

Hovering Information: implementation, simulation and analysis

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1 Introduction

1.1 Vision

The hovering information is an information dissemination service working in an dynamic infrastructure-free environment with a self-organizing behaviour; a MAS approach may offer a sound paradigm for both hovering information implementation and simulation. The simulation implies the design of a *social* system, where people - hovering information users - move in an environment with different and non-random behaviour. From the simulation results, an analysis of the resulting dynamic network can lead to additional consideration and information that may help understanding and defining service properties and requirements.

In section 2 the system is designed using the *SODA* methodology, in ...*TODO*.

1.2 Hovering Information System

Hovering Information is a geo-localized information dissemination service, proposed in [3], able to work without a centralized infrastructure. The service is aimed to mobile users capable of peer-to-peer communication and geo-localization. The hovering information system is composed by two main components: mobile nodes and pieces of hovering information.

Mobile nodes are components moving into the environment with a limited communication range, capable of communicate to peers, discover neighbors,

access and store (inside a limited buffer) pieces of hovering information. A mobile node is assumed able to determinate its geographic position, speed and direction.

Pieces of hovering information are data that have to *survive* inside a circular area centered at a location called *anchor location* and having a radius called *anchor radius*. The survivability goal of a piece of hovering information is achieved moving or replicating the piece itself through the mobile nodes. A piece of hovering information may have some policies controlling the movement between nodes.

In an hovering information system, three main requirements may be defined for each piece of hovering information [3]:

Survivability: a piece of hovering information is alive at some time t , if there is at least one node hosting a replica of this information.

$$survivability = \frac{alive_time}{total_time}$$

Availability: a piece of hovering information is available at some time t , if there is at least one node in its anchor area hosting a replica of this information.

$$availability = \frac{available_time}{total_time}$$

Accessibility: a piece of hovering information is accessible by a node at some time t , if the node is able to get this information; therefore, a replica exists in the node communication range.

$$accessibility = \frac{replica_covered_area}{anchor_area}$$

2 Hovering Information and Social System Design

The system should implement the hovering information system working inside a social environment. Mobile nodes are owned by people, who move inside an environment composed by anchors, that is locations where pieces of hovering information are present. Anchors are usually binded to points of interest, but generally hovering information can be dynamically created by people.

Mobile nodes lose power and may have not enough energy to supply the whole function. In that case some mobile node features may be limited such as information storage, communication, etc..

Preliminary assumptions:

1. *Localization error negligible.*

2.1 Requirements Analysis

Requirements Tables

Actor	Description
HoveringService	The system itself, it offers location-dependent information.
MobileDevice	Device able to interface itself with the system.
Person	User of a mobile device.
GraphAnalyst	Data gatherer, organizer and analyzer.

Table 1: Actor table $(C)Ac_t$

Requirement	Description
ManageDeviceResources	Manage the resources needed by the service, such as geo-location, communication, neighbor mobile device discovery, and so on.
AccessInformation	Access all the information that reside inside an anchor area.
CreateInformation	Creates a new hovering information.
ObtainSystemData	Known the current data (position, information access, etc.) of all the system component.
Availability	Make all information available.
Survivability	Keep all information alive.
Accessibility	Make all information accessible in their anchor area.

Table 2: Requirement table $(C)Re_t$

Actor	Requirement
HoveringService	AccessInformation, CreateInformation, Availability, Survivability, Accessibility.
MobileDevice	ManageDeviceResources.
Person	AccessInformation, CreateInformation.
GraphAnalyst	ObtainSystemData.

Table 3: Actor-Requirement table $(C)AR_t$

Domain Tables

External Environment	Legacy system
External	SimulatorOutput.

Table 4: External Environment-Legacy System table $(C)EELS_t$

Legacy System	Description
SimulatorOutput	Final stage of the simulation, gather and show simulation data.

Table 5: External Environment-Legacy System table $(C)EELS_t$

Relations Tables

Relation	Description
SimulatorData	make relevant information available to the simulator.
UseDeviceFeatures	Access the mobile device features.

Table 6: Relation table $(C)Rel_t$

Requirement	Relation
AccessInformation	UseDeviceFeatures, SimulatorData.
CreateInformation	UseDeviceFeatures, SimulatorData.
ManageDeviceResources	UseDeviceFeatures, SimulatorData.
ObtainSystemData	SimulatorData.

Table 7: Requirement-Relation table $(C)RR_t$

Legacy-System	Relation
SimulatorOutput	SimulatorData.

Table 8: Relation-LegacySystem table $(C)RLS_t$

2.2 Analysis

2.3 Architectural Design

2.4 Detailed Design

References

- [1] Andrea Omicini Ambra Molesini. *SODA - Societies in Open Distributed Agent spaces*. ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA, October 2012. <http://soda.alice.unibo.it>.
- [2] S. Boccaletti, V. Latora, Y. Moreno, M. Chavez, and D. U. Hwang. Complex networks: Structure and dynamics. *Physics Reports*, 424(4-5):175–308, February 2006.
- [3] Alfredo A. Villalba Castro, Giovanna Di Marzo Serugendo, and Dimitri Konstantas. Hovering information - infrastructure-free self-organising location-aware information dissemination service. In *2nd ERCIM Workshop on eMobility*, 2008.