



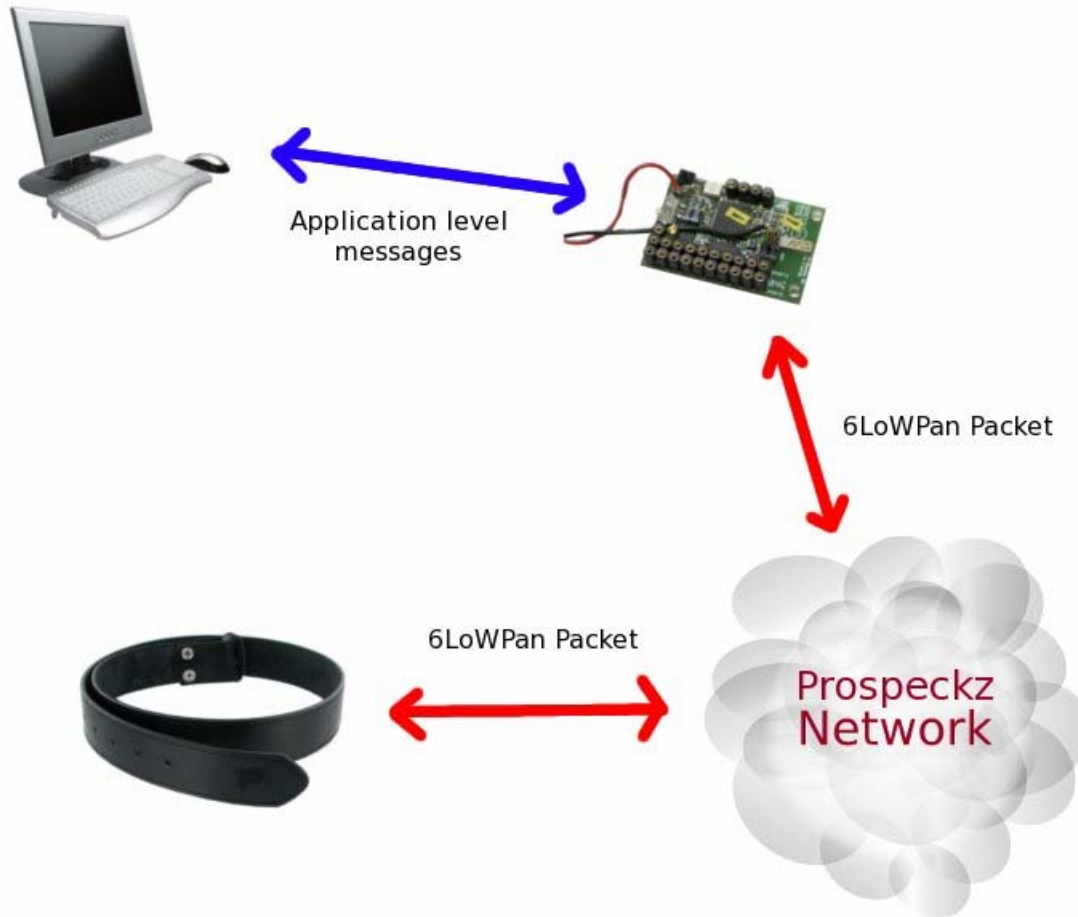
“On-body Indoor Navigational Assistance for the Visually-impaired”

Igor Czerwinski

Dimo Iliev

James McKeown

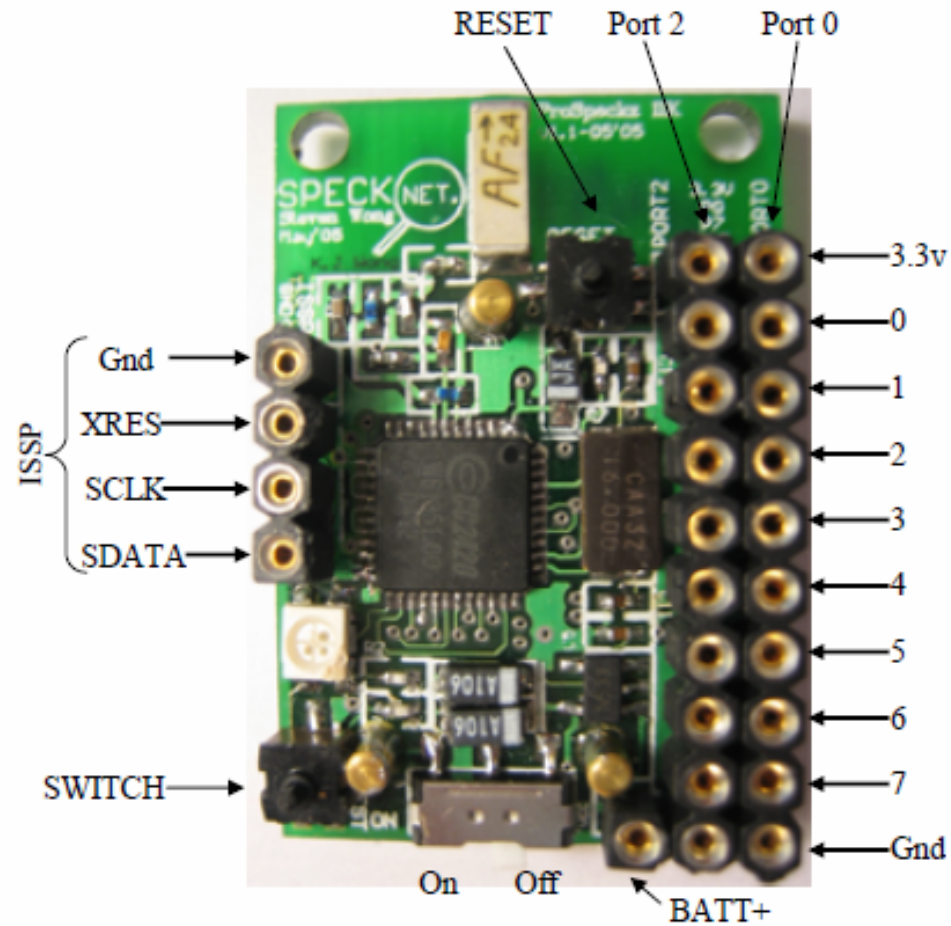
Tsveta Stoyanova



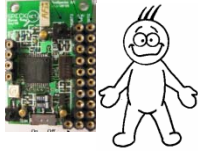
What is a ProSpeckz II K?

- A Programmable System-on-Chip (PSoC)
- A Zigbee Radio Chip CC2420
- A 2.4 GHz Antenna
- A RGB LED
- A general purpose switch
- 2 x 8-bit ports (Port 0, Port 2) free for interfacing with other analog or digital components
- A 32.768 KHz external oscillator

What is a ProSpeckz II K?



The project explained

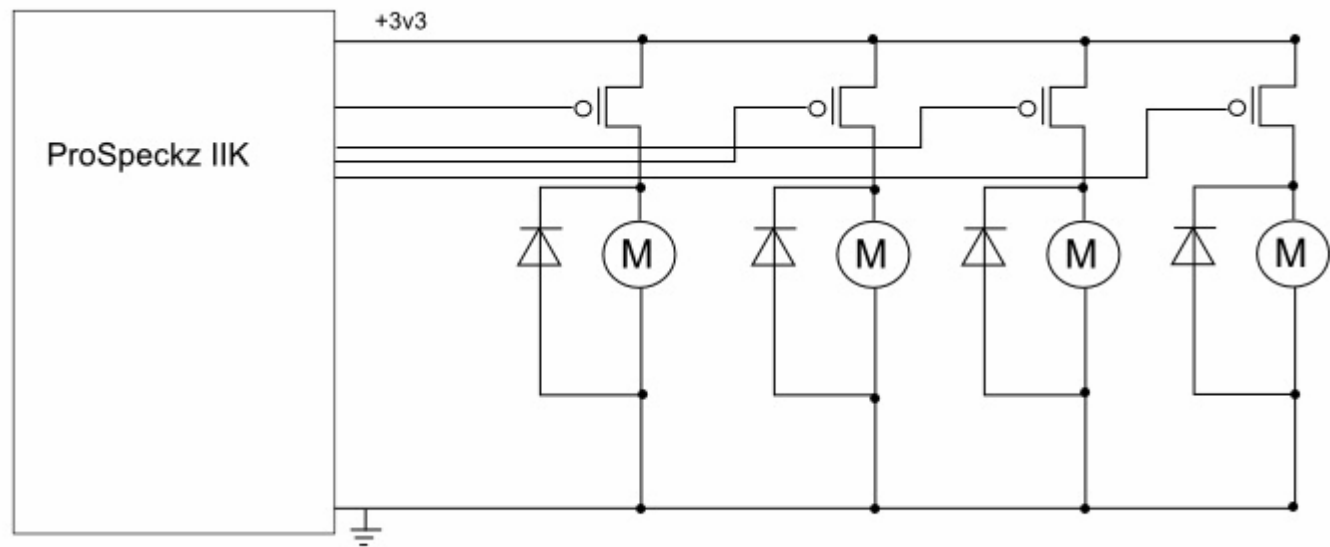


Hardware/Electronics

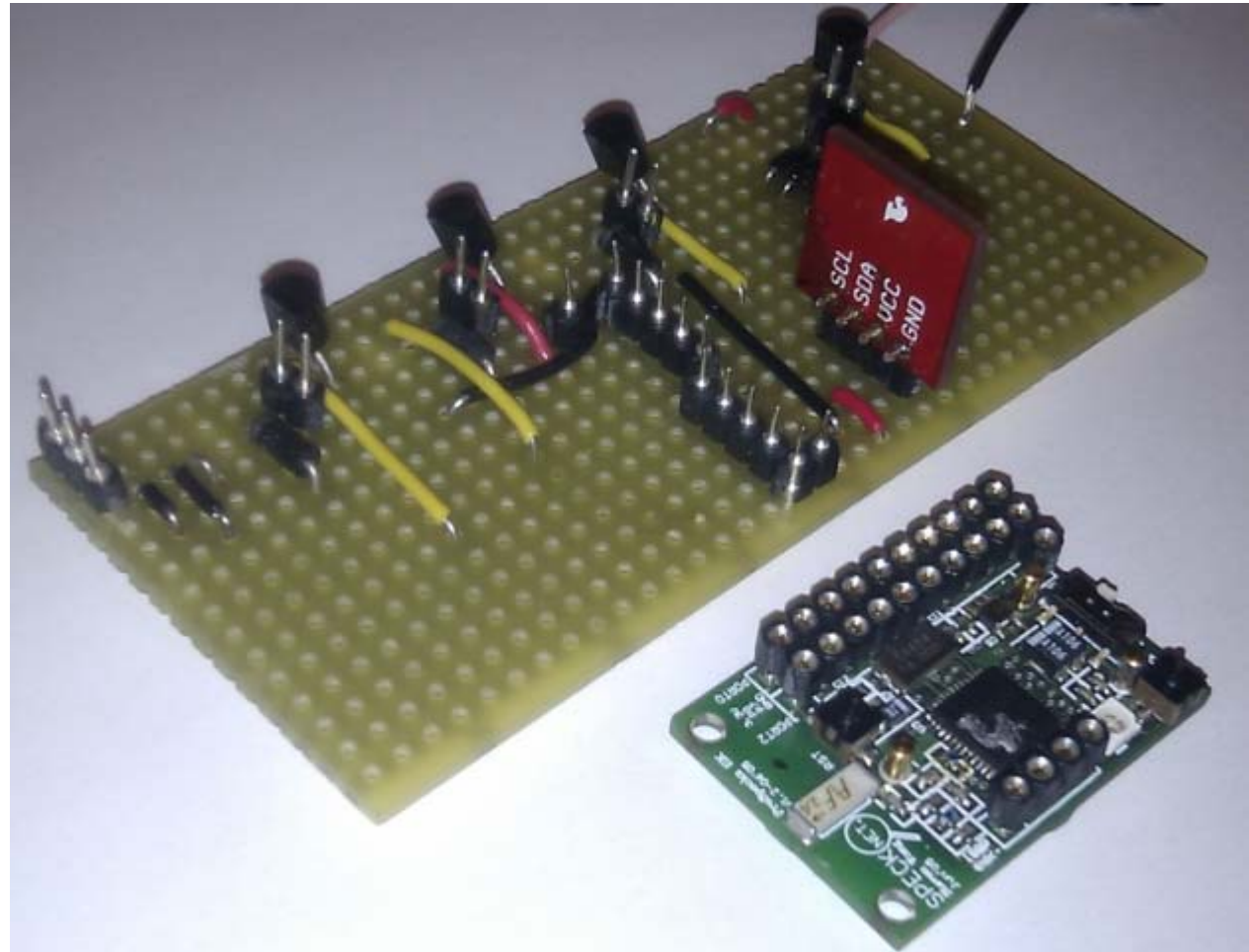
- Four mobile phone vibrating motors
- 100 mA consumption
- MOSFET Transistors P-type



Hardware/Electronics



Hardware/Electronics



Hardware/Electronics



ProSpecktz
as router



ProSpecktz
on the belts



Hardware/Electronics

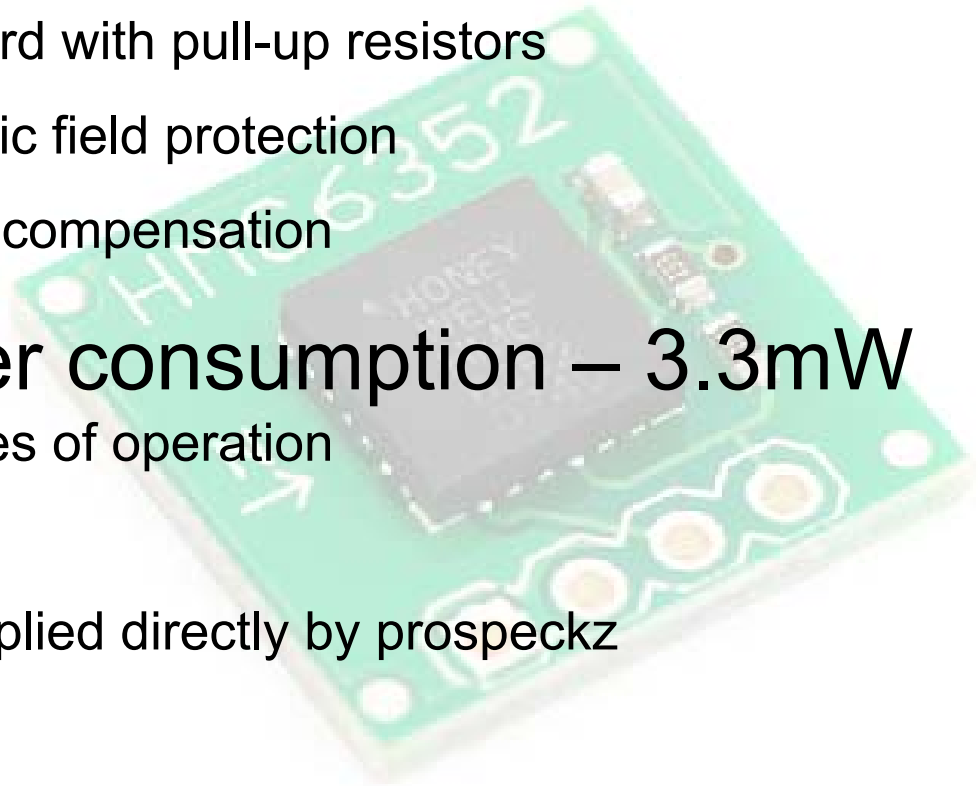
Compass

- Digital compass with an I2c interface
- 2-axis magneto-resistive sensors

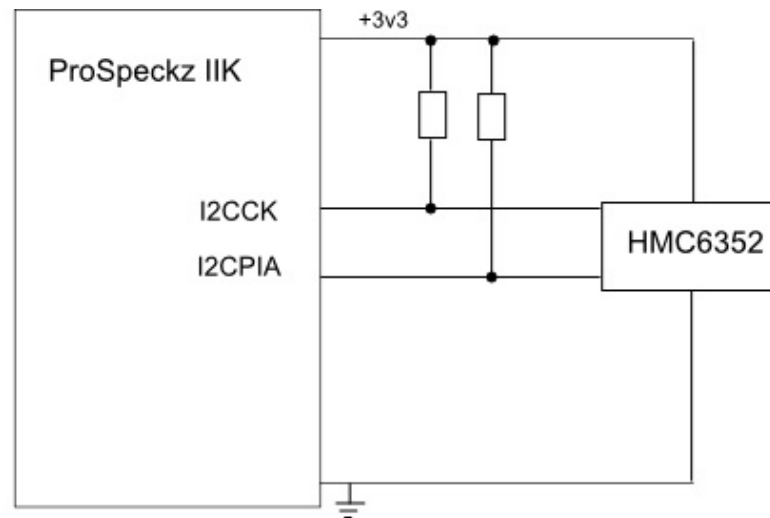


Hardware/Electronics

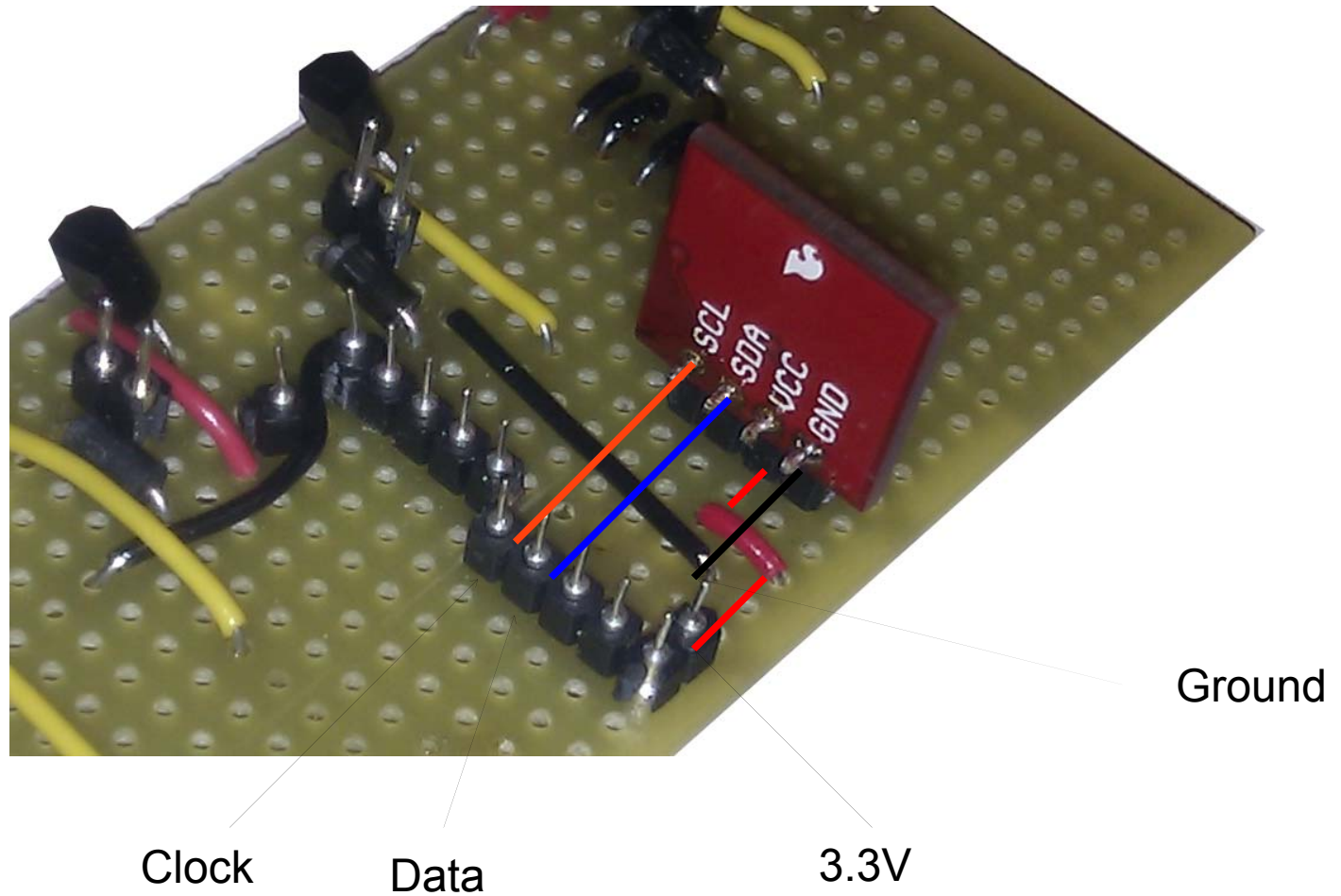
- **Compass features**
 - Heading resolution algorithms built into firmware
 - Breakout board with pull-up resistors
 - Stray magnetic field protection
 - Temperature compensation
- **Low power consumption – 3.3mW**
 - Various modes of operation
 - Query Mode
 - Powered supplied directly by prospeckz



Hardware/Electronics



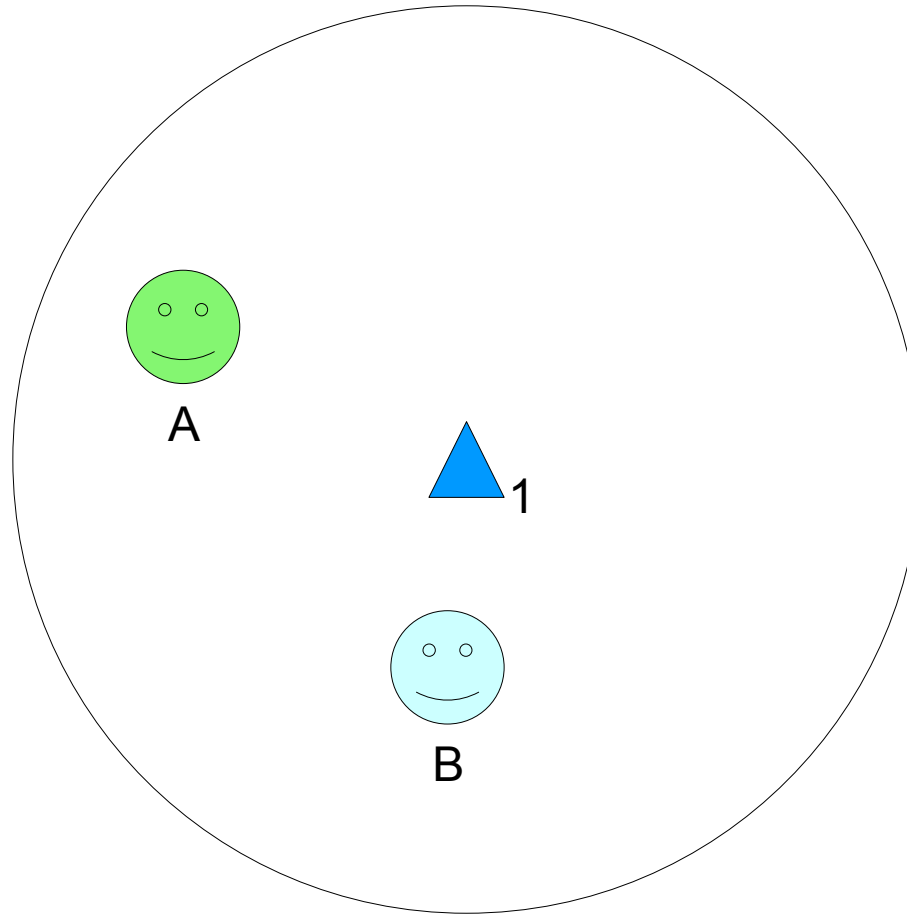
Hardware/Electronics



Location detection

- Where are you?
- Solved problem
- Cell of origin
- Triangulation

Cell of origin - idea



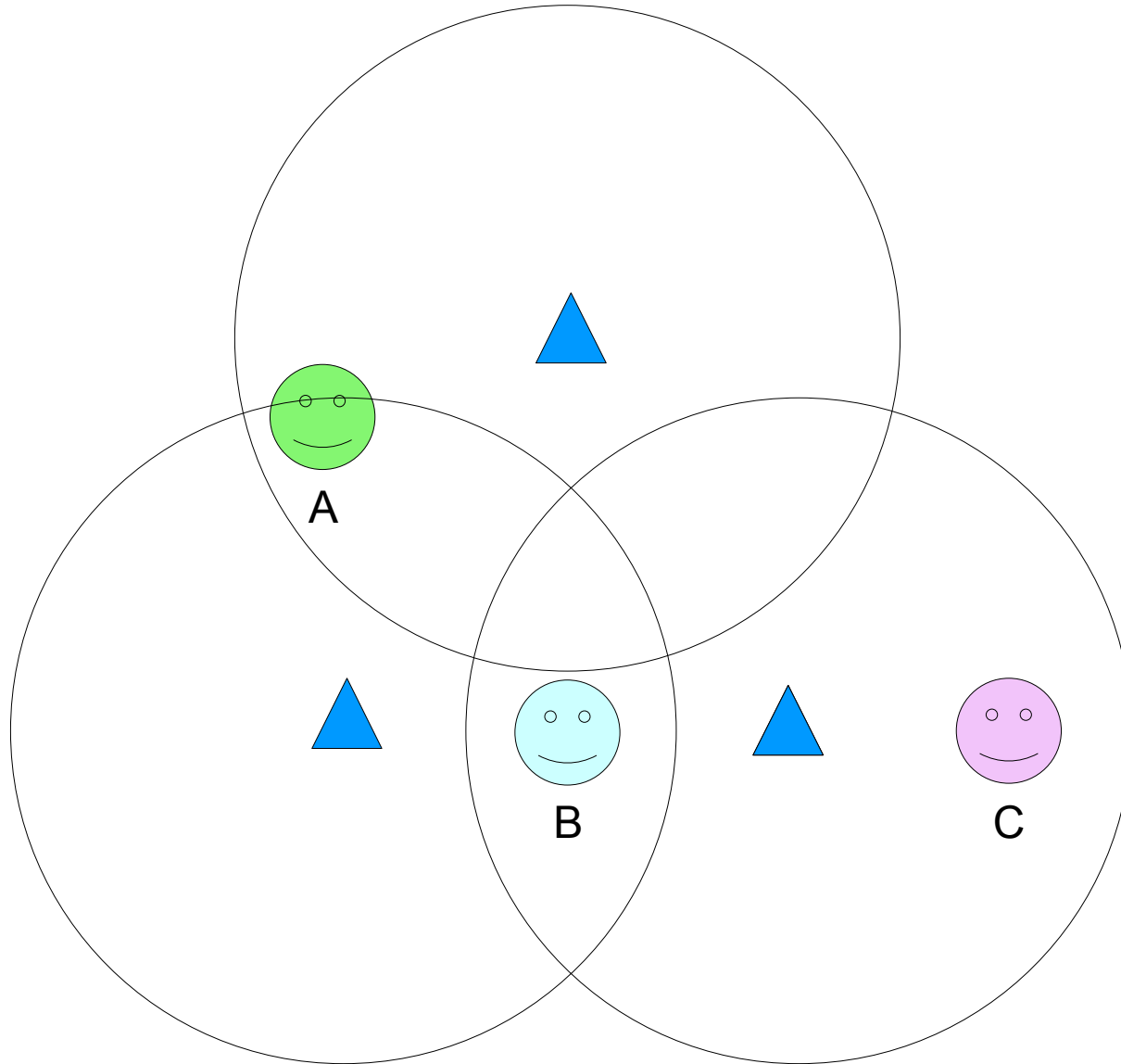
Cell of origin - implementation

- Implemented on top of xlowPan
- “Nearest prospect” address
- Address maps to a location

Cell of origin - evaluation

- Accuracy: depends on number of routers
- Detection delay: 1 – 2 seconds
- Network latency: <1 second
- Not bad, but could be much better

Triangulation

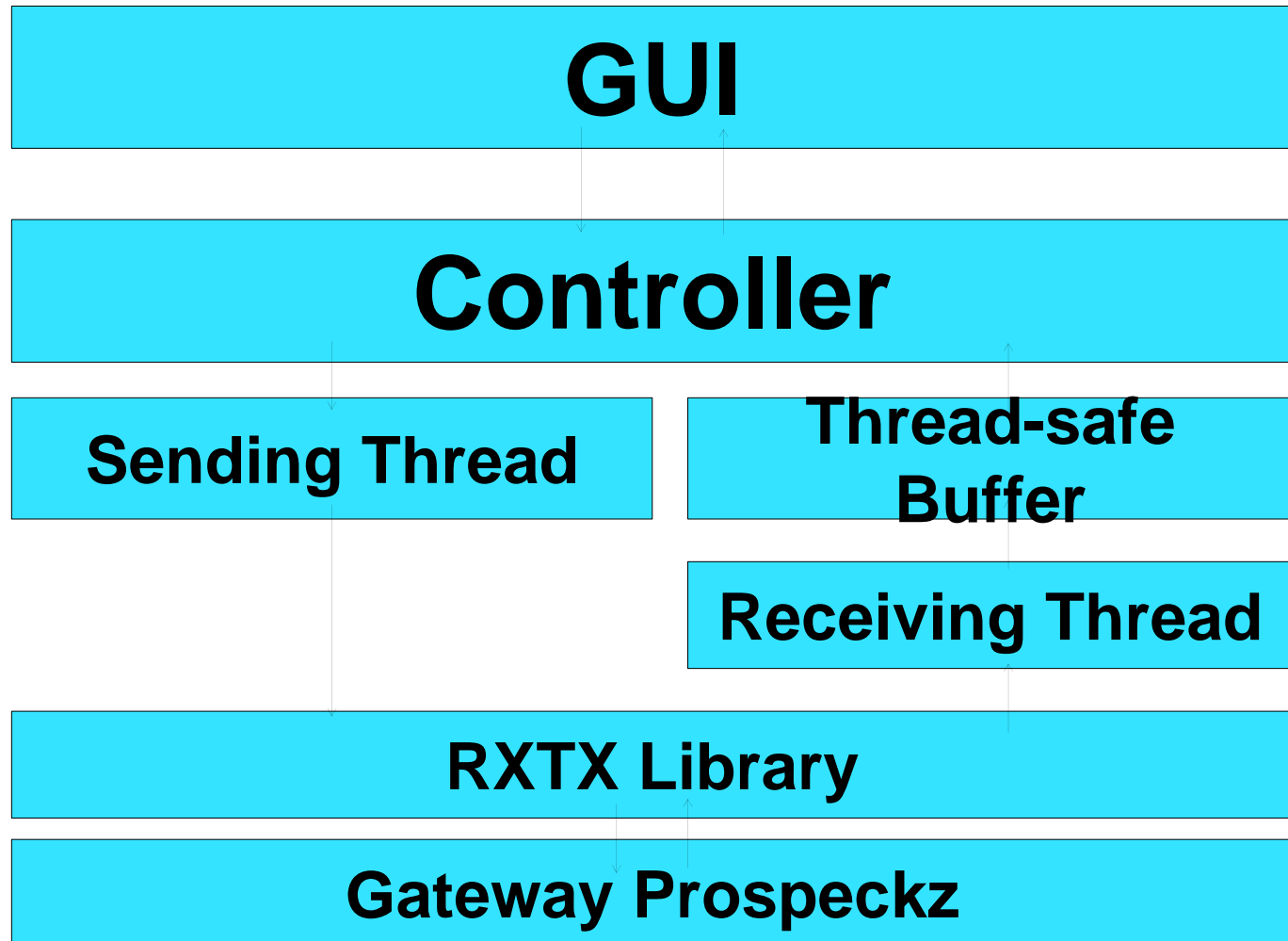


Controller-Gateway Interface

- **Controller – Java**
 - RXTX Serial communication library
 - Application Level
 - Designed for scalability
 - Support for multiple users
 - Multiple listening threads

Controller-Gateway Interface

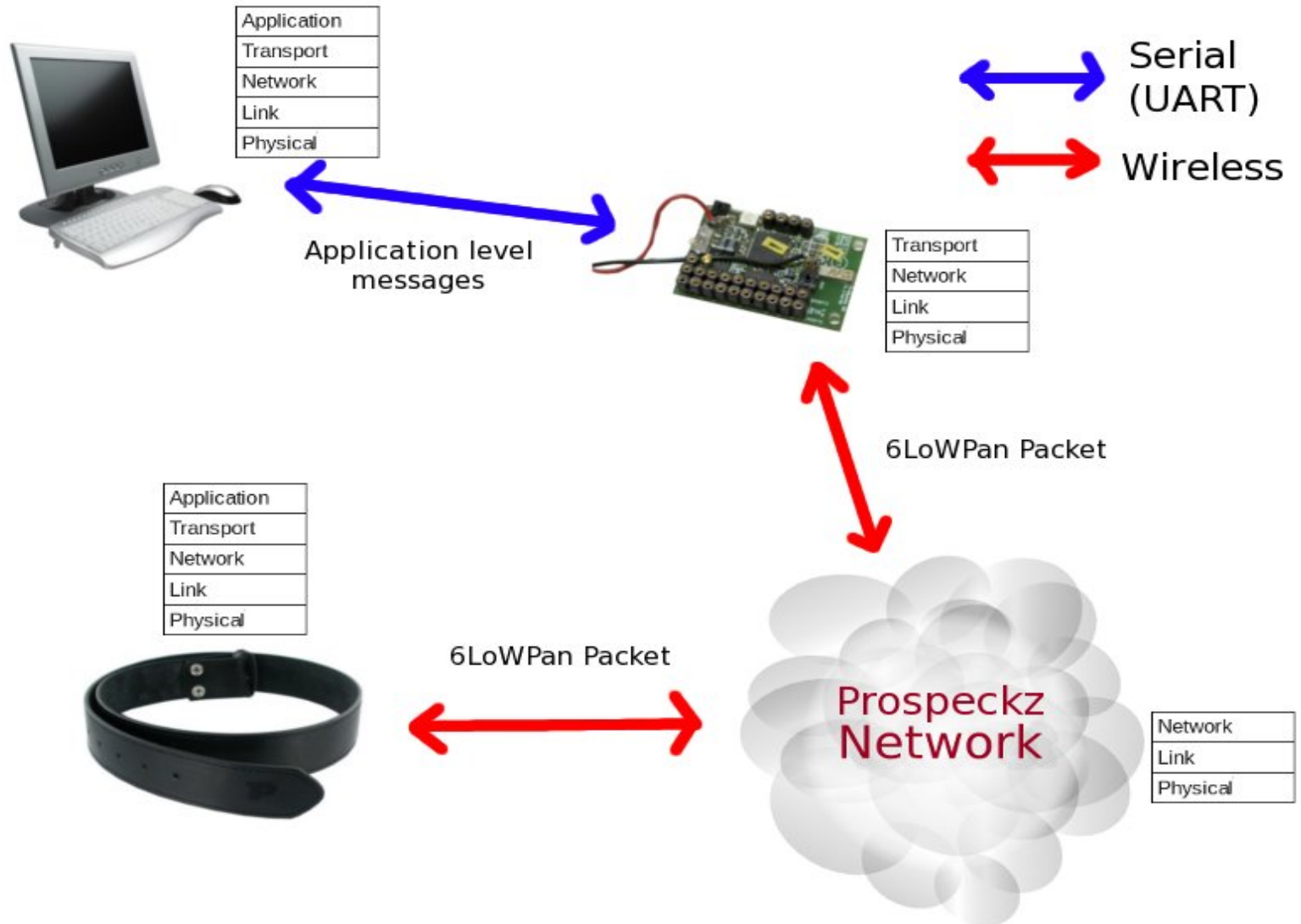
- Controller – Java



Controller-Gateway Interface

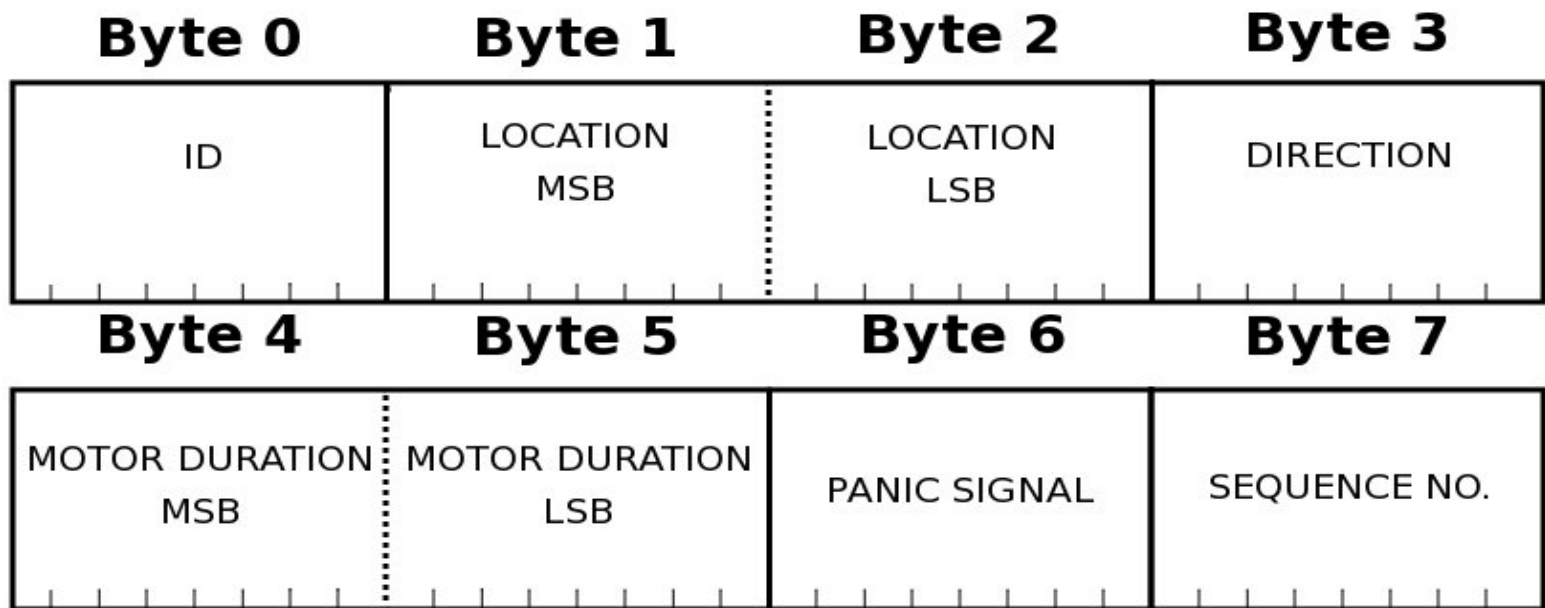
- Gateway Prospeckz
 - PSOC UART Module
 - Transport layer
 - Interface between controller and Mesh network
 - Listens for message on serial interface
 - Adds message to 6LowPan packet
 - Sends packet out via wireless interface

Controller-Gateway Interface

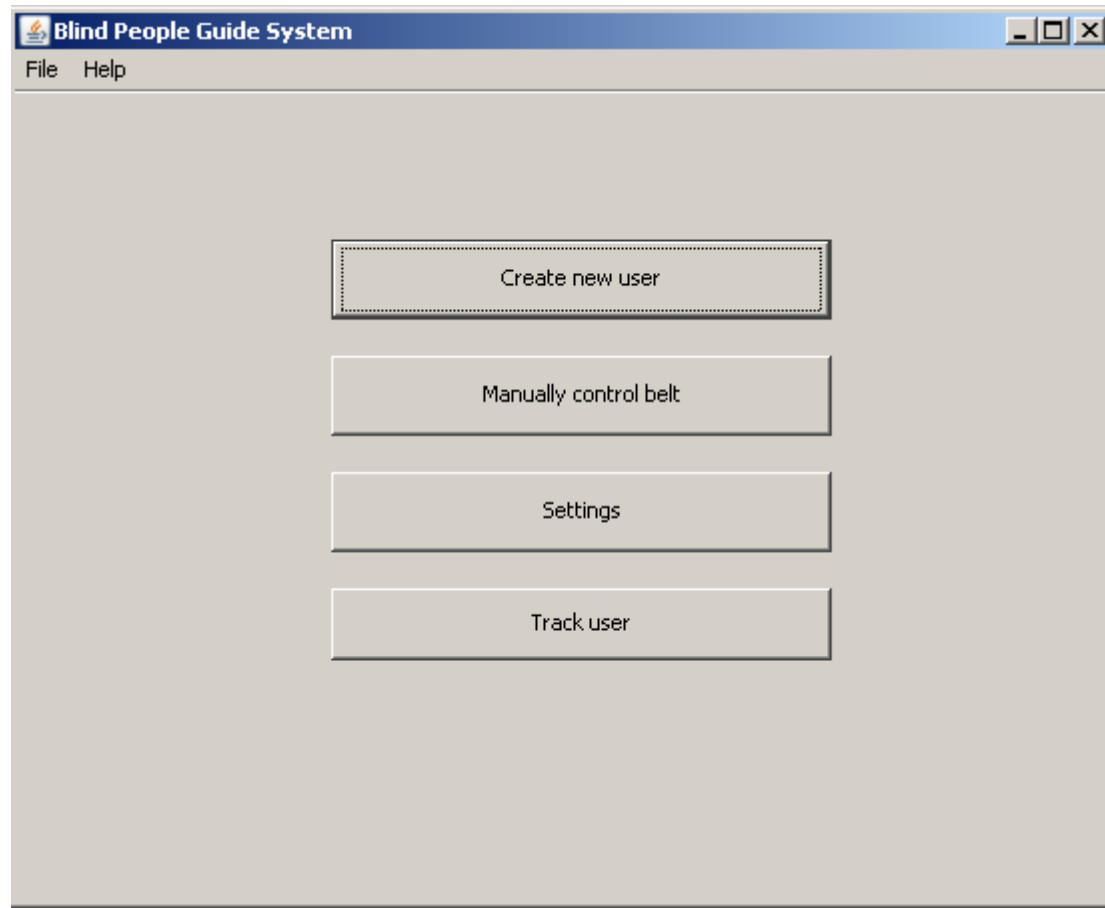


GUI-Gateway Interface

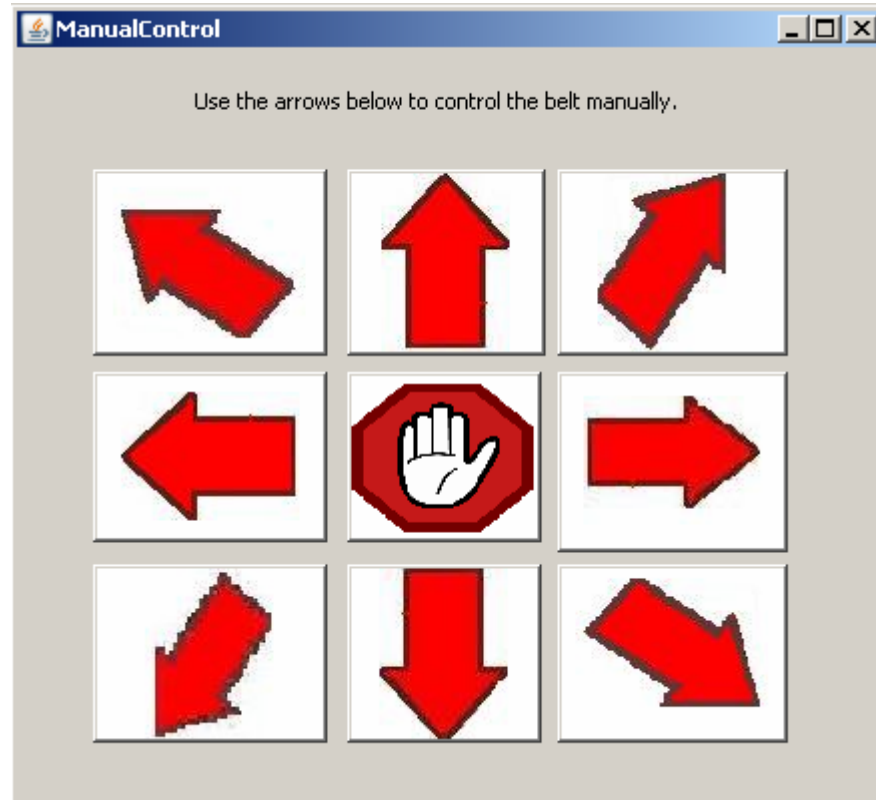
Packet Structure



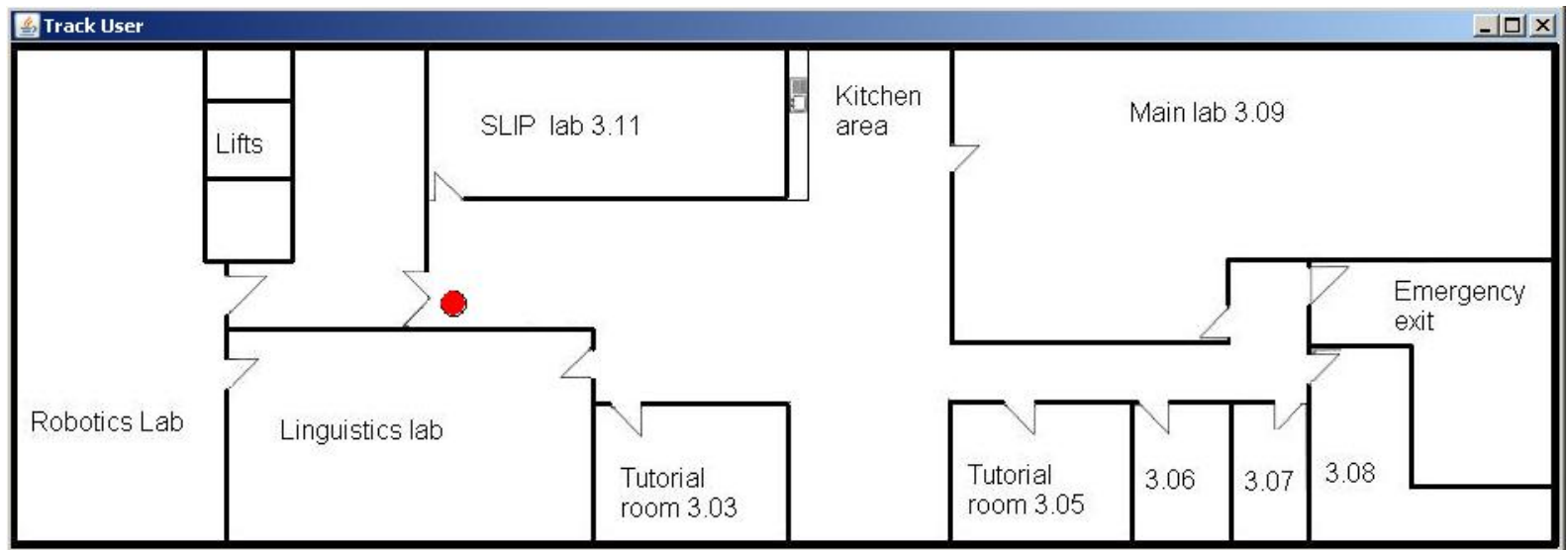
GUI



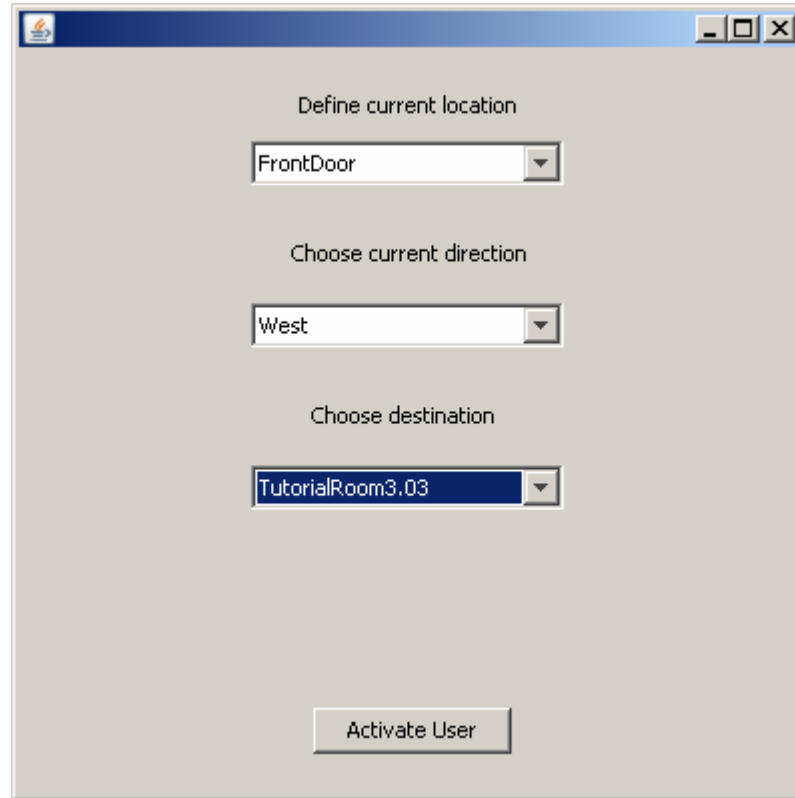
GUI



GUI



GUI



A screenshot of a graphical user interface (GUI) window. The window has a blue title bar with a small icon on the left and standard window control buttons (minimize, maximize, close) on the right. The main content area is light gray and contains three dropdown menus and one button. The first dropdown menu is labeled "Define current location" and has "FrontDoor" selected. The second dropdown menu is labeled "Choose current direction" and has "West" selected. The third dropdown menu is labeled "Choose destination" and has "TutorialRoom3.03" selected. At the bottom center of the window is a button labeled "Activate User".

Define current location

FrontDoor

Choose current direction

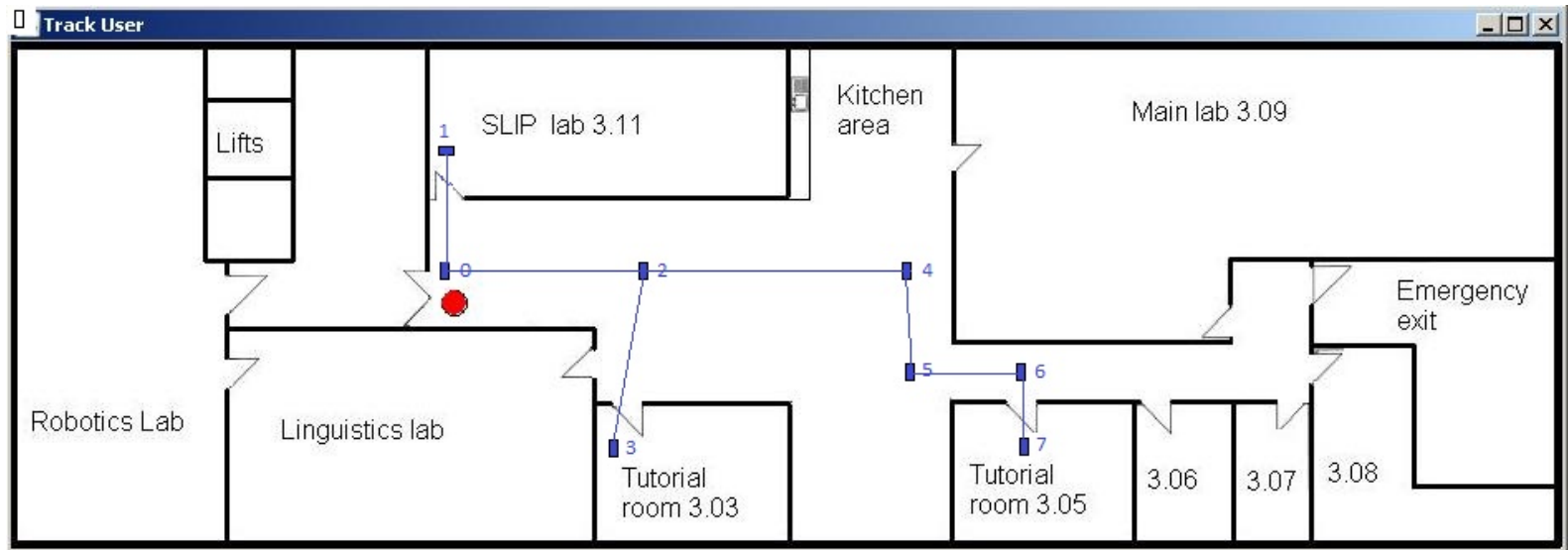
West

Choose destination

TutorialRoom3.03

Activate User

GUI



User feedback

- Liked the idea of vibrators, but said maybe sound commands will be better
- It would be nice to have a sound when the user is approaching a door or a wall, so that the person is prepared
- Another application of the system will be for home use



Demo

Future work

- Reduce power consumption of the motors by adding more resistors to the circuits
- Use gyroscope to hold compass in a horizontal orientation
- Test system with multiple users
- Implement the triangulation algorithm to increase accuracy
- Improve the style sheet of the GUI



Q&A