

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). At the bottom, a 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

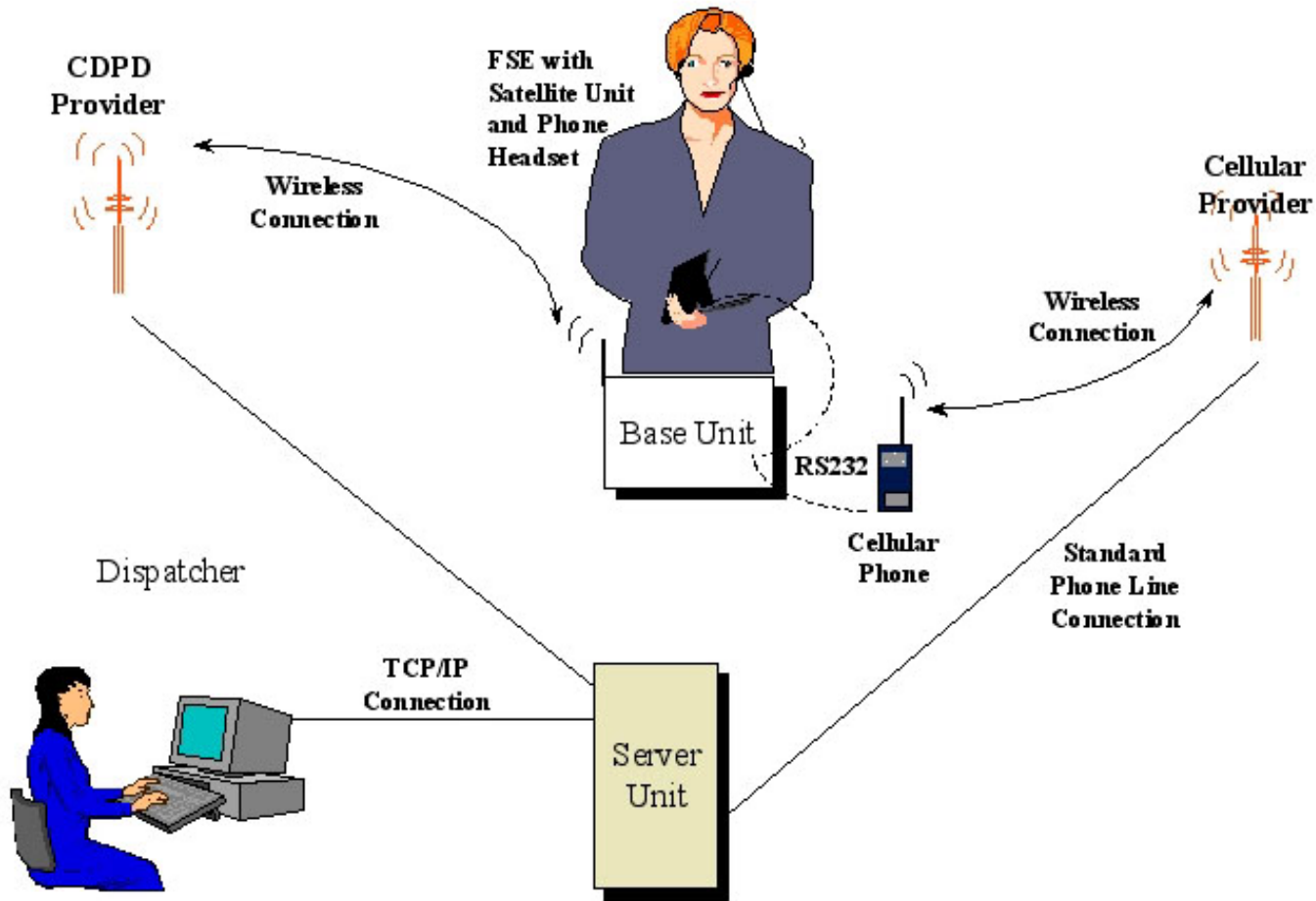
EXIT

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
Callhome 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



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

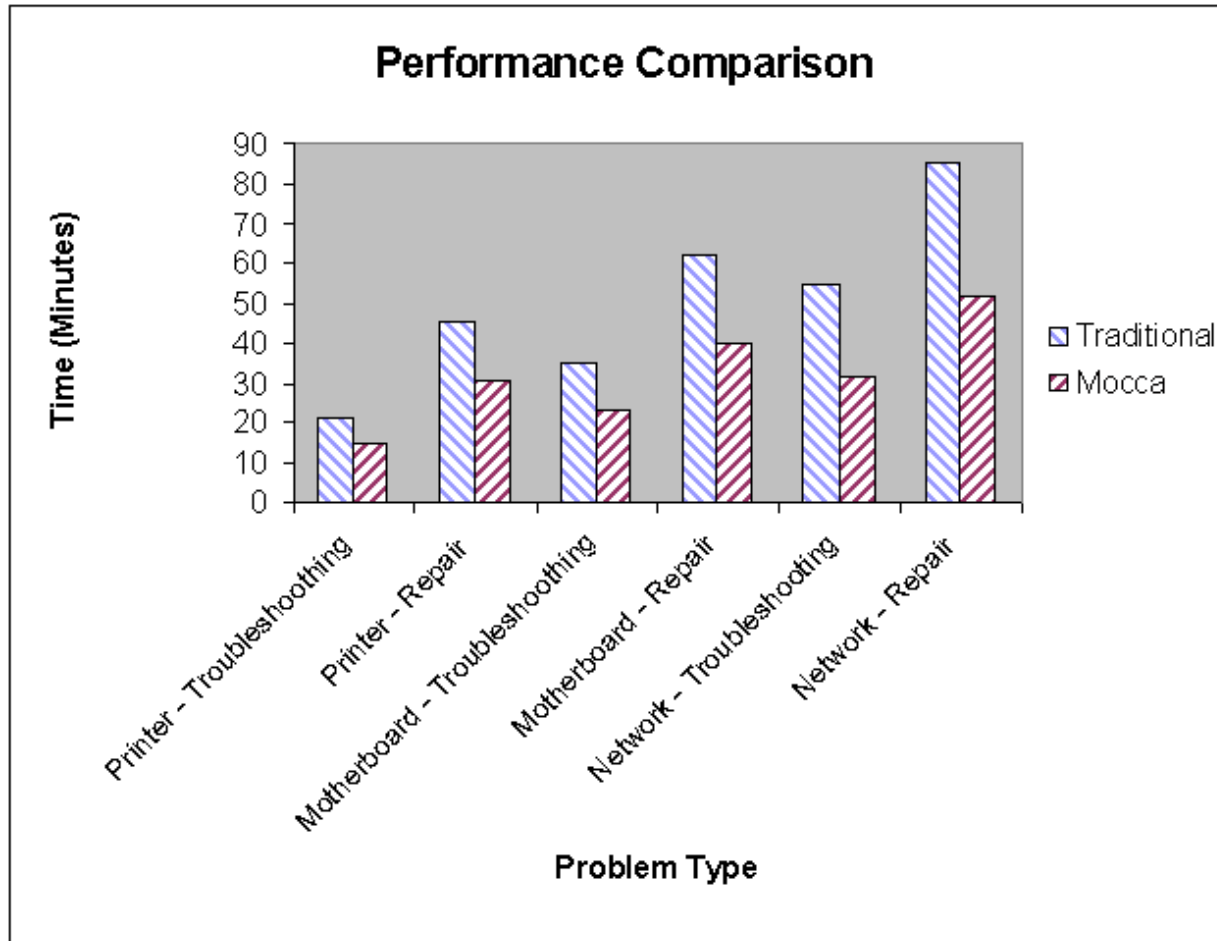
FSE: Myself, All FSEs

Dates: Before: [], After: []

Client: []

Submit Query

Improvement in Problem Solving



Context Aware Collaboration – Proactive Synthetic Assistant

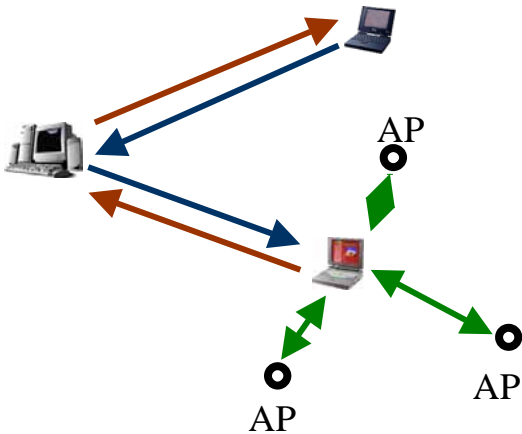
- **Situation where a mobile computer is aware of its user state and surroundings, and modifies its behavior based on this information.**
- **The goal is to enable mobile computers to be proactive, anticipating user needs, exploiting context information to significantly reduce demands on human attention.**

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

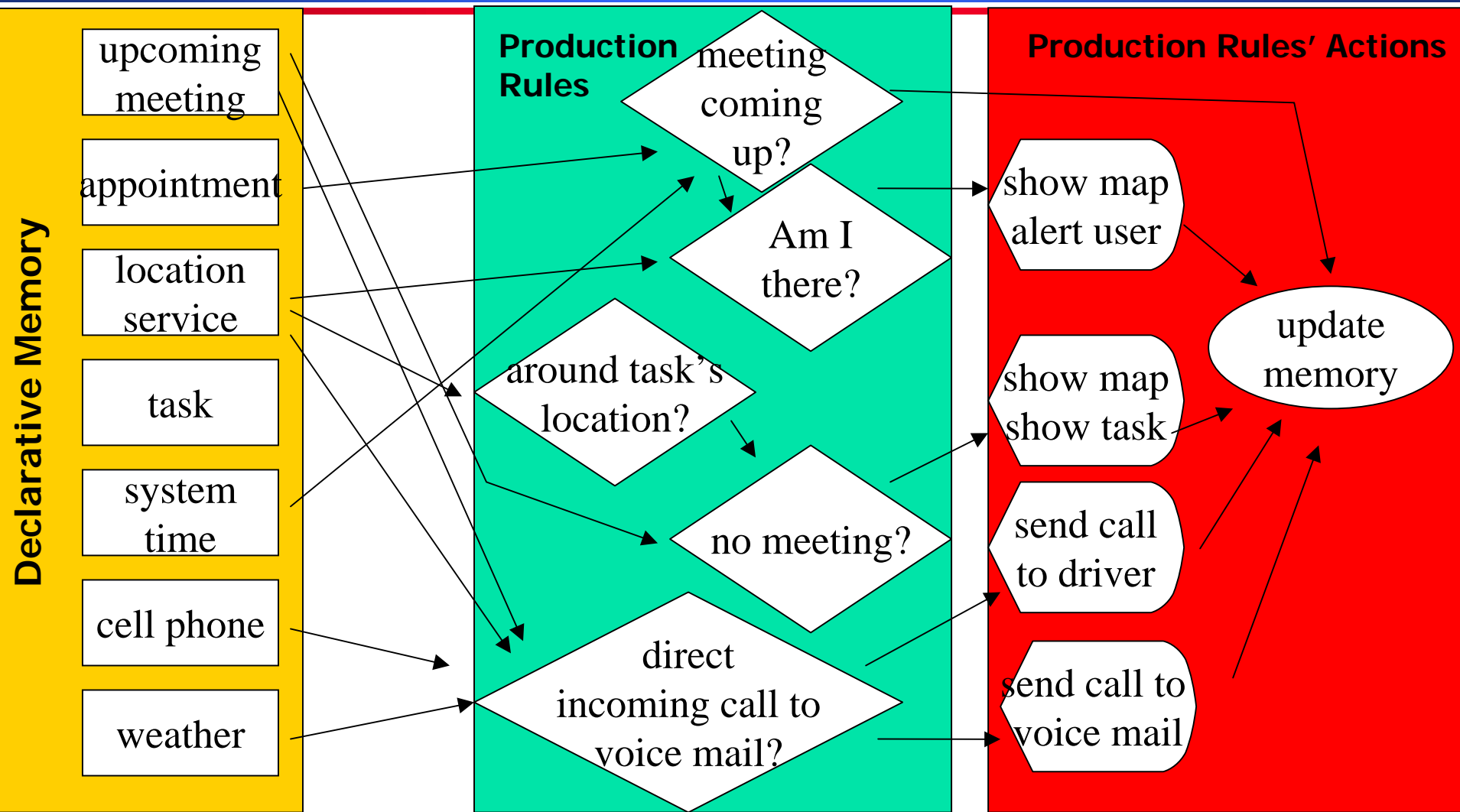


- **Precise** - Can determine location with accuracy of up to five feet.
- Requires gathering information by the target computer from multiple access points (AP).
- Support for privacy control.

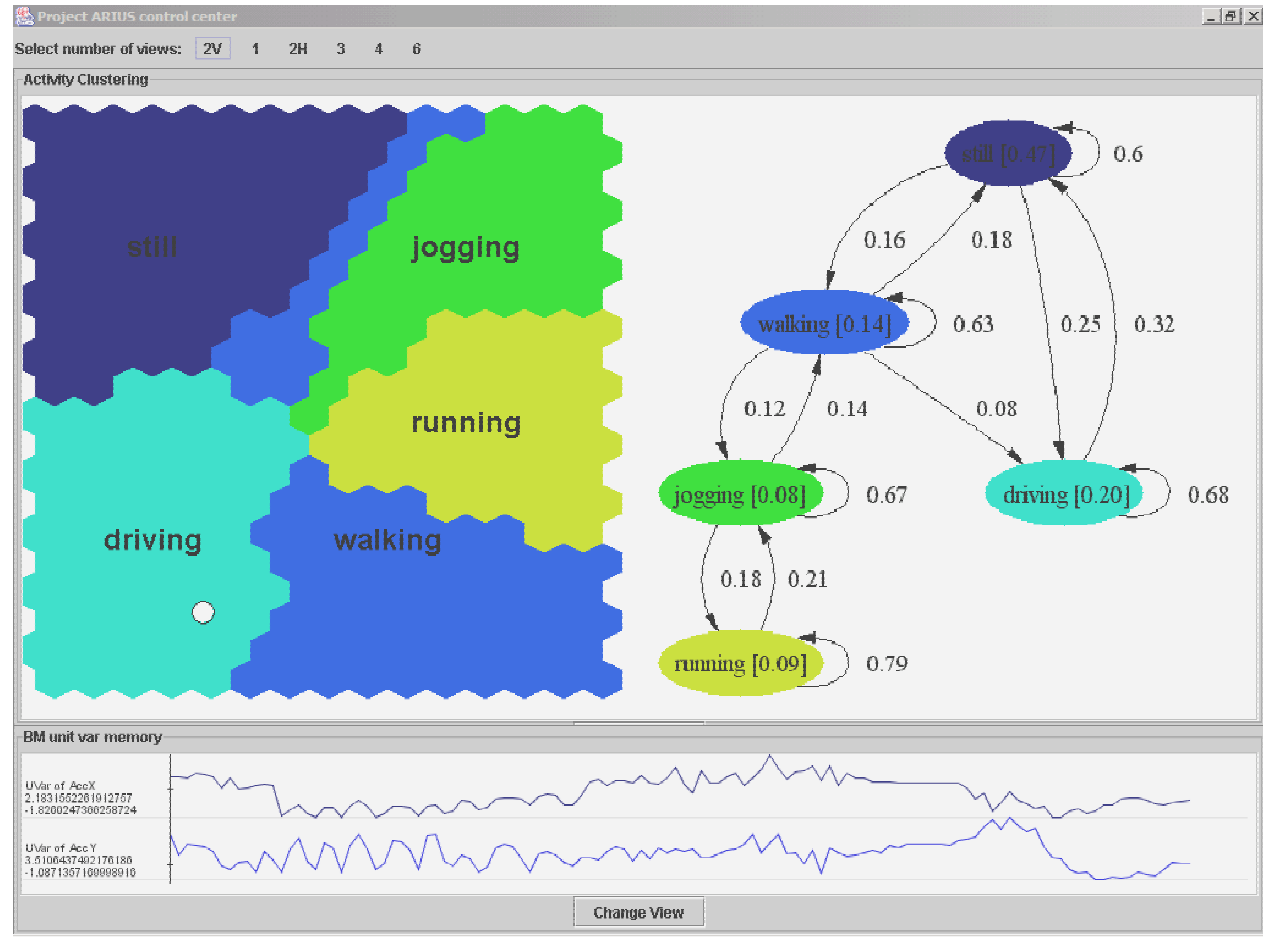
GM/CMU Companion



Activity Inspection



SenSay: Context Aware Cell Phone

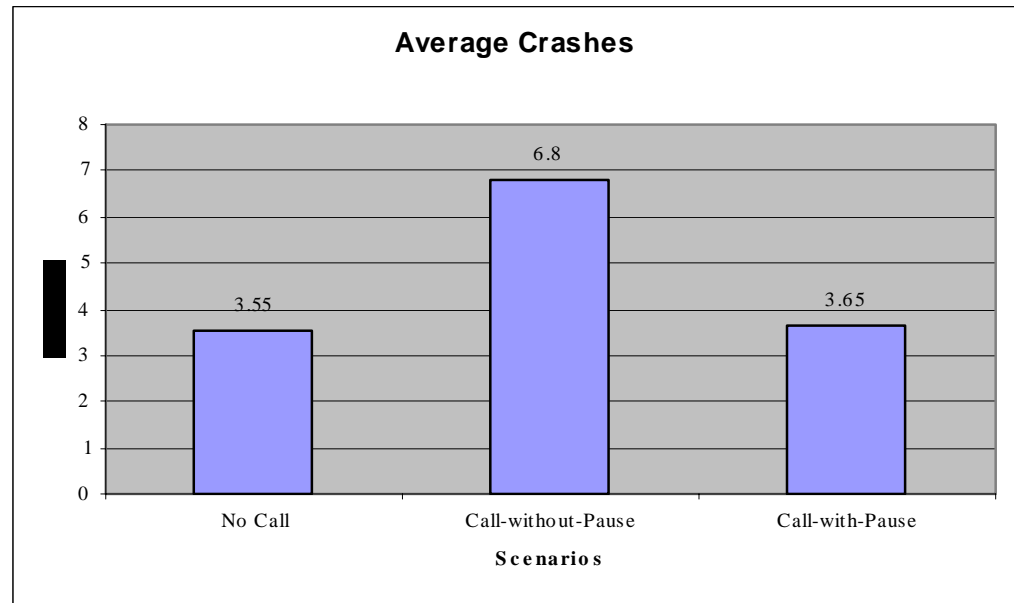


Experiment: Context Aware Collaboration – Proactive Synthetic Assistant

- **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

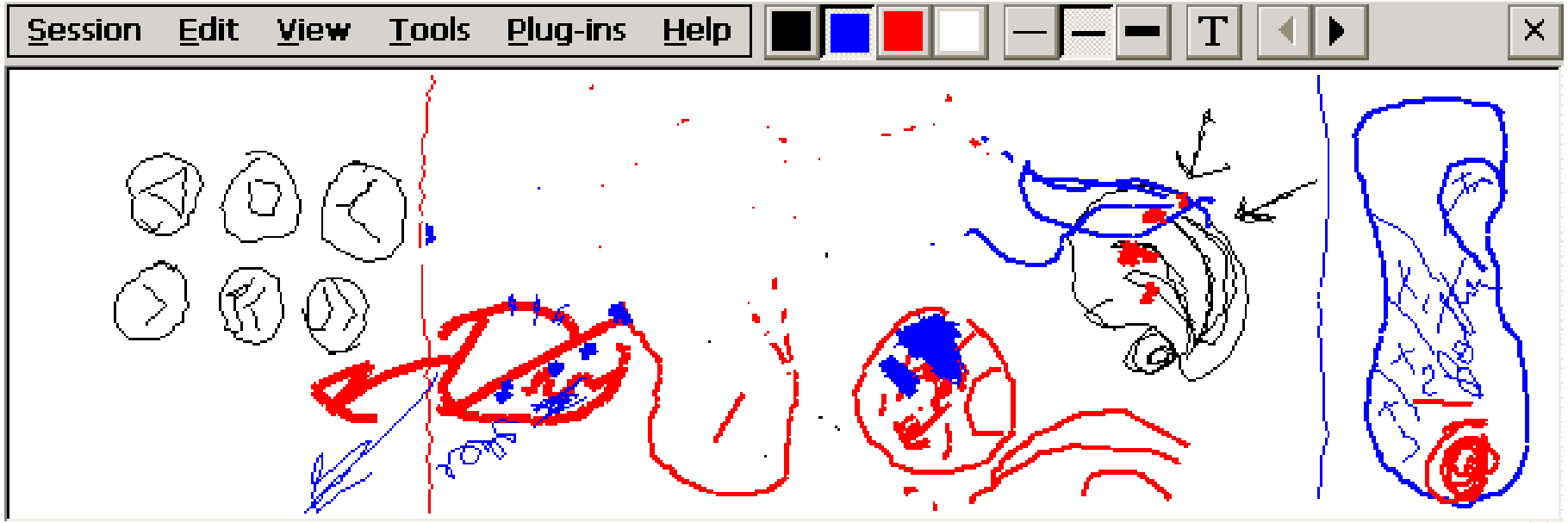
- **Our results show**
 - » **Talking on the cell phone caused people to crash more as compared to driving without a call.**
 - » **Inducing pauses during the call caused the driver to crash less even when using the cell phone.**
 - » **A driver using our phone that interrupts the caller during dangerous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