



Introduction

Presented to the IEE First European Workshop on
Location Based Services, London, 16 September 2002

Intelligent Inhabited Environments as Location Based Services

Intelligent Inhabited
Environments Group



<http://ieeg.essex.ac.uk>



Essex University

- *parkland of 200 acres*
- *Royal Charter in 1965*
- *5,926 students*
- *25% post graduates*
- *24% overseas
(120 countries)*



the campus





IIEG Work?

- ✦ **Primary Research Focus** - the creation of intelligent (learning) mechanisms that can be embedded into networked devices making up everyday living environments (targeting so called Ambient Intelligence, Pervasive and Ubiquitous Computing).
- ✦ **Secondary Research Focus** – Network Infrastructures, HMI, novel sensors / effectors

✦ **Funded Projects**

- ✦ eGadgets
- ✦ careAgents
- ✦ Social

✦ **Test Beds** - evolving experimental environments for testing our ideas...

- ✦ iDorm
- ✦ "Tomorrow's World" Set
- ✦ mDorm
- ✦ iFlat

Gadgets

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IIEs - What Are They ?

✦ **Inhabited Intelligent Environments (IIE)**

- ✦ Living Environments (home, work, commerce, transport etc) where **physical services** (e.g. lighting, entertainment, security) rather than information are provided to people by networked computer based devices.
- ✦ The vision is that the world will be populated with billions of such tiny service providing computers – a highly dynamic and complex world.
- ✦ Embedded Intelligence is needed to shield users from the technology (orchestrate the often unique combinations of available devices to programme the services the user wants)

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An Example: Intelligent Dormitory (iDorm)

- Multi-function space laid out like a student dormitory

Appliances:

- Multimedia PC
- Desk lamp
- Bed lamp
- Room Heater
- Room Cooler
- Window Blind
- Active lock
- Ceiling lights
- Telephone
- TV
- DVD
- CD Player
- Desk
- Chair
- Bed
- Mood Cube



Miscellaneous sensing:

- Actuators' state
- Occupancy
- Location
- Window state
- Indoor light level
- Outdoor light level
- Indoor humidity
- Time

- Interconnected via heterogeneous networking

- All appliances / systems provide services to users


iDorm Communication Structure

- iDorm uses five different network protocols:

- IEEE 802.11b
- Bluetooth
- 1-Wire (Dallas Semiconductors)
- IPv4
- LonTalk (Lonworks)


- Two Communication schemes

- XML based messaging built around HTTP based central server
- ACL based messaging based around DIBAL distributed architecture




Interfacing Mechanism


⊕ Wap




⊕ PDA (3rd Gen Mobile Emulation)




⊕ Voice



⊕ Web based VRML




⊕ Implicit (natural)



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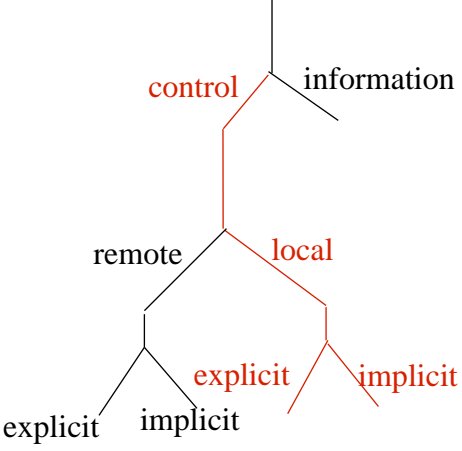
LBS in Inhabited Intelligent Environments

⊕ **Potential LBS Environments**

- ⊕ Home
- ⊕ Work Place (e.g. office)
- ⊕ Public Spaces (e.g. Hospitals, clubs)
- ⊕ Transport (car)

LBS in IIEs target control, not information

⊕ **Types of LBS**




```

graph TD
    Root[Types of LBS] --- Control[control]
    Root --- Information[information]
    Control --- Remote[remote]
    Control --- Local[local]
    Remote --- RemoteExplicit[explicit]
    Remote --- RemoteImplicit[implicit]
    Local --- LocalExplicit[explicit]
    Local --- LocalImplicit[implicit]
    
```

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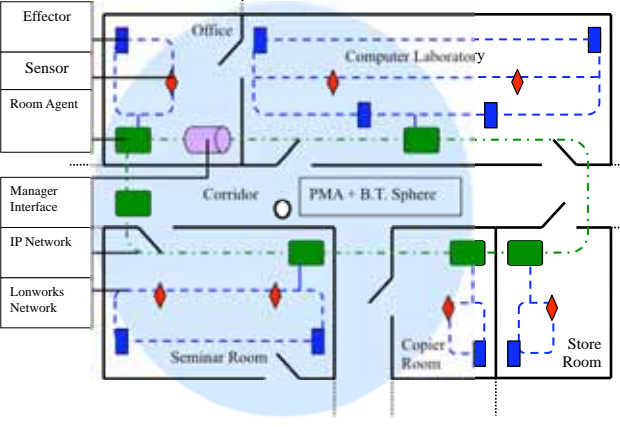


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LBS IIE Mechanisms


- ◆ Location mechanisms
 - ◆ iButtons and tags
 - ◆ RF (Bluetooth)





User requirements, as rule-sets, follow user to differing locations via network, in mobile or PDA


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Ubiquitous Computing & Ambient Intelligence

- ◆ **Ubiquitous** (or Pervasive) **Computing** offers the vision for populating the world with billions of computers embedded into physical systems all offering numerous services (some unique) to people.
- ◆ **Embedding intelligence into appliances** reduces technical & cost barriers by provides a mechanism for pervasive computing devices to adapt (self-program/learn) to the the often unique needs of the user and location.
- ◆ **Mobile devices** (eg phones, pdas etc) offer the means for the users preferences to be transported (and updated) between locations, adapting to available services (plus with interface and id functions)

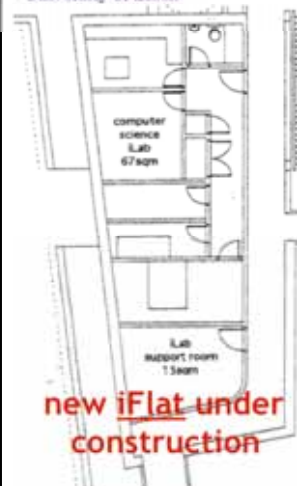


Current technology offers small cheap networked devices e.g. TINI board (Java/web based)



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Location Based Service Research Direction



- ✦ Investigating use of 3G mobile devices as LBS interfaces (via PDA / phone Bluetooth / GSM).
- ✦ Investigating migrating current embedded-agents (& rule learning) in gadgets and appliances to 3G mobiles.
- ✦ Investigating network architectures (e.g. hierarchical gateway, fully distributed etc).
- ✦ Investigating Languages from inter-device (e.g. Dibal) to programming (e.g. Java)

eGadgets: everyday objects, augmented with computation, sensing, communication & intelligence

cAgents: involves internet-linked intelligent rooms in Essex (iDorm) & Korea (Sweetroom)

Any Questions?

This work was made possible by funding from the EU 5th Framework and the UK-Korean Scientific Fund

✦ Some References

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- ✦ Callaghan V, Clarke, G., Colley, M., Hagrais, H. "A Soft-Computing DAI Architecture for Intelligent Buildings", Journal of Studies in Fuzziness and Soft Computing on Soft Computing Agents, Physica-Verlag-Springer, July, 2001
- ✦ Cayci F, Callaghan V, Clarke G, "DIBAL - A Distributed Intelligent Building Agent Language", The 6th International Conference on Information Systems Analysis and Synthesis (ISAS 2000), Orlando, Florida, July 2000
- ✦ ISTAG (EU) "Scenarios for Ambient Intelligent in 2010 see www.cordis.lu/ist/istag.htm



More information can be found on:

<http://iieg.essex.ac.uk>