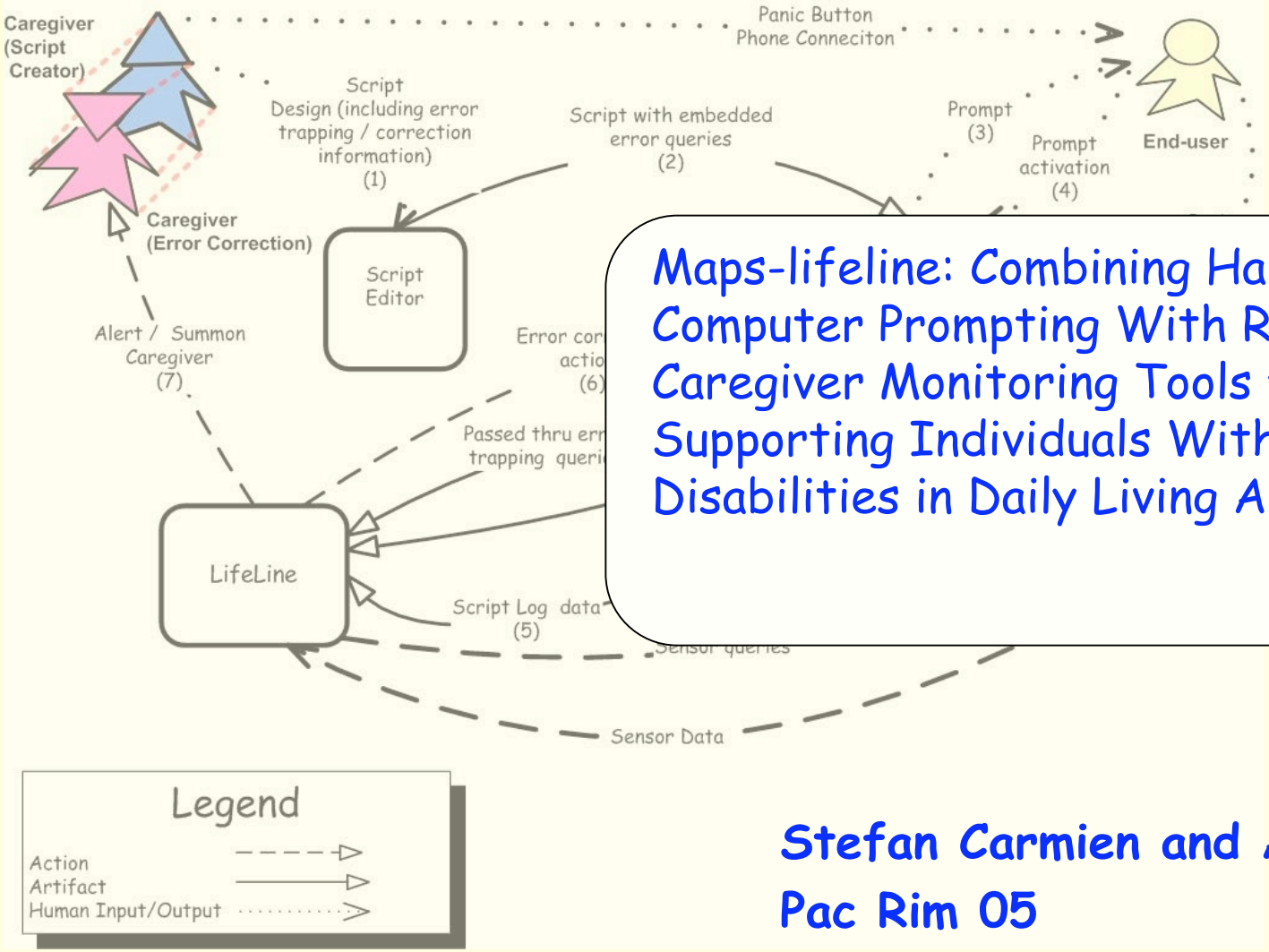

Maps-lifeline: Combining Handheld Computer Prompting With Real-time Caregiver Monitoring Tools for Supporting Individuals With Cognitive Disabilities in Daily Living Activities

Stefan Carmien and Andrew Gorman

Pac Rim 05

Feb 28 2005

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Presentation overview

- Introduction to Clever
- The project & our approach
- Prompting systems
- MAPS/Lifeline
- Demo
- Discussion

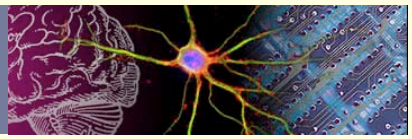
Who are we…

Andy Gorman and Stefan Carmien are Researchers from the Cognitive Levers (CLever) Project in Boulder Colorado

- The Center for Lifelong Learning and Design (L3D)
- The Institute of Cognitive Science
- The Coleman Institute for Cognitive Disabilities

coleman institute
for Cognitive Disabilities
University of Colorado System

The Institute of Cognitive Science



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L3D Perspective

artificial intelligence (AI) → **intelligence augmentation (IA)**
- replacement → empowerment
- emulate → complement (exploit unique properties of new media)

instructionist learning → **constructionist learning**
- learning about → learning to be
- when the answer is known → when the answer is not known (collaborative knowledge construction)

individual focus → **social contexts**
- knowledge in the head → knowledge in the world
- access → informed participation

things that think → **things that make us smart**
- what computers can do → human and computer synergies
- computational → computational and physical

"gift-wrapping" with new media → **co-evolution of media and new theories about thinking / working / learning / collaborating**

What does this have to do with disabilities ?

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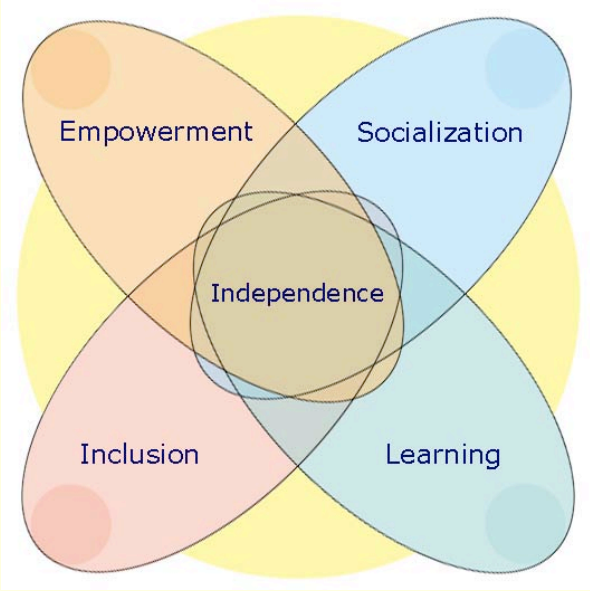
CLever's motivation

- *The mission of the Cognitive Lever, or CLever project is to design and develop socio-technical environments to assist people with a wide range of cognitive disabilities and their support community.*
- Looking at people and technology from a systemic viewpoint
- Space effect / curb cuts
- By understanding this hard problem we understand other human problems better



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CLever Approach

- Story of our involvement and education - the Coleman's foundation
- Concept of Cognitive Levers
- Find the right lever for the right person in order to increase independence
- The difference between 'hard' AI problems and ones we *can* do
- Visions

Clever Video

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Our Approach

- AT's design paradigms:
  - I've got a theory
  - I've got a cousin
- Symmetry of Ignorance
  - Technologists: Andy & Stefan
  - Caregiver professionals: Anja Kintsch & collaborators (Imagine!)

Prompting Systems

- Manual Prompting
  - Effective for learning, not useable as prosthesis
- Visions
  - PC based
  - Difficult to (re)configure
- Ablelink (visual assistant)
  - PDA based
  - static scripts only

Environment Home
Activity Making a Sandwich
Student_____ **Please note kind of sandwich**

1-Independent
2-Model
3-Indirect Verbal
4-Gestural

	A	B	C	D	E	F
1		Modifications				
2	Gets bread package					
3	Opens bread package					
4	Takes out two slices					
5	Closes bread package					
6	Opens jar					
7	Gets knife					

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MAPS/LifeLine Motivation

- Abandonment
- Independence
- Safety

Abandonment

- Unacceptably high abandonment rate (50% - 70%) of expensive (~.5-4 K$) Assistive Technology (AT)
- Mismatch between the individual and tool
- Difficult (re)configuration leads to abandonment

Independence

- Most important Thing?
- Visions worked
- The CLever design concept
  - Find individuals that need a little help
  - Universe of One perspective

Safety

- Most Important Thing?
- Meetings with Caregivers and AT professionals
  - panic button
  - Caregiver monitoring
  - Dynamic prompt generation
  - Effective error detection and correction

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Prompting as a technique

- Prompting as training
- Prompting as tool for living

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Task Support

- Internal and external scripts (Distributed Cognition)
  - A script = linked set of prompts
  - Prompts = Image & sound
  - Prompts (external script) trigger mastered actions (internal scripts)

Stakeholders

- Persons with cognitive disabilities
- Caregivers
- Assistive technologists
- Others?

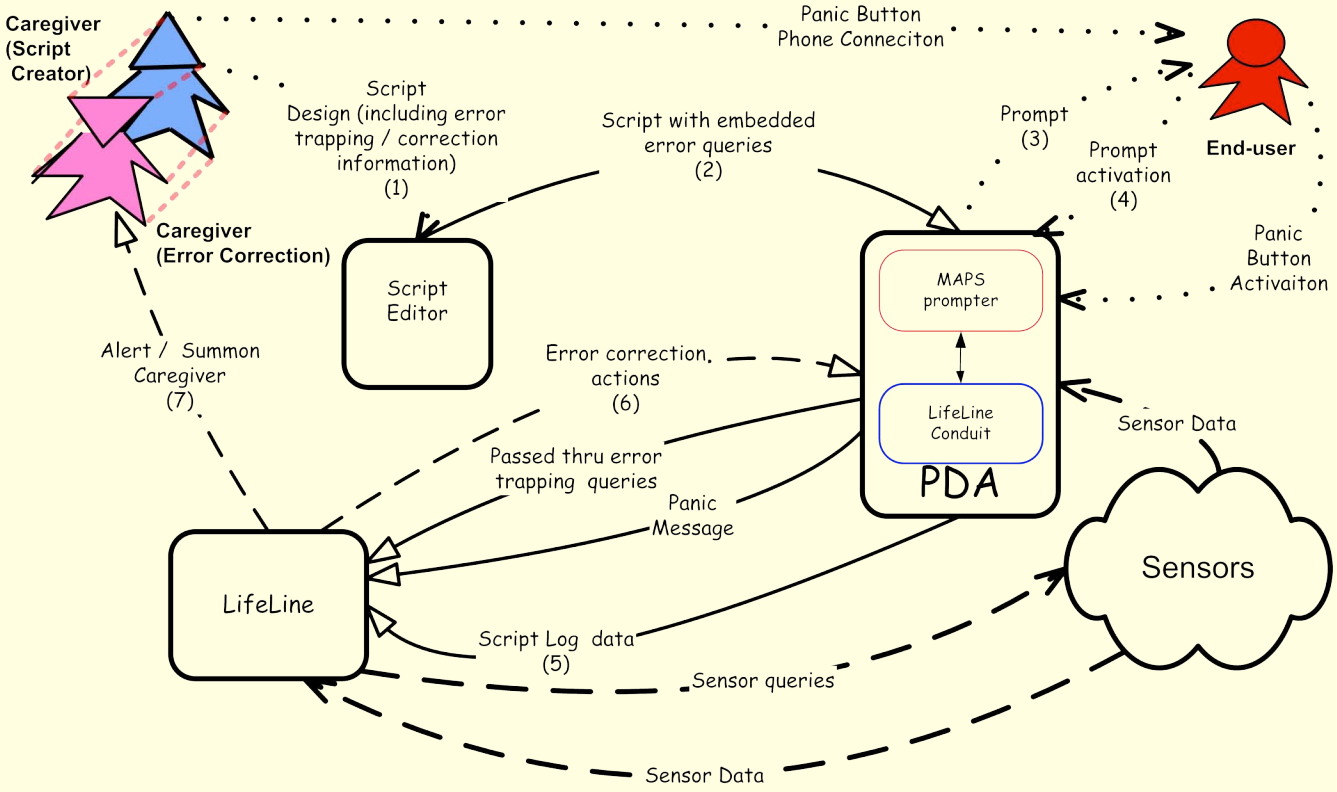
Real time monitoring

- Plans and Situated action
- Safety concerns
- Privacy
- Lifeline approach & architecture

Together

- How MAPS & LifeLine work together

The Elements of the System



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MAPS / LifeLine stages of use

- Needs to be easy to initially succeed
  - Out of the Box Experience
  - Templates
- but extendable
  - Script reuse
- and reliable in real world
  - Error trapping & lifeline
- and finally, self-adjusting to user's growth
  - Collapsing script detail as internal scripts become bigger

Script Editor

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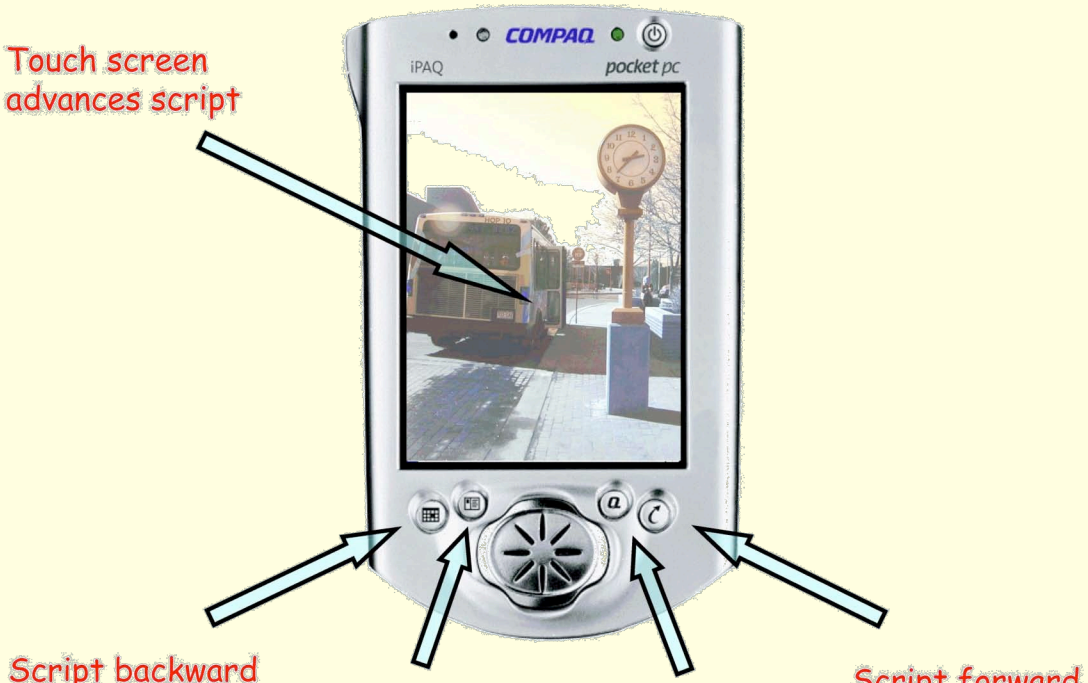
Handheld Prompter



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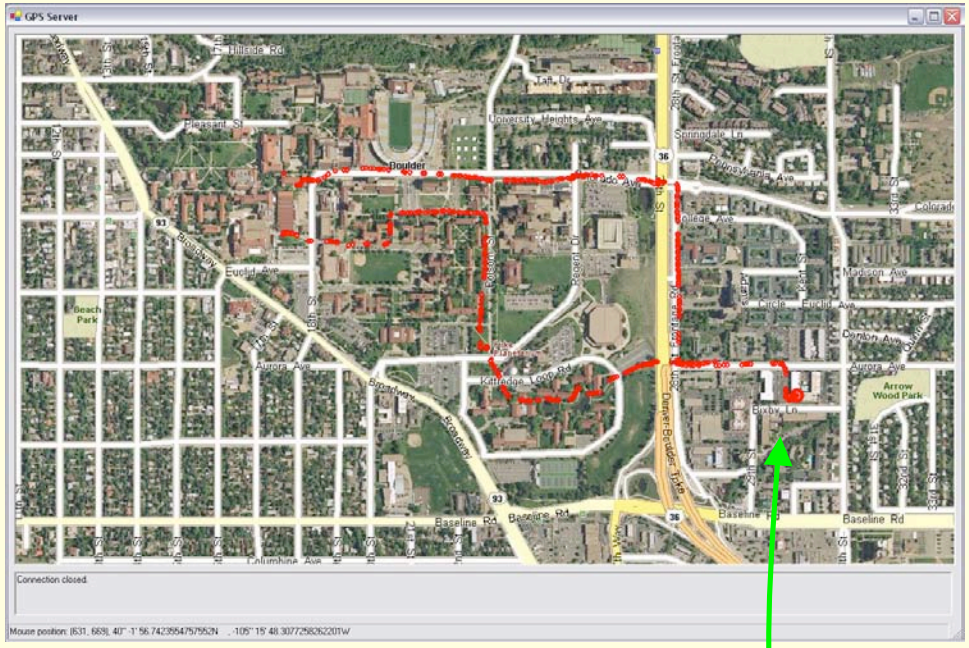
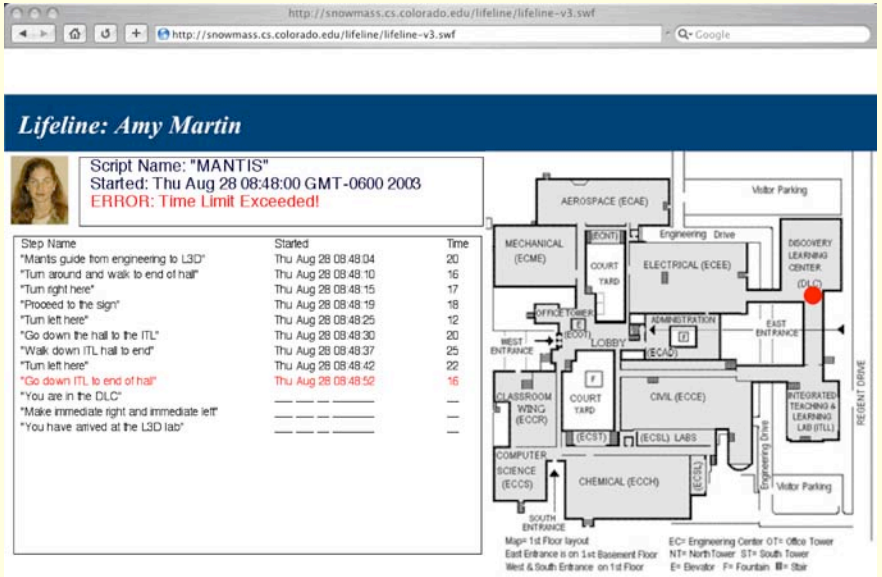
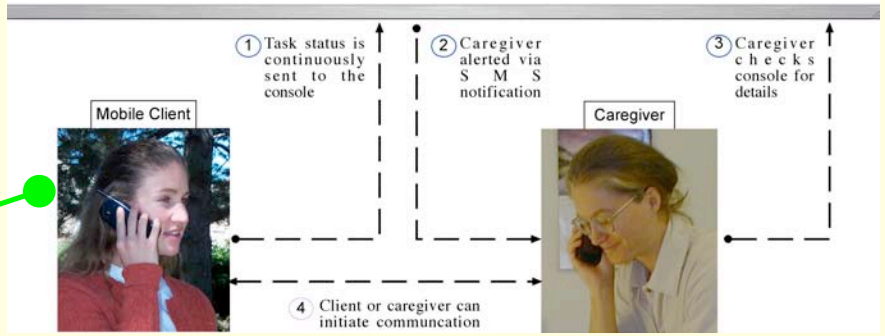
Lifeline Caregiver Consoles







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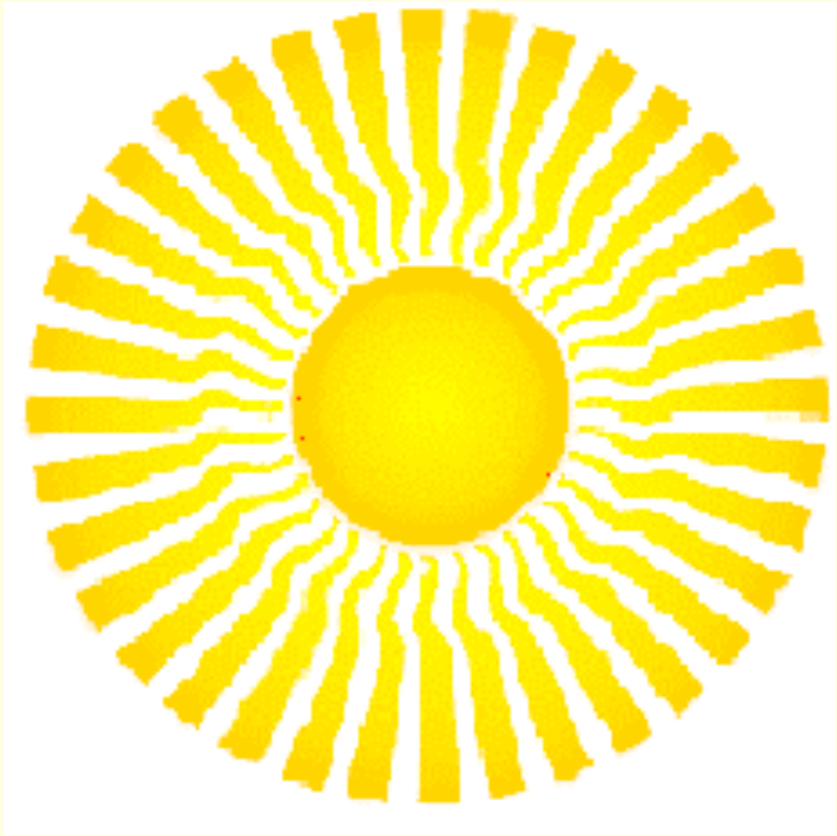
Demo



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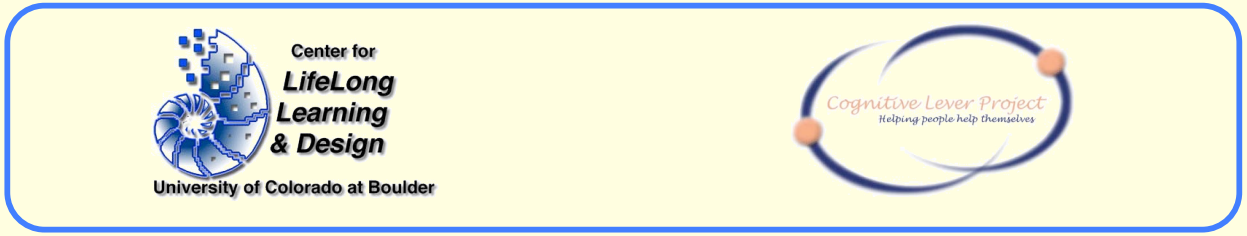
Lifeline Challenges

- Notifying Caregivers
  - False alerts v.s. undetected errors
  - Levels of escalations
- Place the caregiver in the client's context
  - What information is needed?
  - How does it need to be presented?

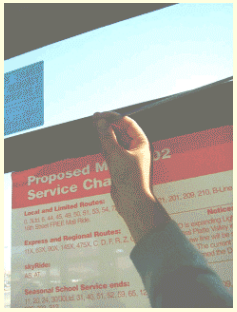
Script Annotations

- Don't require annotations
- Each script step can have:
  - Many error tests
  - Different error correction actions
- Example:

Check every 5 seconds (or until next prompt is activated): if the distance between here and your bus stop is not always getting closer then summon the caregiver or if that fails call 911



Typical Error Scenario



Missed
Bus Stop !

Tom
(more cognitive
resources)

Alert
Caregiver

Tell the
Bus driver
your problem

Summon
Caregiver

Wait on bus
for
Caregiver

Anne
(less cognitive
resources)

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Discussion of Demo

- Does this make sense?
- Was the script editor a reasonable tool?
- What am I missing?
- What is done 'wrong'?

Future Work

- MAPS
  - Image experiment
  - Field trials
  - Template/image/soundfile search tools
- Lifeline
  - Context-aware Environments
  - Additional information sources
  - Network of Caregivers
    (dynamically dispatching caregivers based on availability and proximity)

Thanks

- This work is supported by:
  - Coleman Institute for Cognitive Disabilities
  - The RERC on Advancing Cognitive Technologies funded by the National Institute on Disability and Rehabilitation Research (NIDRR), U.S. Department of Education under Grant #H133E040019.
  - National Science Foundation SGER: Designing and developing mobile computing infrastructures and architectures to support people with cognitive disabilities and caregivers in authentic everyday tasks", National Science Foundation Special Grant for Exploratory Research (#IIS-0456043)
  - Imagine!

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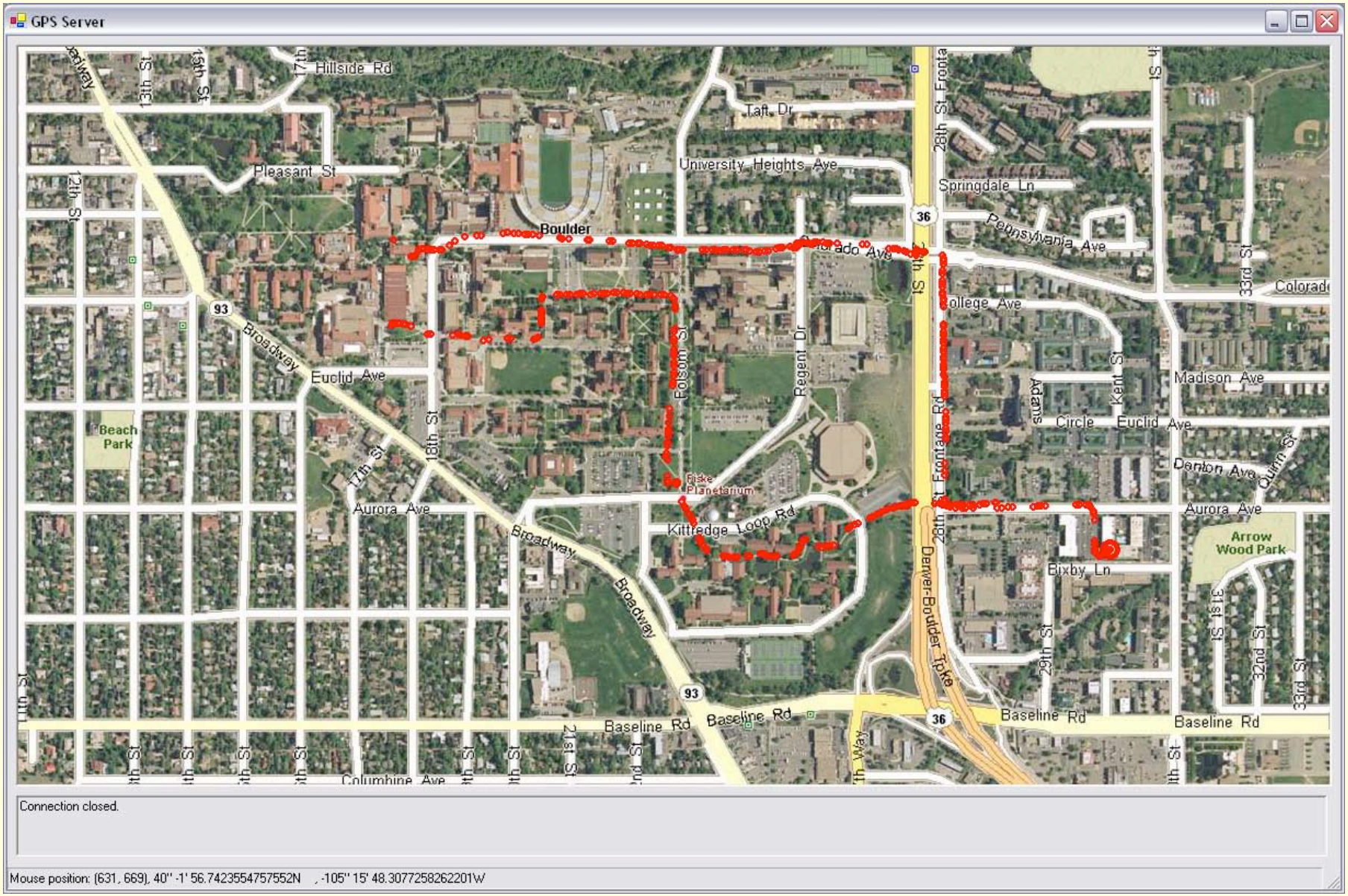
Tracking Pedestrians



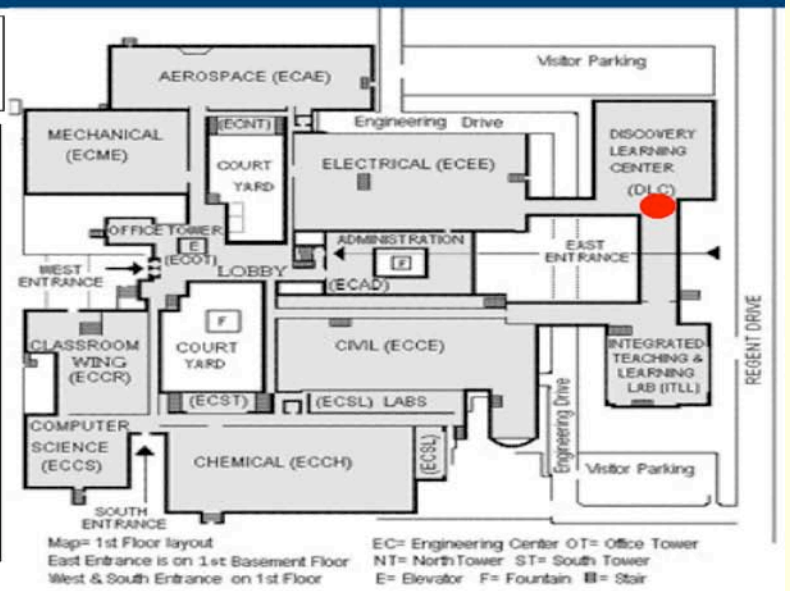
Information Flow

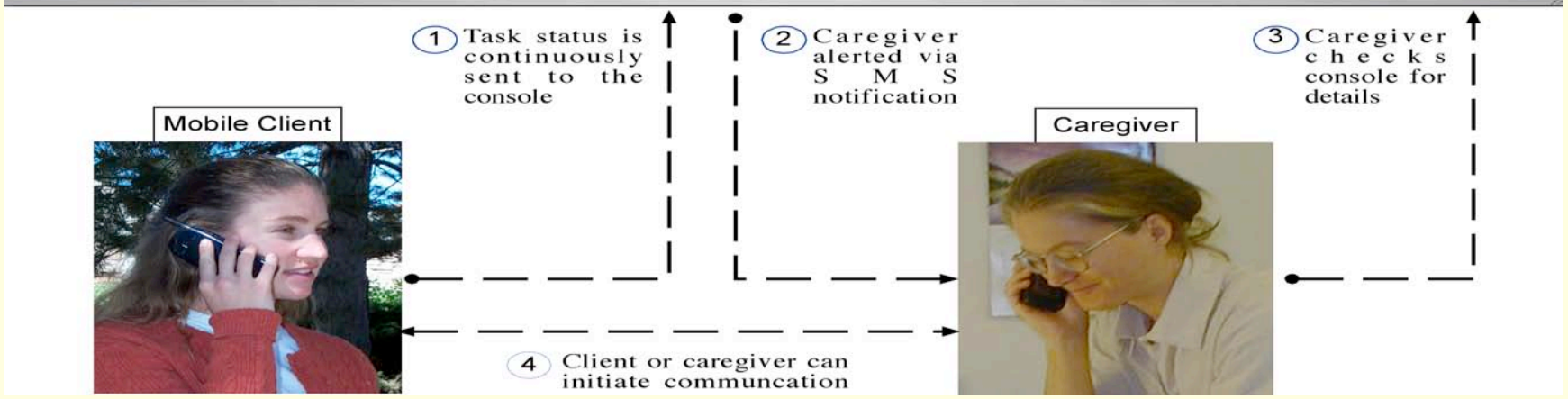
http://snowmass.cs.colorado.edu/lifeline/lifeline-v3.swf

Lifeline: Amy Martin

Script Name: "MANTIS"
Started: Thu Aug 28 08:48:00 GMT-0600 2003
ERROR: Time Limit Exceeded!

Step Name	Started	Time
"Mantis guide from engineering to L3D"	Thu Aug 28 08:48:04	20
"Turn around and walk to end of hall"	Thu Aug 28 08:48:10	16
"Turn right here"	Thu Aug 28 08:48:15	17
"Proceed to the sign"	Thu Aug 28 08:48:19	18
"Turn left here"	Thu Aug 28 08:48:25	12
"Go down the hall to the ITL"	Thu Aug 28 08:48:30	20
"Walk down ITL hall to end"	Thu Aug 28 08:48:37	25
"Turn left here"	Thu Aug 28 08:48:42	22
"Go down ITL to end of hall"	Thu Aug 28 08:48:52	16
"You are in the DLC"	___ ___ __ _____	__
"Make immediate right and immediate left"	___ ___ __ _____	__
"You have arrived at the L3D lab"	___ ___ __ _____	__

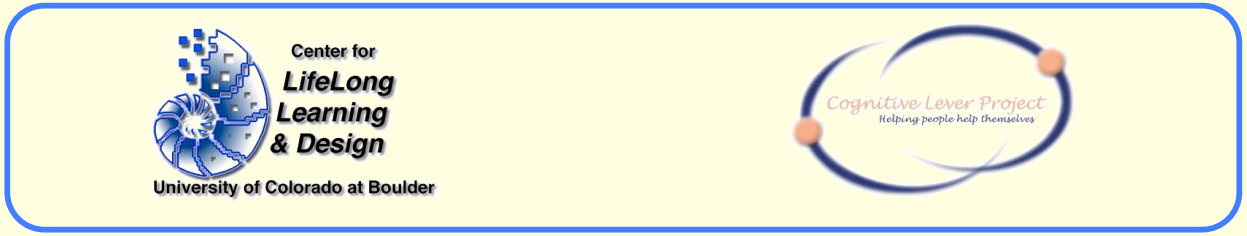




L3D attracted Bill and Claudia Coleman initially to CU Boulder

This is documented by the following quote from Bill Coleman: *"the idea for the gift stemmed from a tour of CU-Boulder's Center for LifeLong Learning and Design following a visit as a guest lecturer in a freshman computer science class on the Boulder campus. I saw some of the incredible research being done in cognitive science, including the use of computer-based technologies to support lifelong learning and online community building. I saw a connection with the work my company, BEA Systems, has been doing with the development of personalization technology for the Internet and possible techniques to help those with cognitive disabilities."*

This initial contact lead to the largest gift ever given to an American public university—$250 million and the creation of the Coleman Institute as the first system-wide institute in CU's history.



Privacy Issues

Monday, February 14, 2005 SECTION • A

Springs man accused of GPS stalking

Associated Press

COLORADO SPRINGS — Michael Carlson is being held on $3,000 bond for stalking his wife — with a satellite GPS.

He was arrested Friday after an argument with his wife when he blurted out that he knew where she was going because he had planted a transceiver in her car.

As far as police could recall, it was the first arrest here for stalking with a GPS, said Sgt. Tim Stankey.

The transceiver, about 4 inches long and 3 inches wide, was powered by the car battery and recorded everywhere she went, Stankey said.

Carlson's wife's name was not released.

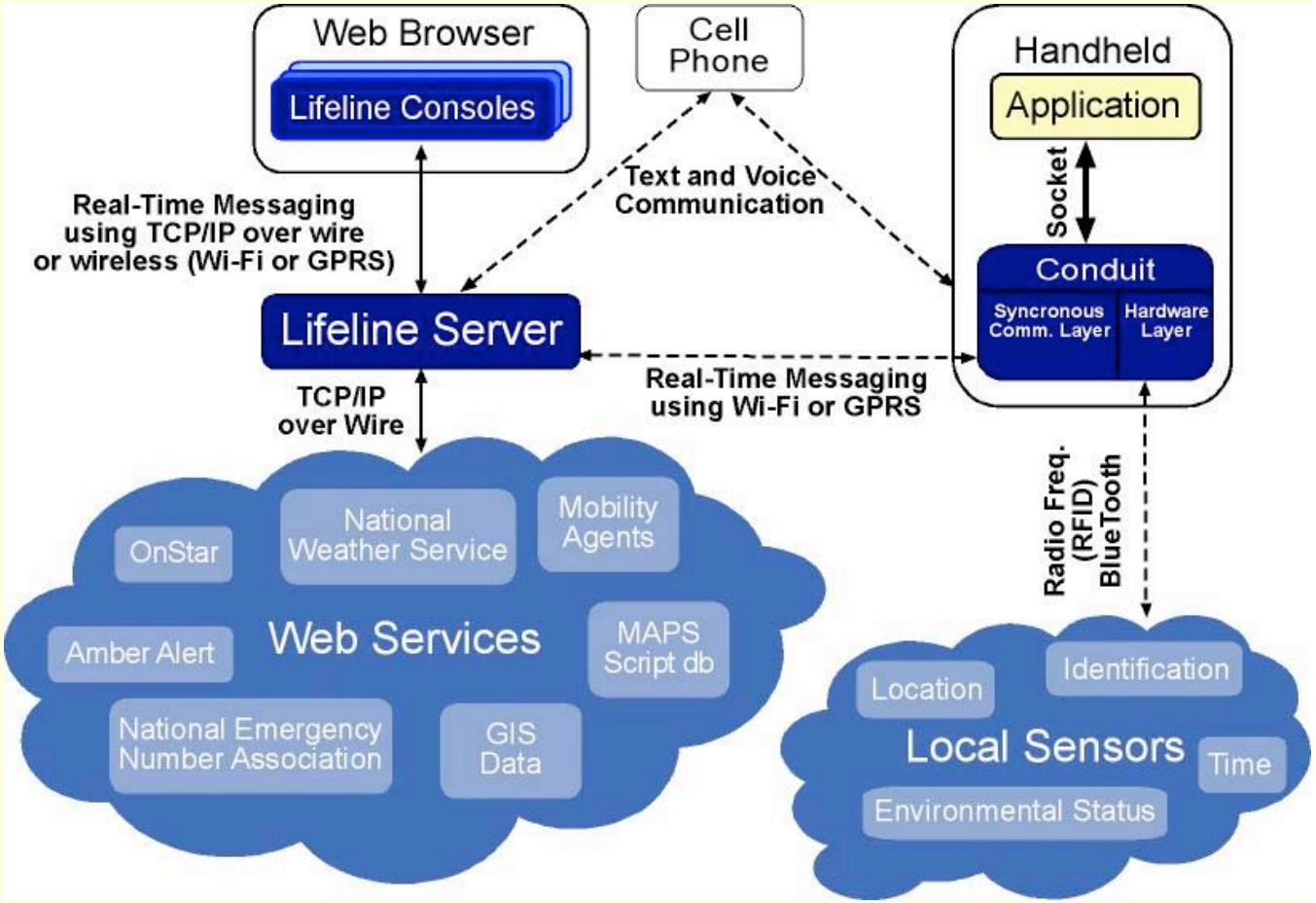
The Stalking Resource Center at the National Center for Victims of Crime says GPS stalking is a growing problem around the country.

Basic GPS devices, once sold for $1,000 or more, now are advertised on the Web for as low as $400.

Lifeline Architecture

Lifeline components:

1. **Conduit** - *runs on the Pocket PC, continuously updates server with client status;*
2. **Server** - *interprets client, detects errors, provides information to the handheld and caregiver console and notifies caregivers of problems via SMS messaging;*
3. **Console** - *allows caregivers to monitor and troubleshoot*



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