

Example Screen

The screenshot shows a mobile application window titled "173s". The interface includes a menu bar with "File", "Edit", "View", "Go", "Communicator", and "Help". Below the menu, the user's name "ID: Bubba Smith" and tail number "Tail#: 90-111" are displayed. A large instruction box states: "This screen can show all available 173s, just those you have done, or only those you have signed off. Tap a region to jump to that part of the list. Check off the 173s by tapping the circles on the right." Below this, there are three filter buttons: "All" (with a document icon), "Done" (with a checkmark icon), and "Signed Off" (with a key icon). To the right, a "Regions:" section contains buttons for "1", "2A", "5", "7B", "10", "11", and "13". The main content area is titled "Region 1: Nose gear, well, doors, fwd fuselage, radome, and speed brake" and contains a list of inspection tasks. Each task has a corresponding status circle on the right. A vertical sidebar on the right side of the screen contains several icons: "Hangar" (birds), "T.O." (red book), "173s" (checkmark), "Defects" (red bug), "New Defect" (red bug with plus), "SignOff" (key), "Help" (question mark), and "EXIT" (red button). The bottom status bar shows "Document: Done" and various system icons.

173s

File Edit View Go Communicator Help

ID: Bubba Smith
Tail#: 90-111

This screen can show all available 173s, just those you have done, or only those you have signed off. Tap a region to jump to that part of the list. Check off the 173s by tapping the circles on the right.

Show:

All Done Signed Off

Regions: **1** 2A 5 7B 10 11 13

Region 1: Nose gear, well, doors, fwd fuselage, radome, and speed brake

Region 1	Visually inspect A/C prior to disassembly for general condition to determine obvious discrepancies, deterioration (structure paint, flight controls, landing gear, etc) wear, tear and cleanliness	<input checked="" type="checkbox"/>
Region 1	Inspect canopy structure for scratches, cracks, corrosion; canopy actuators for leakage and security; canopy pins, latches, rollers and corner castings for cracks, wear and corrosion IAW 1F-15A/E-6WC-6. (1200 hour inspection).	<input checked="" type="checkbox"/>
Region 1	Visually inspect nose landing gear linkages for wear, cracks and/or corrosion.	<input type="checkbox"/>
Region 1	Visually inspect radar antenna for hydraulic leaks, cracks, corrosion and any other defects. Defects will be annotated on AFLC Form 173.	<input checked="" type="checkbox"/>
Region 1	Inspect radome hinge and radome hinge back up angle for warping, cracks, corrosion and missing fasteners. IAW 1F-15A/E-6WC-6 and 1F-15A/C/E-3-1. (1200 hour inspection).	<input type="checkbox"/>
Region 1	Visually inspect upper and lower fuselage splice area. F.S. 415 for	<input type="checkbox"/>

Hangar

T.O.

173s

Defects

New Defect

SignOff

Help

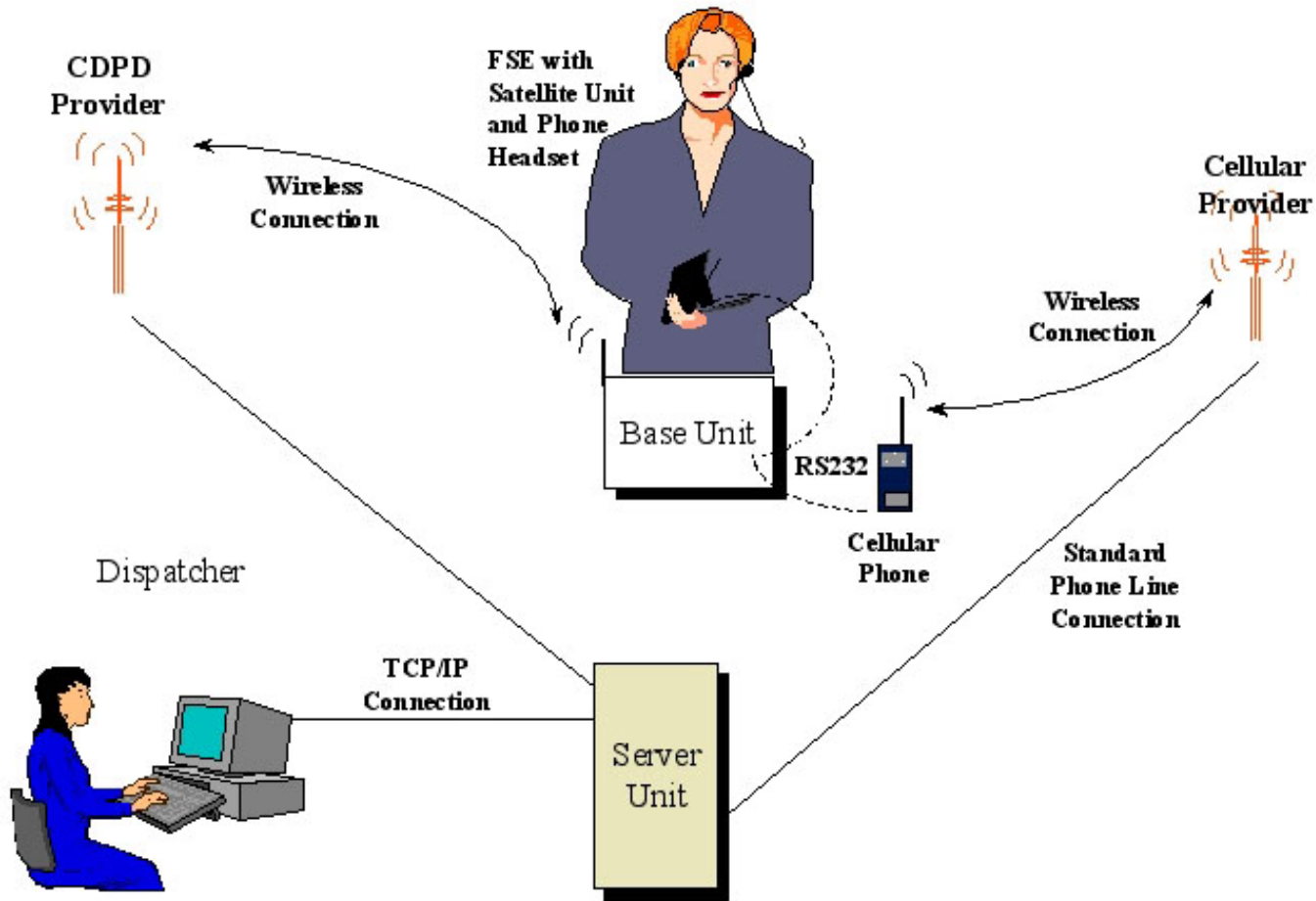
EXIT

Document: Done

Team Maintenance / Collaboration

- **One extension of Help Desk is a team of personnel such as field service engineers, police and firefighters, who are joining together to resolve an emergency situation.**
- **Information can change on a minute-by-minute and sometimes even a second-by-second basis.**

MoCCA System Architecture



MoCCA Prototype



MoCCA Integrated User Interface

Cellphone access to Voice BBoard



1. Make Topic
2. List Topic
3. Add Message
4. Delete Topic

FSE Information

Name	Cellphone	E-mail	Availability
Bill Martin	621-8579	bmartin@dec.com	Available
Martin Warwick	522-0164	mwarwick@dec.com	Pager Only

Pager Messages

Message	Dispatch
Call home 626-8462	Dispatch
<input checked="" type="checkbox"/> Need help with printer - John 284-8362	Dispatch
<input type="checkbox"/> Meet for lunch? Bob 632-4836	Bob Collins

Buttons: Delete, Send A Message

Sending Pager Messages



Dialer

Availability Selection

Change Your Availability

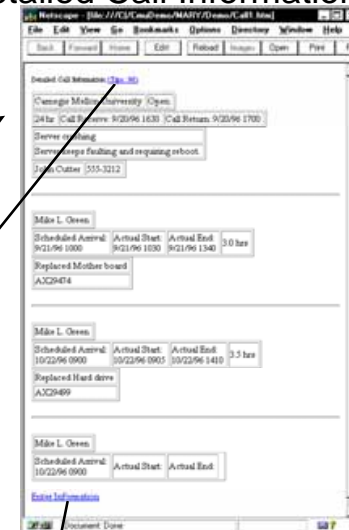
Available
 Pager Only
 E-mail Only
 Off Duty
 Unavailable

Submit

Call List

Customer Name	Call Time	Contract	Contact	CallBack	Abstract
Carnegie Mellon University	12/04/94 12:02 PM	Basic	Bryan Webb	412-227-1864	Bad MSC P Status on R238-EA Drive
Kaufmann's Department Store	12/03/96 11:40 AM	Basic	Laura Holden	412-555-1223	Network running too slow.

Detailed Call Information



Call Logging

Tip Filtering

You have 96 tips from the current call. They break down as follows:

- 62 Tips on [Carnegie Mellon University](#)
- 23 Tips on [Kaufmann's Department Store](#)
- 24 Tips on [John Carter \(Contact at Carnegie Mellon University\)](#)
- 12 Tips on [24 Hour Contact at Carnegie Mellon University](#)
- 1 Tip on [John Carter \(Contact at Carnegie Mellon University\)](#)

Retrieve Selected Tips

Tips

Part	Description
Part AX29474	Don't install with the computer plugged in
Part AX29474	Make sure to disconnect Video Cables
Part AX29474	Never remove jumper #2 from the 5th slot

Interactive S

Call List Queries

Call State: Active, Closed, Canceled

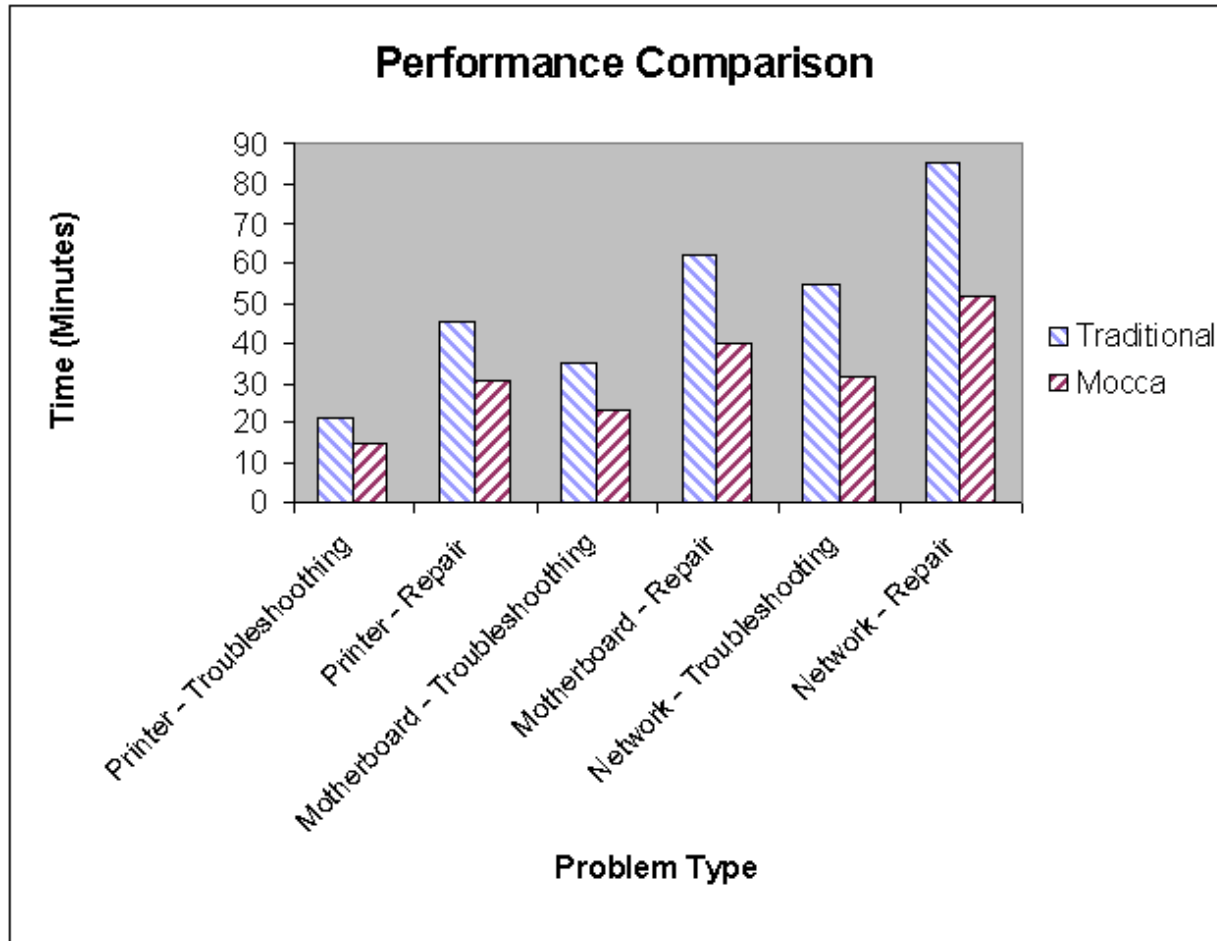
FSE: Myself, All FSEs

Dates: Before: [], After: []

Client: []

Submit Query

Improvement in Problem Solving



Context Aware Collaboration – Proactive Synthetic Assistant

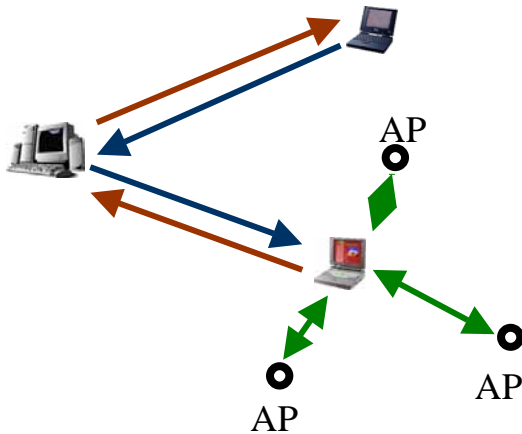
- **Situation where a mobile computer is aware of its user state and surroundings, and modifies its behavior based on this information.**
- **The goal is to enable mobile computers to be proactive, anticipating user needs, exploiting context information to significantly reduce demands on human attention.**

Context Aware Computing

- **Applications that use context to provide task-relevant information and/or services**
- **Context is any information that can be used to characterize the situation of an entity (person, place, or physical or computational object)**
- **Contextual sensing, adaptation, resource discovery, and augmentation**
- **Examples of Context Aware applications**
 - » **Context Aware Maintenance**
 - » **Proactive Assistant**

CMU People Locator

- Requests for location information are forwarded to the target computer.
- The target computer triangulates its position from the strength of the signals of several nearby nodes.
- It then returns the information back to the server, which sends it back to the original client

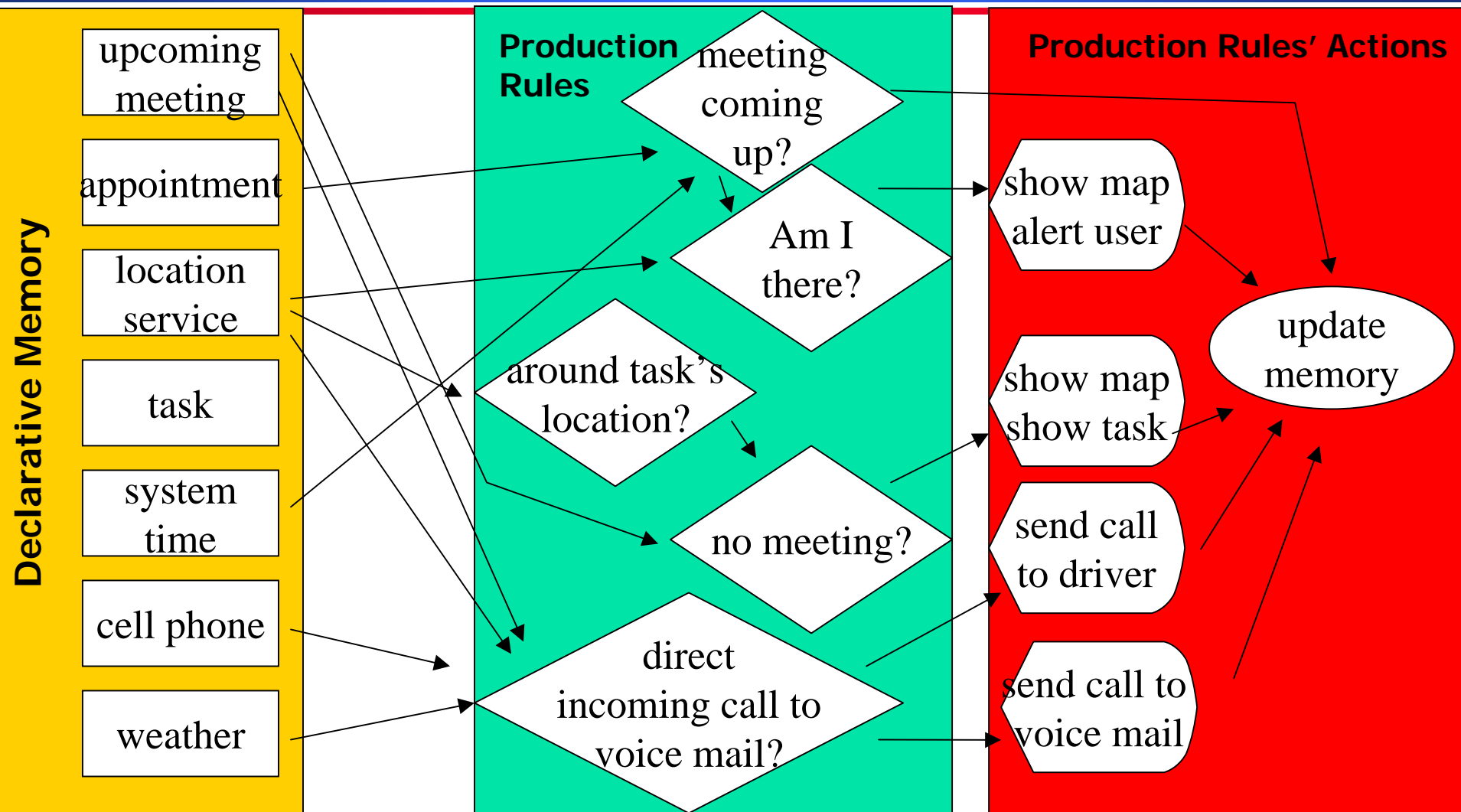


- **Precise** - Can determine location with accuracy of up to five feet.
- Requires gathering information by the target computer from multiple access points (AP).
- Support for privacy control.

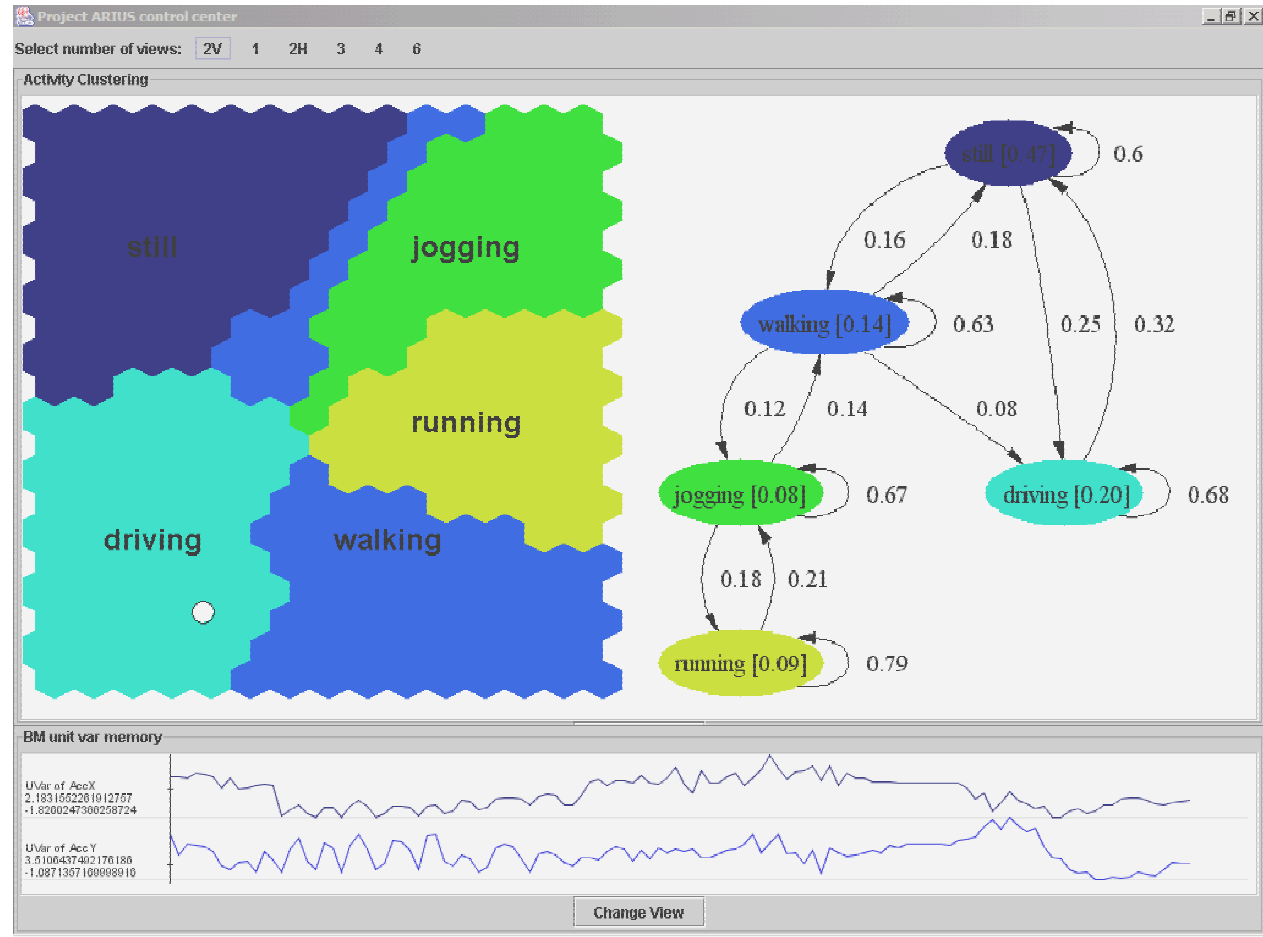
GM/CMU Companion



Activity Inspection



SenSay: Context Aware Cell Phone

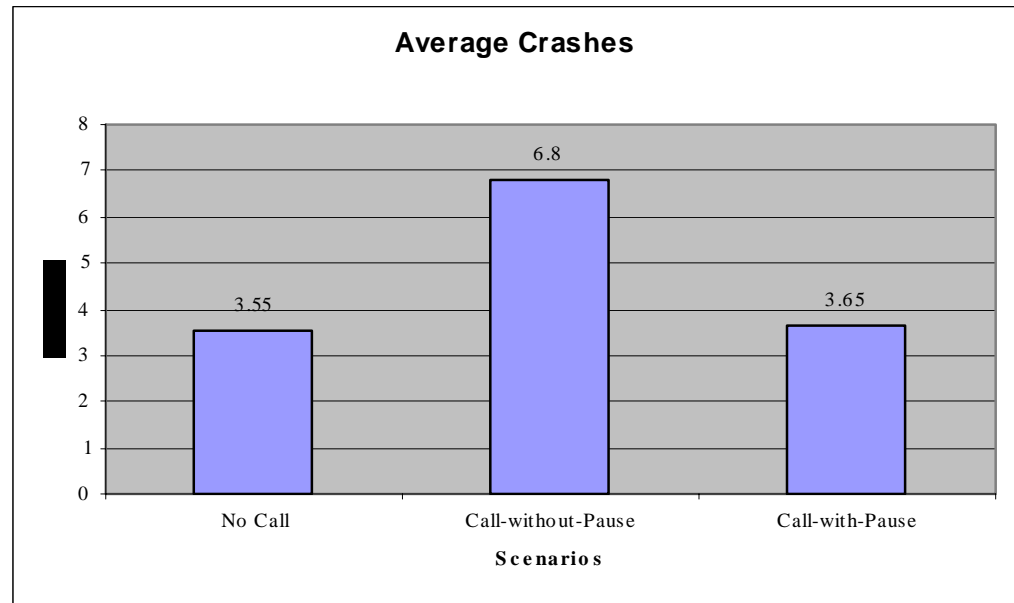


Experiment: Context Aware Collaboration – Proactive Synthetic Assistant

- **Task: Participant plays a “landlord” who is driving a car simulator and must talk to 2 apartment seekers.**
- **In the control condition, participant drives without talking to anyone.**
- **In second condition, participant drives while talking to apartment seeker on phone.**
- **In third condition, participant drives while talking, but caller ceases conversation during most difficult driving section**

Results

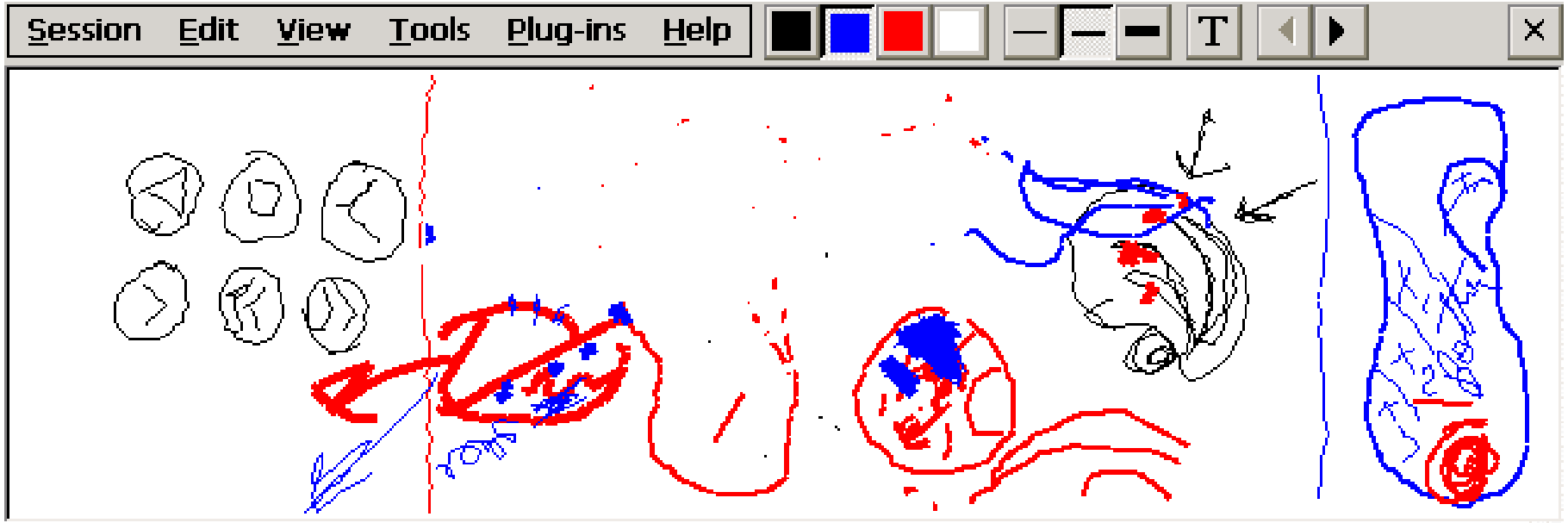
- **Our results show**
 - » **Talking on the cell phone caused people to crash more as compared to driving without a call.**
 - » **Inducing pauses during the call caused the driver to crash less even when using the cell phone.**
 - » **A driver using our phone that interrupts the caller during dangerous driving conditions would make driving while talking on the cell phone safer**



Team Collaboration

- **Idealink provides a virtual space for groups to manipulate graphical objects related to their work task, sharing observations with each other**
- **Asynchronous audio tags enable users to record an audio explanation or annotation of a particular object or procedure**
- **Each session is recorded and archived for later playback, making the knowledge contained within them available for later reference**
- **To evaluate Idealink, we developed a group problem solving task in which groups collaborated on the design of a stereo remote control**

A Shared Space for Collaboration: Idealink



A Shared Space for Collaboration: Idealink

Session #	Whiteboard					Idealink				
	1	2	3	4	TOTAL	5	6	7	8	TOTAL
Mechanics of collaboration events										
Explicit Communication	8	13	15	18	54	7	10	12	4	33
<i>errors and difficulties</i>	0	3	0	0	3	0	0	0	0	0
Implicit Communication	9	8	5	18	40	2	4	1	0	7
<i>errors and difficulties</i>	0	2	0	0	2	0	0	0	0	0
Cooperation	7	1	0	1	9	0	0	1	0	1
<i>errors and difficulties</i>	0	6	0	0	6	0	1	1	0	2
Planning	2	5	4	2	13	7	1	4	1	13
<i>errors and difficulties</i>	0	0	0	0	0	0	1	1	0	2
Monitoring	1	0	0	0	1	1	2	4	2	9
Assistance	1	1	1	0	3	0	1	1	0	2
Protection	0	0	0	0	0	0	0	0	0	0

- Idealink reduced communication errors by providing a shared space in which collaborators can clearly identify objects that designers create and refer to.

CMU Spot With Head Mounted Display



F-18 Inspection Application: Production vest fits under “Float Coat”



11 Mb/s wireless LAN connects Wearable Computer to server



Selection of “hot links” with CMU’s Wheel/Pointer





“MCC Element”

- 3 in x 5 in x 0.75 in; 9 oz.
- Full Win XP or Win2K OS
- 300-800 MHz x86 CPU
- 128 MB or 256 MB DRAM
- ALI1535 Southbridge Chip
- SMI Lynx 7213D graphics controller w 8MB frame buffer
- Internal 802.11b Port.

- 10 GB 1.8" Disk
- 1.6 Hour internal suspend battery
- Low power consumption: No fan, Thermal Docking
- Single I/O Connector
 - 3x USB,
 - Analog & Digital Video
 - CardBus/PC Card
 - Keyboard
 - Mouse
 - Audio

Antelope
TECHNOLOGIES



Advanced Prototypes: upcoming solutions

- Wearable systems
 - » Lightweight usable information storage, retrieval and communication devices with secure access
- Advanced Interactive Electronic Technical Manuals (IETMs)
 - » Current, easy to navigate and search multi-media documentation linking technical data, parts information, etc.
- Adaptable Interfaces
 - » Immediate adjustment of level of information to fit user's experience and ability profile
- Interaction Alternatives
 - » Use of speech interaction and natural language dialog, pen-based and/or gestural interaction options (system adapts to fit user's context)

Summary and Future Challenges

- **We have introduced and described a taxonomy of problem solving capabilities for wearable and context aware computers.**
- **We have shown how these capabilities impact choices of input/output modalities, user interface models and collaboration.**

Current Improvements

- **Advanced Interactive Electronic Technical Manuals (IETMs):** Current, easy to navigate and search multi-media documentation linking technical data, parts information, etc.
- **Adaptable Interfaces:** Immediate adjustment of level of information to fit user's experience and ability profile
- **Interaction Alternatives:** Use of speech interaction and natural language dialog, pen-based and/or gestural interaction options (system adapts to fit user's context)

Future Challenges

- **Future research will focus on development of a Virtual Coach (Brain++).**
- **It will capture a wearable augmented cognition platform and software application, as well as be able to monitor an individual's cognitive load and route tasks to less loaded individuals.**
- **Providing immediate suggestions to a user for cognitive augmentation and arbitration of resource redeployment will further enhance performance in maintenance environments.**