iCampus: A Connected Campus in the Ambient Event Calculus

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ABSTRACT

iCampus is a prototype multi-agent system whose goal is to provide the ambient intelligence required to connect people in a university campus and make that campus inclusive and accessible. Software agents called guides run on mobile phones to help students with information about people, places, and events, thus providing people real-time, location-based advice that makes them more aware of what is going on in the campus. The work outlines how to specify iCampus in the Ambient Event Calculus and implement it using the agent environment GOLEM to deploy guide agents over a campus network. The work is illustrated by showing how iCampus improves the mobility of blind or partially sighted students within a campus, which has been the main motivation behind the work.

Keywords: Ambient Event Calculus, Connected Campus, GOLEM, Software Agents

1. INTRODUCTION

John is a visually impaired university student in his 1st year. Although his university is small, the university’s campus has 72 areas between buildings and park areas in which John has to learn to find his way. During term time, teaching takes place in different buildings and, many times, John has to move quickly from a building to another in order to find his way to the classroom. Once he finds the classroom, he may have to wait outside the class until the previous lecture has finished and once the class is empty, enter the room and find out where to sit.

Many tasks can be complicated for John and the practice so far has been to assign to him a helper, typically another student. However helpers are not constantly present, therefore John relies mostly on his memory and on people nearby. Due to the fact that he has only partial information about his surroundings he is faced with problems such as how to find a new building or a classroom, especially if the map and the information board in the entrance of the building are not accessible. He is also facing problems such as how to find where his best friend is

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standing in the class, including deciding when to enter the class and where to sit.

We study how to use Ambient Intelligence (Sadri & Stathis, 2008) to help people like John. For this purpose we are experimenting with iCampus, an ambient intelligence system where John downloads a guide, a software agent that works proactively to help the student with its everyday activities within the campus. His activities typically involve discovering the current location of friends, places, and events within the campus, not necessarily only teaching. As a result of using iCampus, John is able to find the location of lectures, people who are nearby but he cannot see, building entrances and other information that can help him within the campus.

iCampus assumes a mobile phone with GPS and bluetooth capabilities based on a campus map. In the case of John the mobile is equipped with an additional screen reader library, which reads to him the information that is visualised on the screen of the phone. When John is outdoors, the iCampus uses the GPS service to provide him information about the outdoor environment, while indoors the campus contains access points that provide indoor information using the bluetooth services of his mobile device.

In the remainder of the article we first discuss the iCampus concept and how a user can interact with the application, then we show how we have organised the interaction of guide agents in the GOLEM platform, where we also outline our current implementation. We conclude with an evaluation of the application and our plans for future work.

2. THE CONCEPT OF ICAMPUS

iCampus maps the physical environment of a campus to an electronic environment with people’s avatars, guide agents, places, events, and objects (Stathis et al., 2005). The kind of information offered on demand by iCampus agents include discovery of people e.g. a friend, identification of the location of places and objects within them e.g. a building or a board in a room, and happening of events e.g. whether a lecture has started or not. iCampus also supports requests that provide functionalities such as path finding, alerts for the user and personalisation operations which allows the user to specialise the application with his/her own profile (Mamdani et al., 1999).

“Who is around” queries allow the user to see other people that are nearby. Locality is based on the location of the user and the specified radius for the area of interest. Users can see each other if they make available their position to others. Figure 1 shows how John searches his friend Visara. John can locate Visara because she has published her location as visible. Similarly, “What is around” queries examine the current place of the user including objects such as electronic boards, projectors, or sub-places such as rooms, corridors, and lecture theatres. Once people, places, or objects have been discovered, “Where is” queries find the exact location of a person, place, or object. Once an object/user is localised, iCampus provides any additional information that is associated to it. As shown below, for brevity of interaction “Who is around” and “What is around” can be combined to one query.

Additional features of iCampus, include: “Guide me to”, which provides information about how to move from the current location to a destination one, “Alert me about”, which allows a user to register about events of interest in the campus, and “my iCampus”, which allows a user to personalise the system according to a user’s needs. An example combining all these features includes John who uses “Alert me about” inaugural lectures and listens to only the accessible routes using “Guide me to” because he has specified on “my iCampus” that he is partially sighted.

Figure 2 shows how John requests “Guide me to” that will allow John to be guided to a location of interest. The path returned consists of a set of important reference points, which are read to John in order to guide him to the desired location.
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