Tracking the Pedestrian

Due June 6th, 2008

You are to build a database to track a pedestrian walking within a city. The city is modeled as a set of polygon shaped landmarks and the city is modeled on a $5m \times 5m$ grid. Directions are modeled as 'N','NE','E', etc. In figure 1 we see a pedestrian facing 'NW' whose field of view encompasses 'W' and 'N' as well.

![Diagram of a pedestrian facing 'NW']

1 Input Data

The data includes a set of polygons that represent landmarks. Assume the following schema:

```sql
CREATE TABLE Landmark(
  id INT PRIMARY KEY,
  plan POLYGON);
```

```sql
INSERT INTO Landmark VALUES (1, '((0,0),(3,0),(3,3),(3,1),(4,1),(4,0))');
INSERT INTO Landmark VALUES (2, '((0,5),(0,7),(7,8),(5,8))');
...
```

In addition, assume the following relations that associate additional information with landmarks.
CREATE TABLE Comment(
    lid INT REFERENCES LANDMARK,
    comment TEXT);

INSERT INTO Comment VALUES (1, 'Before you is the Ringwald Church. Note the flying buttress.');
INSERT INTO Comment VALUES (2, 'Before you is the Grupp’s Fish Market. The health department has them under watch after several tourists died last month after eating the Grouper.');

CREATE TABLE Type(
    lid INT REFERENCES LANDMARK,
    type VARCHAR(20));

INSERT INTO Type VALUES (1, 'Church');
INSERT INTO Type VALUES (2, 'Market');
...

The final relation that you will be given is the relation that records the pedestrian’s trajectory through the city. For example:

CREATE TABLE Position(
    time TIME PRIMARY KEY,
    point POINT,
    direction VARCHAR(2));

INSERT INTO Position VALUES ('10:00:00', '(6,0)', 'N');
INSERT INTO Position VALUES ('10:00:10', '(6,1)', 'N');
INSERT INTO Position VALUES ('10:00:20', '(6,1)', 'NE');
...

2 Tasks

1.) A viewshed gives the point-to-landmark visibility relation. Using any tool you wish, build a system that builds a viewshed, from reading data from Landmark and inserting data into Viewshed. Note that the viewshed is the complete viewability relation for the map and should not just be built for the points of the trajectory of the pedestrian in the given datafile. Thus it will be a very large relation indeed. On the order of 80,000 tuples in the case of the data file that is given to you for this assignment.

CREATE TABLE Viewshed(
    point POINT,
    direction VARCHAR(2),
    distance REAL,
    landmark INT REFERENCES Landmark);
From figure 1, your viewshed algorithm should insert (among numerous other facts):

```
INSERT INTO Viewshed VALUES ('(6,1)', 'W', 2.0, 1);
INSERT INTO Viewshed VALUES ('(0,4)', 'S', 1.0, 1);
...  
```

2.) Answer the following queries

a. Give the churches that the pedestrian has been inside of.

b. Give the churches within 30 meters of a market.

c. Give the nearest restaurant to point (10,10).

d. Give all the landmarks with a comment containing the phrase “good food”.

3.) Informing the pedestrian

a. When the pedestrian is within 30 meters of an object and the object is within their field of view, print out a comment associated with the landmark.

4.) Web interface

a. Create a web interface to your database so that the queries may be asked online. Note that you do not need to implement query 3. a. as a trigger and instead may achieve it via polling.

b. Display a map of the stores and the pedestrian locations through time. You may wish to give the web-user control to turn the pedestrian left or right and to advance the pedestrian to the next grid point (5 meters in the ‘N’, ‘W’, ‘E’, ‘S’ direction and \(5 \times \sqrt{2}\) in the ‘NE’, ‘NW’, ‘SE’, ‘SW’ directions).

3 What to hand in

You are given a data files to test your systems on. Document your approaches to and results for tasks 1-4. Provide a URL so that I may test your web-interface. Please send an electronic copy of your report and source codes to mjm@cs.umu.se.