Embedded Systems Design Projects for Social Impact

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Preamble

- Microprocessor based system design
  - 3rd year core course

Boring!

- Sabbatical in Germany 1994-95
  - Successful group projects

Self-learning

Embedded Systems Design Course

- Open ended project
  - concept demonstration or building prototypes
- Specification, design and demonstration – all made significant
- Lot of emphasis on demonstration in an open forum
- Groups of 4 to 6 students
  - preferably from different disciplines
- Projects in three broad themes
  - Assistive technology
  - Smart campus
  - Sustainable habitat

COP315 Projects - 2017

- Indoor navigation assistance: LHC
- Sound Map: depth map using ultrasonic sensors
- Pratyaksh: Compact wrist band
- Smart notice board: Campus wide display
- Traffic monitoring: Campus speed monitoring
- Smart fan switch: Lift lobby switch
- Persistence of vision: Bike display project

COP315 Projects - 2018

- Inclusive classroom: Access to projected information
- Testing TacRead: Automated testing of Braille cells
- Braille tutoring app: DotBook application
- Sound detection network: Campus map
- Rare activity detection: Peacock dancing
- Service monitoring: Mess feedback system

COP315 Projects - 2019

- Navigation assistant: AIIMS wayfinding
- Remote visual assistant: Supporting visually impaired
- Sound classification: Assistant for hearing impaired
- DeBoard: Assistance for de-boarding
- Traffic monitoring: Speed violation detection

Some Campus Deployed Projects

- PickMe – Campus rickshaw calling service
- Intelligent display – Campus wide display system
- Campus traffic monitoring
- Lunch club accounting

COP315 Course Flow

- Announcement and meeting with interested students before the semester break
- Present and discuss projects in three streams
  - Assistive technology
  - Smart campus
  - Sustainable habitat
- Students to form project groups (inter-disciplinary preferred)
- Three presentations
  - Specification and methodology
  - Methodology and progress
  - Progress and demonstration (incl poster plan)
- Final evaluation
  - Demonstration at the Institute Open House (3/4th Saturday of April)
  - Feedback from a jury

OH-0191

Deboarding Assistance for Visually Impaired

Ujjwal Agrawal (2017EE30548)
Varun Gupta (2017EE30551)
Raghav Gupta (2017EE10544)
Sarthak Garg (2017EE30546)

ABSTRACT

- There is no support for deboarding a bus on existing OnBoard project; a problem for visually impaired people
- We have created a GPS based device and an app to speak out next 3 bus stops on pressing a Query button
- The bus operator can view the real time location of all buses using a server. Also, functionality to assign specific routes to buses has been provided.

Server

Real Time Map

Assigning Bus Route

METHOD

Server assigns bus routes to Pi - sends route database to pi

Pi gets current coordinates from GPS and uses database to compute next 3 stops

Sends real time data to server where live location can be viewed

Pi functions as an Eddystone BLE beacon and advertises data about next three stops in packets

App receives the packets, converts them into string format and uses Text to Speech to speak out the next three stops

ELECTRICAL DEPARTMENT, IITD

ACKNOWLEDGEMENTS

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We thank Vikas Upadhyay Sir for his assistance in the project.
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ASSISTECH: A Lab to User Journey in Assistive Technology

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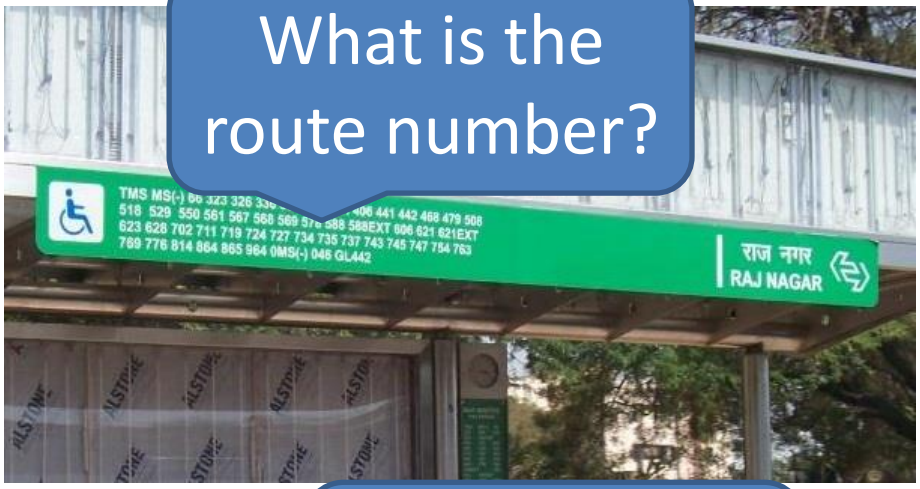
Pedestrian Mobility Challenges

- Ultrasonic ranging – 3 meters
- Warning through intuitive vibratory patterns
- Complements white cane functionality
- Detachable handle
- Suitable for all grips
- Low power & chargeable

SmartCane

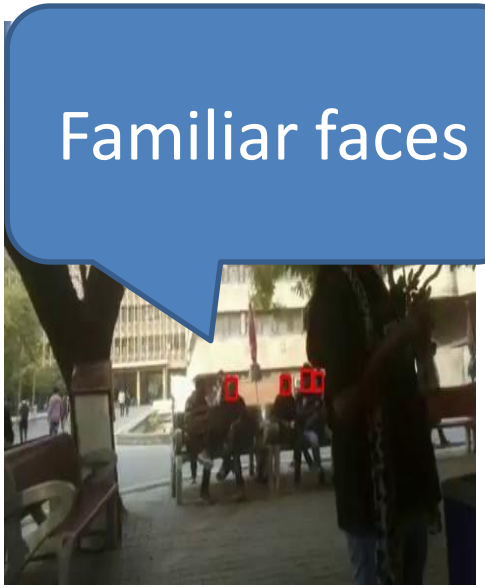
Knee-above + non-contact obstacle detection

Mobility Using Public Transport

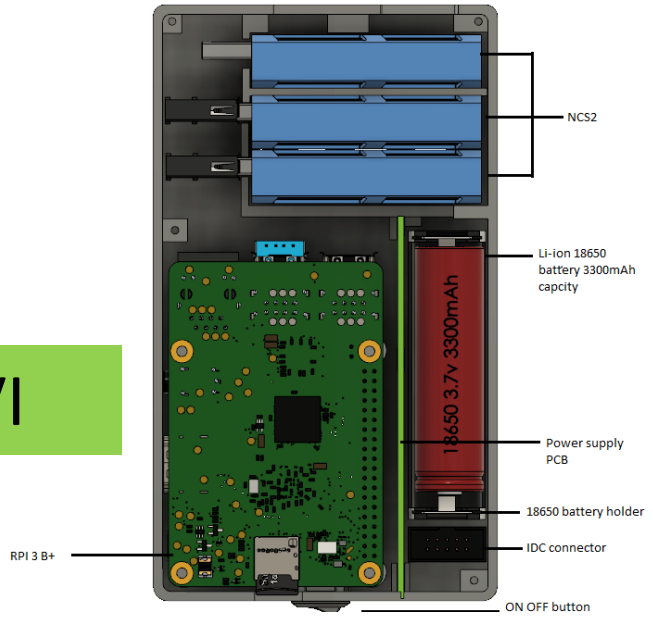


OnBoard

Outdoor Mobility & Navigation



MAVI



Mobility Assistant for Visually Impaired (MAVI) – Current Status

Research now supported by DST – IoT of Cyber-Physical Systems (ICPS)
Collaborator: Prof Chetan Arora, CSE Department, IIT Delhi

Features:

Capable of detecting and alerting presence of

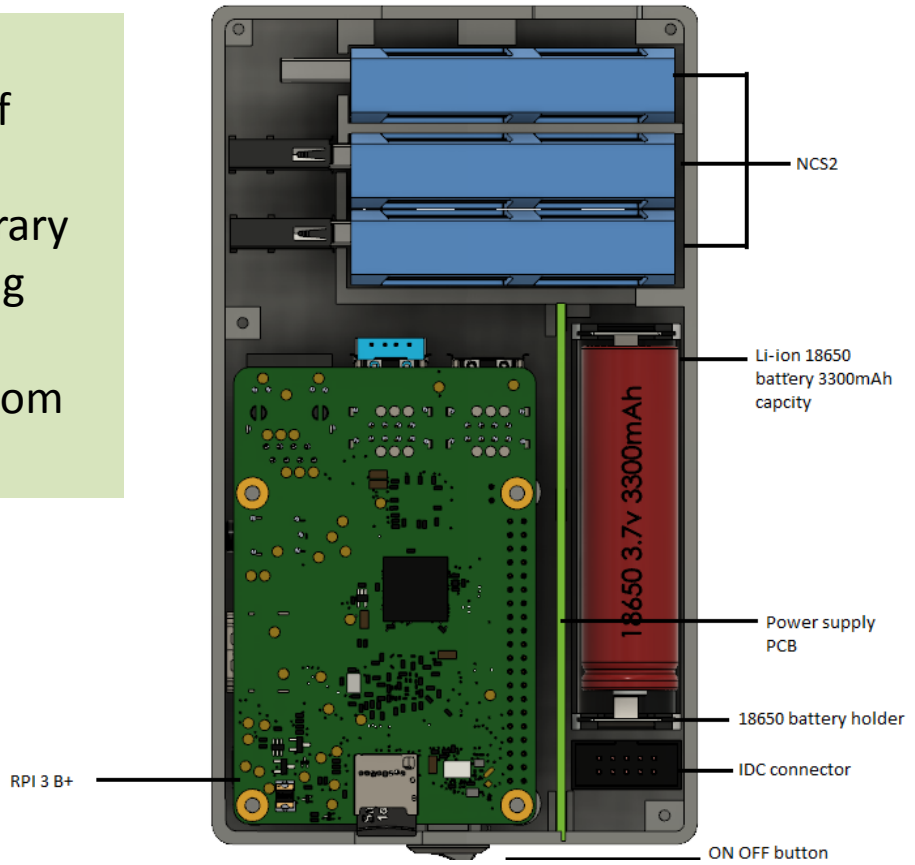
- Dogs and Cows
- Human faces + face recognition from a library
- Signboards (English and/or Hindi) + reading them out

(Pothole detection dropped as not suitable from the same camera angle)

Solution:

Camera + MAVI Device + Mobile (for I/O)

MAVI device – includes Raspberry PI 3B+ 3X NCS2 Accelerators + Custom power supply PCB + 3300 mAH Battery



Completed: Datasets ready; Mobile app ready; Proof of concept demo ready;
In progress: Models need fine-tuning; Hardware and latency need to be optimized;

Indoor Navigation

- Public buildings barring airports and metro stations have very poor signage
- Independent indoor mobility requires easy navigation to your intended destination as well as access to utilities like toilets, water points, lifts, stairs etc

IncluNav

AIIMS RP Ophthalmic Centre

To touch a million lives