

Location-Based Services and Privacy in Airports



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Introduction

Mobil phones with location facilities -> privacy concerns

Airport use location technology to predict queues and get passengers to their plane on time

Passengers want information:

1. Boarding time, gate number, changes
2. Location of gate and how to get there
3. Time it takes to get to gate

Can location-based services provide this information?

Give up privacy to obtain the information when passing through a transitional public place?



The Airport Case

Challenging environment for passengers and operators

Passengers:

- Frequent travelers need efficiency

- Occasional travelers need security, information, peace of mind

Operators:

- Complex logistics, queues, baggage, passenger services, security procedures, running a business



Infrastructure – the SPOPOS system



Indoor, location-based platform

Design guided by airport case – can be applied broadly

93% bring mobile phone when travelling –
electronic boarding pass on mobile phones
in near future

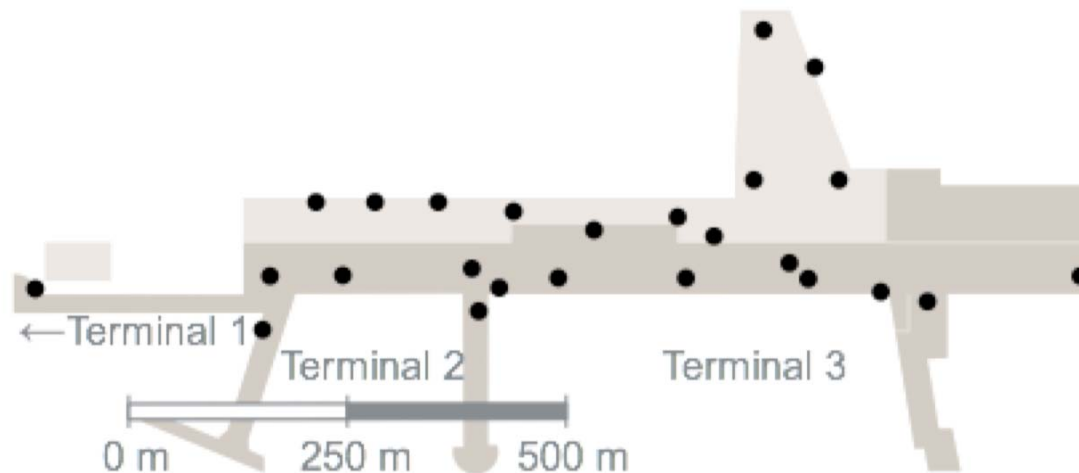
Use of Bluetooth and RFID to track passengers
and their moving between zones

Web interface to services



Tracking zones

Mobile phone registration prior to departure – match number and tracking ID.
Tracking ID: either MAC-address of phone or RFID tag handed out at check-in
Almost 100% success rate in detection of Bluetooth and RFID



Location-Based Services for Operators

Overview of queue-building -> better manning of control points

Precise and individualized information to passengers

Fewer public calls for late passengers

Better passenger flow analysis

'Lean boarding'

BUT location-based systems raise privacy concerns for passengers



Location-Based Services for Travelers

Customized information sent to passengers' mobile phone

Reduce uncertainty

Reduce number of delayed flights



Remote view of passengers

PAX for flight

User: ls

Destination OSL	Flight SK452	Date 30-11-07	Nationality All	Age All	From All	To All	Travel Frequency All
Pier B	Hour 16:10	Residence All	Sex All	Purpose All			

Status	PAX ETA	Estimated walktime	Last RP	Seq. no.	Name	ID/Mobile number	Object	Object returned
🔴	16:15	10	12	42	-	1234567890	PAX tag	No
🔴	16:12	7	1	11	-	1234567891	PAX tag	No
🔴	16:09	4	5	32	Niels Nielsen	+4522222222	Mobile	-
🟡	16:06	1	6	8	-	1234567892	PAX tag	No
🟢	16:05	0	20	03	Niels Nilsen	+4533333333	Mobile	-
🟢	16:02	-	20	02	-	1234567893	PAX tag	No
🟢	16:00	-	20	117	Bjørn Bjørnsen	1234567894	PAX tag	No
🟢	15:58	-	20	01	-	1234567895	PAX tag	No
🟢	15:53	-	20	100	-	1234567896	PAX tag	No
🟢	15:52	-	20	10	-	1234567897	PAX tag	Yes
🟢	15:52	-	20	09	-	1234567898	PAX tag	Yes
🟢	15:52	-	20	08	-	1234567899	PAX tag	Yes
🟢	15:49	-	20	53	-	1234567881	PAX tag	No
🟢	15:48	-	20	41	-	1234567882	PAX tag	No
🟢	15:47	-	20	22	-	1234567883	PAX tag	No
🟢	15:47	-	20	23	-	1234567884	PAX tag	Yes
🟢	15:45	-	20	71	-	1234567885	PAX tag	Yes
🟢	15:45	-	20	72	-	1234567886	PAX tag	Yes
🟢	15:42	-	20	35	-	1234567887	PAX tag	Yes
🟢	15:42	-	20	36	-	1234567888	PAX tag	Yes
🟢	15:40	-	20	18	-	1234567889	PAX tag	Yes
🟢	15:37	-	20	87	-	1234567871	PAX tag	Yes
🟢	15:35	-	20	66	-	1234567872	PAX tag	Yes

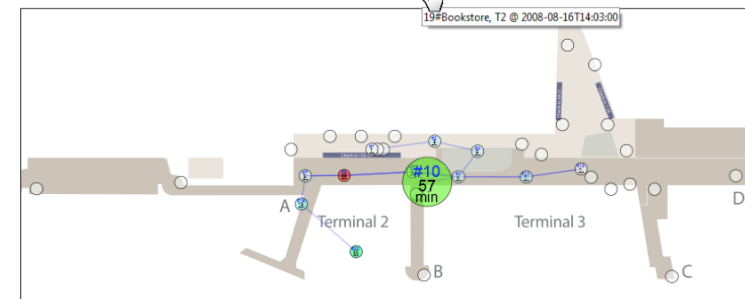
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Print Export

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Spopos PAX Trace

Compact trace: z33 z18 z16 z7 z5 z4 z1 z4 z5 z19 z7 z9 z14 z9 z7 z5 z4 z1 z3 z999



Auto-zoom Reset view

Detailed trace for passenger:

Step number	Zone ID	Zone Name	First detection	Dwell time in zone
Total (all zones)				
				16200 min
#1	z33	00#Check In	2008-08-16T12:00:00	60 min
#2	z18	18#Security Entrance 2 - west-end	2008-08-16T12:05:00	300 min
#3	z16	16#Tax-Free entrance after SEC	2008-08-16T12:10:30	270 min
#4	z7	07#Nytovr	2008-08-16T12:16:00	30 min
#5	z5	05#Pier B square	2008-08-16T12:17:00	30 min
#6	z4	04#Starbucks T2	2008-08-16T12:18:00	60 min
#7	z1	01#Pier A Entrance	2008-08-16T12:19:30	120 min
#8	z4	04#Starbucks T2	2008-08-16T12:22:30	5850 min
#9	z5	05#Pier B square	2008-08-16T14:02:00	30 min

'Tag-along' view



Relatives can follow movements from password-protected website

Privacy Implications of the Gatecaller

Privacy – even in public spaces

Depend on identity of observer

Tag-along offer comfort but also threatens individual privacy



Design methods

Scenarios and personas:

business traveler

teenage traveler -> tag-along

Confirm goals with airport professionals

Scenarios as basis for usability requirements,
design issues, system architecture

Observations among airport operators and
passengers

Interviewing airport staff



Prototypes

Passenger prototypes of Gatecaller Service

Better understanding of mobile interaction

Wizard-of-Oz tests

June 2007 among project members

December 2007 among press representatives

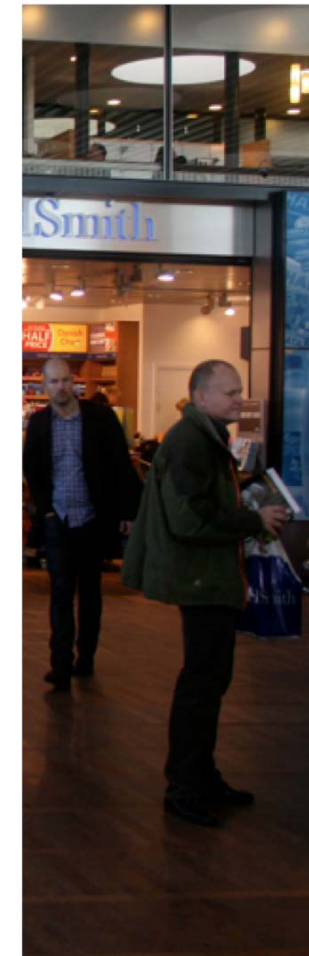
Operator and management prototypes tested
by heuristic evaluations and think-aloud
usability tests



Passenger Evaluation I

Responses given by passengers at gate to the question “Has it made you feel more secure that the gate personnel now may find you if you are late?”

[N = 76]	No, not at all	No, hardly at all	Yes, to some degree	Yes, to a large degree
	20%	20%	39%	21%



Passenger Evaluation II

Responses given by passengers at gate to the question “Have you felt yourself being monitored while you have been carrying the RFID tag?”

[N =116]	No, not at all	No, hardly at all	Yes, to some degree	Yes, to a large degree
	86%	9%	4%	1%



Passenger Evaluation III

Responses given by passengers at gate to the question “Has time spent on information influenced your movements in the airport?”

[N = 98]	No not at all	No, hardly any time	Yes, some time	Yes, a lot of time
	38%	27%	24%	12%



Discussion

Will finding generalize to other transitional spaces?

In airports, but not in general.

Trust in organization that requires information



“I don’t mind using the tracking service (.....) in this airport. Here I can see the benefits.

I would not use it in the shopping mall, where they would hunt me down with “offerings” all over the place” (Danish female, 40 years)

“I have no worries that information handled within governmental institutions would ever be used in any harmful way” (Dutch male, 34 years)

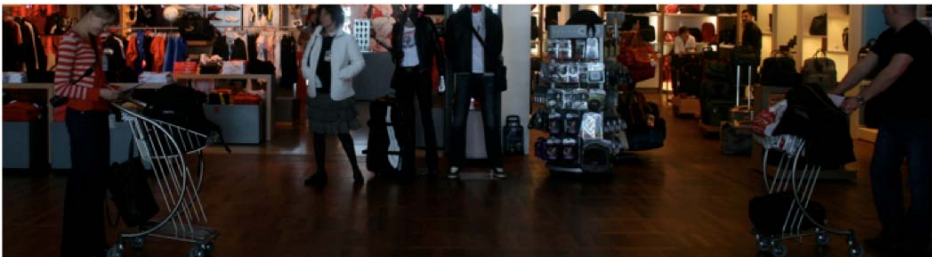
Discussion II

National / local differences
Openness and securing privacy

Actually experiencing being tracked might
change passengers' view on tracking

Accuracy of tracking

"I like the idea of this system. But I would not like it to know in detail when I am at the restroom" (Polish female, 24 years)



Conclusion

A majority of passenger feel more secure using the Gatecaller service

Only a small fraction feel themselves monitored

Usefulness

Trust

Approximate location



Thank you.

Want to know more about the project?
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