USING SMART MAP IN A MOBILE INFORMATION ENVIRONMENT FOR TOURISM

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Abstract: Mobile computing has been growing in recent years. It is a revolutionary style of technology emerging from advances in the development of portable hardware and wireless communications. Mobile GIS applications for tourism range from tour planning, navigation support to yellow page services and mcommerce. Within the last few years, we were facing advances in wireless communication, computer networks, location-based engines, and on-board positioning sensors. Mobile GIS as an integrating system of mobile agent, wireless network, and some GIS capability has fostered a great interest in the GIS field.
In this paper, we define a smart map as a multimedia spatial database integrated with different sensors like GPS (Global Positioning System) and INS (Inertial Navigation System) running in a mobile environment. A detailed discussion about the properties smart maps and their differences with traditional digital maps are presented. Contrary with traditional map, a smart map is no longer homogenous and isotropic. It is an egocentric view to the world The presented idea is supported by our work which leads to a system so called MOTA (Mobile Tour Assistant).

1. INTRODUCTION

Mobile computing has been growing in recent years. It is a revolutionary style of technology emerging from advances in the development of portable hardware and wireless communications. Mobile GIS applications for tourism range from tour planning, navigation support to yellow page services and mcommerce. Within the last few years, we were facing advances in wireless communication, computer networks, location-based engines, and on-board positioning sensors. Mobile GIS as an integrating system of mobile agent, wireless network, and some GIS capability has fostered a great interest in the GIS field (AGI 2003 & Ferscha 2004).
Producing maps via these technologies in tourism has become widespread. But they are often quite simple in terms of adaptation to the user or context. Although the mobile computing has been increasingly developed in the past decade, there still exist some notable constraints which complicate the design of mobile information systems. The constraints include limitations of computational resources (e.g., processor speed), limitations of user interfaces (e.g., size of display), network problems (e.g., bandwidth of the communication channel) and limitation of energy source (e.g., battery). (Malek, M. R., 2004). In addition, it is assumed that in a mobile GIS environment, sensors of user side could not access all relevant information about other users and they are concerned to the user and its neighbors.
We argue that it is not enough to focus on adoptions to technical parameters (device characteristics, location, …), but propose that tourist maps need to be dynamically generated according to a wider range of variables from user preferences and interests, the given task, cultural aspects to communicative goals and actual context and location. This means that a system that is able to generate such maps needs to exploit user models and context knowledge. Within this paper, we focus on using smart maps for tourism application by presenting an overview about possible parameters and propose a model for smart map generation and give the results of first implemented plan.
Mobile systems are important assets for travelers visiting foreign environments, as they provide instructions on how to traverse the space. Research has shown that finding ones way in a foreign environment is primarily based on cognitive specifications and forming spatial knowledge. In order to implement efficient systems, it is necessary to regard to natural coordinating systems that a person needs for interaction with the foreign environment and spatial objects (Malek, M. R. 2004). In this paper the concept of smart maps or maps in the mobile environment have been introduced. Then using method of spatial cognition theory for information presentation and processing in a smart map is described. We presented the efficiency of smart maps through implementation a mobile GIS for pedestrian tourist.
Tourist needs a range of information for completing spatial tasks such as wayfinding. People acquire and develop their spatial knowledge through various experiences and processes which may include recognizing and understanding characteristics of objects, localities and inter-relationship between elements in environments. In this paper we want to show that another important thing which leads to a flexible and useable mobile GIS is the concept of

"Smart Map" or "Map in Mobile Environment". We define a smart map as a multimedia spatial database integrated with different sensors like GPS (Global Positioning System) and INS (Inertial Navigation System) running in a mobile environment. We argue that it is not enough to focus on adoptions to technical parameters (device characteristics, location, …), but propose that tourist maps need to be dynamically generated according to a wider range of variables from user preferences and interests, the given task, cultural aspects to communicative goals and actual context and location. This means such a system needs to exploit user models and context knowledge.

2. RELATED WORKS

Wayfinding process in indoor and outdoor spaces has been investigated in a number of research and different wayfinding solutions are established. Previous works on sensor-based information systems was predominantly conducted for mobile guiding systems.

The CYBERGUIDE system was one of the first that used location aware information to help tourists. The indoor component relied on infrared beacons broadcasting a unique ID that was used to display an arrow on a map whenever the user entered a new room. Additionally, the user's orientation was estimated from her/his actual walking, direction and the topology of the building. In outdoor system, GPS is used to determine the user's position and to display it on a map (Baus Kruger and Stahl 2003 & Neisany Samany et.al. 2006)

Both systems operated independently from each other and could not be combined. GUIDE is a location-aware multimedia tourist guide developed for the City of Lancaster. The system provides location based information based on a radio cell infrastructure (Baus Kruger and Stahl 2003).

The MOBIS system is an electronic guide based on a PDA that provides information on the exhibits to a visitor of a museum. The PDA receives its position from infrared beacons distributed in the environment and uses this position as a pointer to a specific content that is stored in a database on the PDA. The HIPS system uses sub-notebooks, which supports a broader range of media content than the PDA used for MOBIS. HIPS takes into account the absolute position, as well as the distance to objects in the exhibition and uses a radio back-channel for downloading information (Baus Kruger and Stahl 2003).

3. WAYFINDING

Wayfinding, getting from some origin to a destination, is one of the everyday problems that humans encounter (Raubal and Winter 2002).It is a purposive, directed and motivated activity (Golledge, 1999). Human wayfinding researchers investigate how people find their ways in the physical world, what they need to find it, how they communicate directional information and how people's verbal and visual abilities influence wayfinding (Raubal et al. 1997). According to Lynch (1960) wayfinding is based on "a consistent use and organization of definite sensory cues from the external environment". Wayfinding is a complex human activity involving moving along while evaluating alternatives and making decisions. It is defined as a spatial problem solving process with the three sub-processes including decision-making, decision execution and information (Caduff, D. and Timpf, S. 2002)

Wayfinding typically requires planning and the ability to stay oriented while moving. Navigation is a coordinated and goal-directed travel through space. It consists of two components, locomotion and wayfinding. Locomotion refers to the guidance of oneself through space in response to local sensor motor information in the immediate surrounding and includes such tasks as identifying surfaces of support, avoiding obstacles and moving toward visible landmarks. Locomotion generally occurs without the need for an internal model or cognitive map of the environment. Wayfinding refers to the planning and decision-making that allows one to reach a destination that is not in the immediate sensory field and includes such tasks as choosing efficient routes, scheduling destination sequences orientating to non-local features and interpreting verbal route directions (Hajibabai et al. 2006).

Allen (1999) distinguishes between three categories of wayfinding tasks: travel with the goal of reaching a familiar destination, exploratory travel with the goal of returning to a familiar point of origin, and travel with the goal of reaching a novel destination. A task within the last category, which is also the focus in this paper, is most often performed through the use of symbolic information. Without wayfinding aids people would not be able to negotiate their way efficiently through an unfamiliar environment.

There are four classes of environmental variables that influence wayfinding performance within built environments: visual access, architectural differentiation, signs and instruction guidance to provide identification or directional information and plan configuration (Weisman 1981). However, the original concept of delivering the instructions has not changed very much. Still, spoken language instructions use a relatively small set of commands (like 'turn right now'), which only refer to properties of the street network (Brenner and Elias 2003). There are two different kinds of route directions to convey the navigational information to the user: either in terms of a description (verbal instructions) or by means of a depiction (route map), (Hajibabai et al. 2006).

4. SMART MAP

There are no differences between current maps on mobile environments and conventional maps. Recently, many studies and investigations have been

focused on how to solve restrictions of mobile environments such as low memory and bandwidth. Current maps have same responses in various situations. Map is a tool for creation of communication between users and spatial data.
Maps on mobile environments are different in tree cases: application, spatial data type and communication methods. Humans receives continues and analogue data through their sensors, interpret them and gain conceptual and perceptual cognition. Smart maps should be available every time, every day to do its role like humans (Figure1).

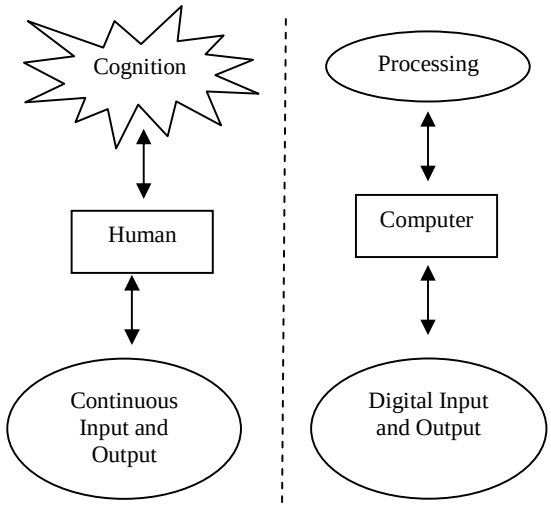

Figure1: Tow different space in mobile environment

Smart maps differ with custom digital maps in most aspects. The focus of most researchers have been on loading digital maps in mobile instruments just from particular engineering points of view such as to reduce the memory in use, the transfer rate, etc. The main differences of information systems in mobile environments with static environments need paying more attention to maps in mobile environments. Such maps have more possibility of having uncertainty with respect to static states.

5. METHODOLOGY AND IMPLEMENTATION

The implementation of a mobile system based on smart map is depended on mobile terminal component and related equipment and software. Our system has been designed as a digital tour guiding and pedestrian wayfinder to reach destination point and other tourism services. This system has been composed of four subsystems which are followed as:
1- Subsystem which makes the image maps georeference through joint coordinated points.
2- Subsystem which guides the group with mobile device by means of GPS to achieve goal.
3- location-based services subsystem i.e. providing spatial services based on location.
4- Subsystem for network communication.

5.1. Mobile Equipment

Our usable system based on their operation systems is categorized to Symbian, Palm OS, and Windows CE. These frameworks have different versions and equipment. The variations are in the velocity of processors, the amount of memory, size and type of screen, the existence of peripheral programs such as sound and image, the tools to communicate to network. Windows CE is a version of windows which is able to implement in mobile environment. Nowadays, this system environment is converted to Windows Mobile. The computers based on it are known as pocket PC and smart phone. In this environment we can utilize from Embedded Visual language such as Embedded Visual C, Power builder .NET and etc. (Fig2)

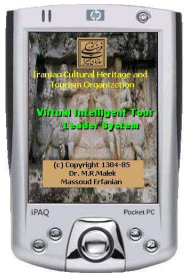

Figure2: The performance of the system on Pocket PC

5.2. Software:

Our system provides information for user based on its position. Presentation of sound and image services including descriptions about historical feature, image and film display is some of its tasks. The maps are both north up and track up. This matter results that the unfamiliar user adapt to the environment with the least complexity.

One of the most important services of MOTA is wayfinding. Figure 3 show the wayfinding file of this system.

Figure3: Some pages of MOTA

MOTA is implemented based on -historical city- Bishapour.

6. CONCLUSIONS

Smart map, is a multimedia graphical and spatial databases which is integrated with different sensors such as GPS and gravimeter in mobile environment. The smart map is different with paper and digital maps. The maps on mobile devices are uncounted with uncertainties more than familiar case in desktop and static system. Furthermore, mobile information systems are fairly personal. So it is better to implement the system based on natural coordinate system of the user.

In this paper, we define a smart map as a multimedia spatial database integrated with different sensors like GPS (Global Positioning System) and INS (Inertial Navigation System) running in a mobile environment. We argue that it is not enough to focus on adoptions to technical parameters (device characteristics, location, …), but propose that tourist maps need to be dynamically generated according to a wider range of variables from user preferences and interests, the given task, cultural aspects to communicative goals and actual context and location. This means such a system needs to exploit user models and context knowledge.

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