

CONTRACTOR'S PROGRESS STATUS AND MANAGEMENT REPORT

Intelligent Collaboration and Visualization

for the period 1 July to 30 September 1999

Report #10
CDRL A001

Contract N66001-97-C-8517

30 September 1999

SUBMITTED TO

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Quarterly Status Report

Intelligent Collaboration and Visualization
for the period 1 July to 30 September 1999
Cooperative Agreement N66001-97-C-8517
CDRL A001

1.0 Purpose of Report

This status report is the quarterly contract deliverable (CDRL A001) which summarizes the effort expended by the Carnegie Mellon University team in support of Intelligent Collaboration and Visualization (IC&V) on Contract N66001-97-C-8517.

2.0 Project Members

Wactlar
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Other technical staff

3.0 Project Description (last modified 2/97)

This work will develop tools, techniques, and systems allowing people to capture a complete record of their personal experiences, and to share them in collaborative settings. Users may range from rescue workers carrying personalized information systems in operational situations to remote crisis managers in coordinating roles. Personal Informedia Experience-on-Demand (EoD) units record audio, video, GPS and other sensory data, which can be annotated by human participants. The EoD environment synthesizes data from many EoD units into a “collective experience” – a global perspective of ongoing and archived personal experiences. Distributed collaborators are thereby brought together over time and space to share meaning and perspectives.

Each constituent EoD unit captures and manages information from its unique point of view, making this information available to others in the EoD environment. Each operates as a portable, interoperable, Informedia system, allowing search and retrieval by both its human operator and remote systems. The EoD environment thus enables integration of the multiple points of view to provide more details for local decision-making and superior event coverage in support of real-time collaboration. The EoD capability will significantly improve situation awareness and analysis, both in real-time and retrospectively. The indexed and summarized information also enables “remembering” analogous past experiences and “projecting” into future simulated ones. Techniques will be developed to manage the vast quantities of information and to search, summarize, and visualize video, audio, and text content and annotations from multiple perspectives. The foundation for this work, the Informedia Digital Video Library (DVL) Project, has demonstrated the successful application of speech, image, and natural language processing in automatically creating a

rich, indexed, searchable multimedia information resource. We will build on these technologies, moving beyond a DVL into new information spaces by addressing collaboration and summarization of multiple simultaneous information generators integrated across people, time, and space.

4.0 Performance Against Plan

Spending proceeded as planned during this reporting period.

5.0 Major Accomplishments to Date

- Integrated VOOCR (video optical character recognition) into EoD's underlying Informedia system, allowing EoD to "read", detect and recognize some naturally occurring scene text.
- Improved our image-retrieval method by exploiting color-cluster and image-region characteristics.
- Tested image-retrieval performance using a larger image set (20,000 images) from the Informedia database.
- Modularized our image-retrieval methods to facilitate integrating it into the EoD system.
- Integrated a data-visualization technique, VIBE, into the EoD system.
- Developed a method to synthesize a basic panoramic view from multiple perspectives that might be provided by concurrent EoD users.
- Developed a technique for motion detection in video, by comparing against reference frames, without the high cost of frame-by-frame optical flow computations
- Integrated automatic silence filtering into video processing.

6.0 Artifacts Developed During the Past Quarter

- None.

7.0 Issues

7.1 Open issues with no plan, as yet, for resolution:

- None.

7.2 Open issues with plan for resolution:

- Real-world detection of incidental "scene text" is still not robust. Our VOOCR can detect some scene text (signs on a truck, for instance) if it has certain properties (horizontal, stable, etc.).
- Existing wireless bandwidth makes multiple data streams from a single EOD unit impractical to transmit.

7.3 Issues resolved:

- Completed transition of underlying Informedia system to Oracle for greater speed and reliability.
- Rudimentary filtering of redundant video and composition of basic panoramic views are now possible.

- Simulated integration of digital-compass data into the EOD system to allow tracking of view direction and enable more accurate creation of 3D panoramic views.
- Location names can now be disambiguated automatically in geocoding.

8.0 Near-term Plan

- Field-test multiple EOD data gathering units to simultaneously capture and transmit video data back to a command post, using existing wireless-network infrastructure.
- Investigate communication between multiple deployed EOD units
- Experiment with distribution of the IDVLS across a number of machines to determine what configuration provides greater utility.
- Continue exploring query-space visualization for the user.
- Explore the effects of wider bandwidth and on-board processing to improve system performance and efficiency.

9.0 Completed Travel

None.

10.0 Equipment Purchases and Description

Four express modules for 500 series switches - \$4,349

11.0 Summary of Activity

The Informedia code base was re-engineered to be more manageable, extensible, and distributable in the future by:

1. replacing the Informix database server and original schema (our data description) with an Oracle database server and better optimized schema,
2. breaking up the monolithic IDVLS code (with few service calls) into components (many communicating pieces with multiple outside services).

The result of this effort, completed this quarter, provides little new functionality; but rather, significantly expanded metadata through a revamped schema, improved performance through re-implementation in Oracle, and ongoing extensibility to both the interface and automated processing as a result.

Extracted location names can now be disambiguated through a process of *scoring* additional clues in the transcript. For example, if there are two instances of Salem in the address coverage, one in Ohio and one in Massachusetts, the system scans the transcript for any mention of Ohio or Massachusetts. Each time one of the two states is mentioned, the corresponding Salem is given a point. The system then concludes that the place accumulating the most points is the correct location.

We began investigating how a user query might be enhanced "behind the scenes" by automatically implementing concurrent, related searches across multiple fields. The results

of these distributed queries will then be combined with the original query results. We are experimenting with algorithms for weighting the different query results to improve retrieval accuracy and relevance.

We've developed and integrated a global interactive map display within Infromedia and EOD. Geographic references in the audio stream are extracted through automatic processing. The operational library interface shows the geographic entities addressed in a given story, highlighting the regions discussed at any point in the video through a map display synchronized with the video playback. The map can also be used as a query mechanism, allowing users to search the terabyte library for stories taking place in a selected area of interest. This complements the geographic map display of GPS coordinates that correspond to the video capture camera locations.

We integrated body temperature sensor and heart rate monitor into the EOD data collection unit. This information will be processed along with GPS data, etc., into the EOD record being written.

We also conducted a number of field trials on campus using the existing wireless Andrew network, operating at only 2Mbps, shared campus-wide and accessible mostly inside the buildings. This revealed insufficient bandwidth for multiple data streams.

11.2 Significant Events:

- None this period.