Millipede : A Rollerblade Positioning System

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Paris Rollerblading Tour

Context
Every Friday evening and Sunday afternoon in Paris, weather permitting, groups of between 5,000 and 15,000 people go rollerblading. Together, for about three hours and over about thirty kilometers, they will glide up and down the streets of Paris on roller skates. Due to the crowd and to the participants' mobility, the chances to lose track of friends are high, finding a friend is thus challenging. A common problem for friends participating in the tour is to find each other at each pause.

The old method
Currently, in order to locate a friend, a participant should: (1) call his friend, using a cellphone, (2) describe the environment (street name and number, shops name, monuments, etc), and (3) according to the environment description, try to discover if the friend is forward or behind.

The modern method
PDA or mobile phones of people are communicating in an ad hoc fashion. They run Millipede which provides virtual coordinates so that they could be relatively positioned.

The problem
Looking for someone? Millipede is the key.

Millipede Algorithm

Description
Millipede maintains an unidimensional relative coordinate system to attribute positions to skaters between 0 and 100. The closer the skater to the tour's head, the higher its coordinate.
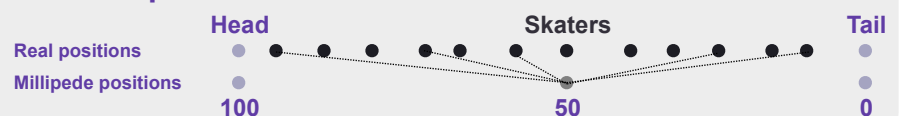
The algorithm requires two kinds of nodes:
- **landmark nodes** with fixed positions. They are carried by staff members (1 leads the tour, 1 follows the tour).
- **skater nodes** that constantly average their neighbors' positions.
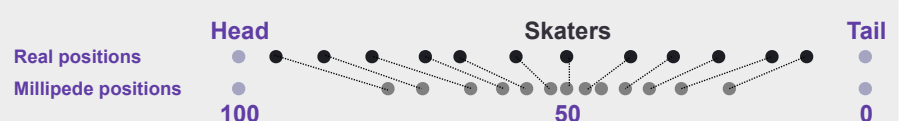
Requirements
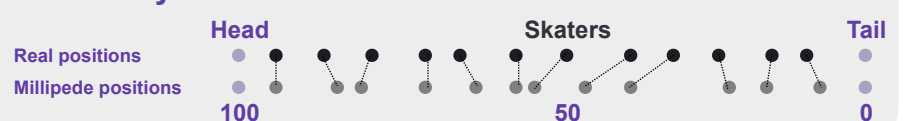Cellphones with Java and Bluetooth capabilities.

Landmarks software
```
If Head landmark
        Position ← 100
else Position ← 0
Broadcast (Position)
```

Skaters software
```
Position ← 50
while(rollerblading)
        Position ← avg neighbors positions
        Broadcast (Position)
```

Bootstrap

After few iterations

Stationary state

Demo description

Zigbee Demo
Crossbow MPR2400z motes.
2 landmark nodes.
16 skater nodes.
2 display modes: blinking or binary.

Blinking mode
The closer the mote to the tour head, the higher the blinking frequency.

Binary mode
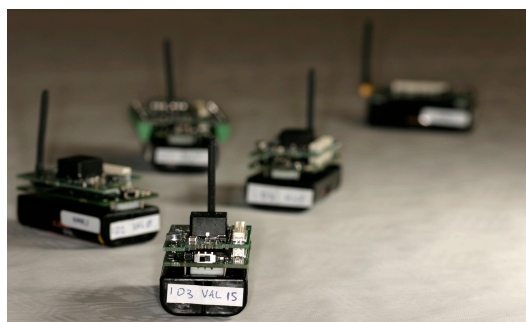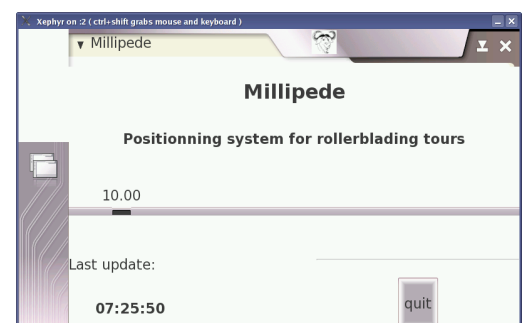Each LED represents a bit. The bit value is 1 if it is ON, and 0 else.

Bluetooth Demo
Nokia N770
2 cellphones used as landmarks.
2 N770 used as skater nodes.

The demo

Nokia N770 GUI