Universität Augsburg

Augsburg Indoor Location Tracking Benchmarks

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This manual shall support you in using the *Augsburg Indoor Location Tracking Benchmarks*. This benchmarks include the movements of four persons through an office building. The movement data were measured from July 2003 till January 2004 at the fourth floor of the building of the Institute of Computer Science at the University of Augsburg.

Contents

1 Why are the benchmarks needed?

We investigate techniques for context prediction in ubiquitous computing and have developed new prediction methods called state predictors [1, 2, 3, 4]. In a first step the method was adapted to location prediction. The lack of real movement data posed a problem for the evaluation which is still reflected in the cited papers. This problem should be eliminated by recording the movements of several persons through the offices of the institute.

2 How were the benchmarks obtained?

The measurements of the movements were performed manually. That means there wasn't a location detection system at the building. We are working to install an indoor tracking system in the future. Therefore a small program with a simple graphical user interface was implemented on a PDA which displayed the plan of the fourth floor, the floor of the chair of *Systems and Networking* (see figure 1 and 2). All test persons were equipped with PDAs running this program. Now if a test person entered a location the person had to click the corresponding location label on the PDA. For every click the program stored the timestamp in human readable format, the location which was entered, the name of the test person, and once again the timestamp in machine format in milliseconds, which could be used for computation purposes.

Figure 1: Floor plan on the PDA

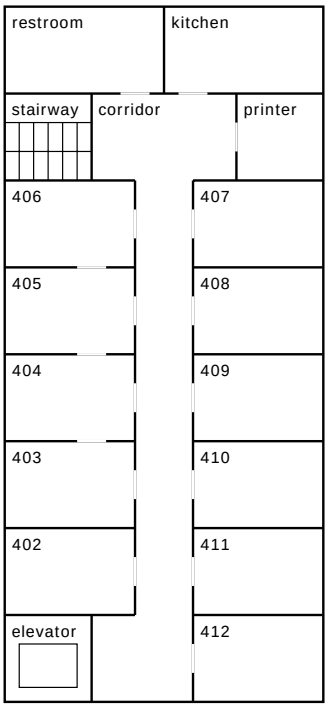

Figure 2: Plan of the fourth floor

A general problem in the manual process was that persons often forgot to take the PDA with them or to click when entering a new room. In this case at a later point in time the persons made up the movements based on their reminder, or they forgot also this. Thus timestamps are often incorrect and several movement sequences aren't complete.

The experiment was separated into two parts, the summer and the fall measurements. The summer measurements were performed over two weeks, the fall measurements covered a longer period of time of about 4 to 9 weeks.

3 How are the benchmarks structured?

The experiment was performed by four anonymous test persons: A, B, C, and D. For every person there are two files, one for the summer data and the other for the fall data. Thus there are eight data files:

```
a_summer.data
a_fall.data
b_summer.data
b_fall.data
c_summer.data
c_fall.data
d_summer.data
d_fall.data
```

Every line in the files contains the data for an entering of a new location. A line is formatted as follows:

```
yyyy.mm.dd hh.mm.ss;location;person;timestamp
```

The data in one line are separated by semicolons. The first value is the timestamp in human readable format when the person entered the location. That means the timestamp is composed of the date in the form: four-digit year, two-digit month, and two-digit day, and the 24-hour time in the form: two-digit hour, two-digit minute, and two-digit second.

The next value is the location which was entered, and then the person who entered this location. The last value is the timestamp in machine format. That means this value contains the time of the first value in milliseconds from 1970, January 1st.

For example the test person B enter the kitchen at July 16th 2003, 2:27 pm and 59 seconds. The corresponding entry is shown in the following line:

```
2003.07.16 14:27:59;kitchen;B;1058358479907
```

The benchmarks contain the locations shown in table 1. For a better evaluation a short description is given in the second row. The fourth floor can be exited by the stairway or by the elevator. These two options are combined in the location `away`.

Table 2 shows the basic data of the benchmark files. It contains the person, the period of time, the number of location entries, and the own office of the person. Every

Table 1: Location of the fourth floor

location	description
402	office of person A and B
403	office of person D
404	secretariat
405	
406	
407	
408	
409	meeting room
410	
411	
412	office of person C
corridor	
printer	
kitchen	
restroom	
away	means the person isn't located at the fourth floor

file contains the location data of a single test person which is given in second row. The period of time means the number of weeks the measurements were performed. The entry in the last line is separated into two parts because this measurement was interrupted by the two weeks Christmas vacations. The number of entries gives the number of locations the person had entered in the experiment. For completeness the last row shows the person's own office.

Table 2: Overview of basic data

file	person	period of time	number of entries	own office
`a_summer.data`	A	one week	101	office 402
`a_fall.data`	A	four weeks	432	office 402
`b_summer.data`	B	two weeks	448	office 402
`b_fall.data`	B	five weeks	982	office 402
`c_summer.data`	C	two weeks	351	office 412
`c_fall.data`	C	four weeks	911	office 412
`d_summer.data`	D	two weeks	158	office 403
`d_fall.data`	D	seven + two weeks	848	office 403

4 How can the benchmarks be obtained?

The *Augsburg Indoor Location Tracking Benchmarks* can be downloaded from:

`http://www.informatik.uni-augsburg.de/lehrstuehle/info3/research/ailtbenchmarks/`

References

[1] Jan Petzold, Faruk Bagci, Wolfgang Trumler, and Theo Ungerer. Context Prediction Based on Branch Prediction Methods. Technical Report 2003-14, Institute of Computer Science, University of Augsburg, Germany, July 2003. http://www.informatik.uni-augsburg.de/skripts/techreports/.

[2] Jan Petzold, Faruk Bagci, Wolfgang Trumler, and Theo Ungerer. Global and Local Context Prediction. In *Artificial Intelligence in Mobile Systems 2003 (AIMS 2003)*, Seattle, WA, USA, October 2003.

[3] Jan Petzold, Faruk Bagci, Wolfgang Trumler, and Theo Ungerer. The State Predictor Method for Context Prediction. In *Adjunct Proceedings Fifth International Conference on Ubiquitous Computing*, Seattle, WA, USA, October 2003.

[4] Jan Petzold, Faruk Bagci, Wolfgang Trumler, Theo Ungerer, and Lucian Vintan. Global State Context Prediction Techniques Applied to a Smart Office Building. In *The Communication Networks and Distributed Systems Modeling and Simulation Conference*, San Diego, CA, USA, January 2004.