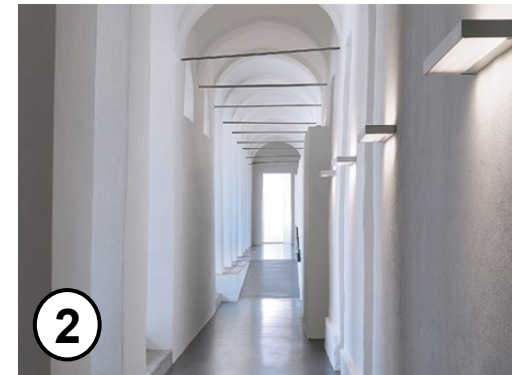
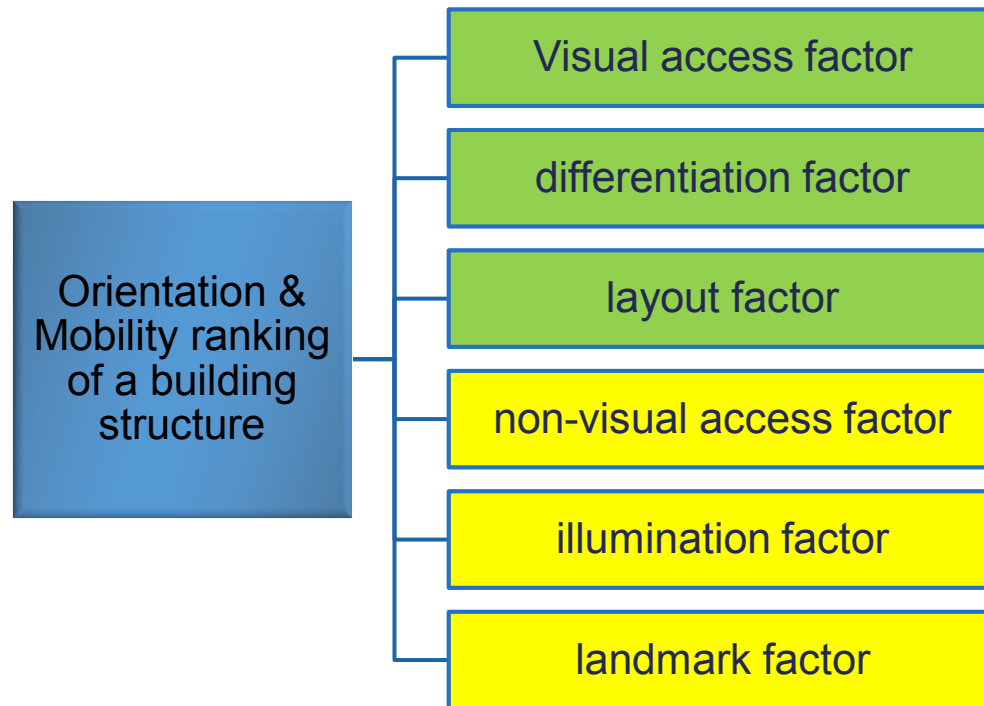
- ▶ Assumes that the path suitable for indoor navigation of VI people would be better determined considering the,
 - ▶ **Individual's capability** to negotiate with the indoor environment
 - ▶ The support and restrictions related to **building structures** and features within the indoor environment for navigation of people with VI
- ▶ Contexts identified

| | Contextual domains | Examples | |
|---|-----------------------|---|------------|
| 1 | User Characteristics | Vision Related attributes, using a White cane | Individual |
| 2 | Building Structures | Corridors, Light Switch | |
| 3 | Physical Environments | Tables, aisles in a supermarket | Building |
| 4 | Ambient Environment | Lighting levels, noise | |

Overview of the functionality of the proposed model



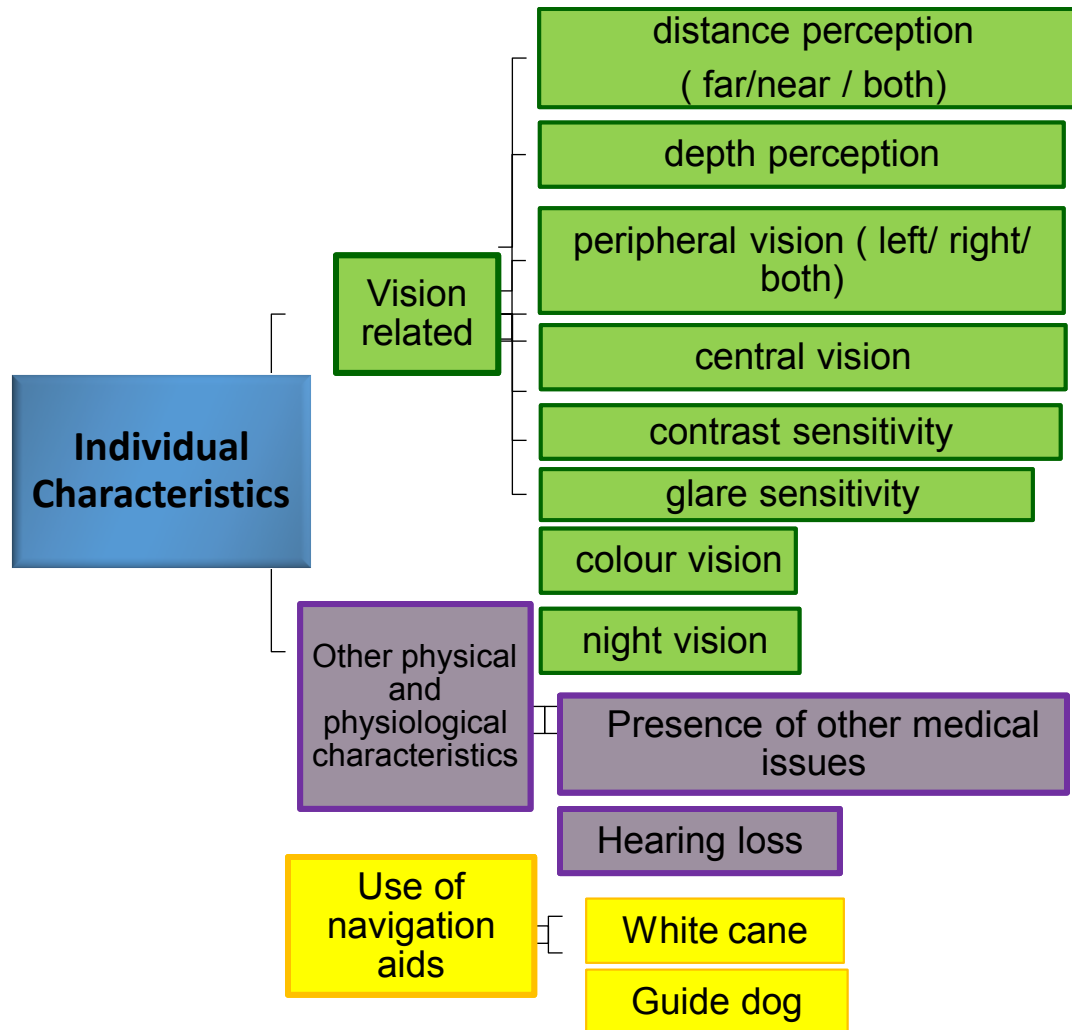
Building Environment Characteristics



First three parameters are as per [6]

Image source : (top) <http://www.solvinaward.com/news/1366/puzzle-solution-vector-system-aids-visually-impaired-tactile-footways> (bottom) <http://www.waldmannlighting.com/OfficeArchitectural/Applications/Corridor.aspx>

Contexts of User : Individual Characteristics



Impaired peripheral vision (Glaucoma)



Impaired central vision (Macular Degeneration)

Future work and Conclusion

- ▶ Final outcome would be a multi-criteria model for path planning, with building feature OMR
- ▶ Can be useful for other purposes also
- ▶ The sub parameters of the building environment need to be identified, analyzed and classified
- ▶ Individual characteristics also needs to further analyzed
- ▶ Comparison of contexts useful based on two scenarios: simple & complex environment and two settings (Sri Lanka & Perth, Australia)
- ▶ Indoor OSM is being considered as a possible tool to record the OMR

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<https://cuatrg.wordpress.com/indoor-navigation/>
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Thank you !



Source : <http://www.worldaccessfortheblind.org/>

Daniel Kish, President of World Access for the Blind, leads a group of blind hikers. Recreational activities such as hiking are a valuable way for the blind to build confidence, improve their navigation skills, and fully participate in society. (Photo by: Volker Correll)

References

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