Mobile Multimedia for Improving the Administrative and Security Services

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Abstract –The "i2010 – A European Information Society for growth and employment" initiative was launched by the Commission on 1 June 2005 as a framework for addressing the main challenges and developments in the information society and media sectors up to 2010. It promotes an open and competitive digital economy and emphasizes ICT as a driver of inclusion and quality of life. The initiative contains a range of EU policy instruments to encourage the development of the digital economy such as regulatory instruments, research and partnerships with stakeholders. According to the European interests, this article proposes new concepts and methods the authors used for designing a telecommunication infrastructure that provides the end-users from administrative and security areas with collaborative work functionalities. The presented approach highlights the most important advantages of a heterogeneous telecommunication system designed for improving the administrative and security services by using the media capabilities such as image and video capture from the mobile devices, server-side real-time image processing, media content retrieving and delivery. The concept proposes some of the most popular technologies for implementing the client- and server-side components of a simple but very useful collaborative work environment: Java, Macromedia/Adobe and PHP technologies.

Keywords – mobile multimedia, advanced technologies, video capture, media streaming, media content.

1 Introduction

In the European countries, for example Romania, the administrative and security services have big problems with the hooligans during the public events such as meetings, strikes, sport events, even cultural events or music concerts. The security agents have to manage the situations in area but also to communicate each problem to headquarter and get orders from the persons in charge. The community police agents meet situations with the cars outside the parking place, problems in traffic, non functional traffic lights, car incidents, or calamities. Sometimes, there is no time to wait for a solution from the special departments and an image or a short video capture illustrating the situation helps so much.

Starting with those scenarios, the authors designed a telecommunication infrastructure that allows the agents to communicate the problems in area to headquarter and get an authorized feedback in a fast and secure manner. In other words, the agent in area can take suggestive photos or record short video sequences for advising the person in charge about the situation created. From the users' point of view, the communication management functionalities are really transparent: the agents continue their activities until receiving the order from the person in charge. In fact, two different blocks perform the following tasks: the client block captures the video data and transmit the data packages to the server block that handles the client requests, processes the information, and shares the results between the persons in charge.

The photos and video sequences stored in the media library will be also used for proving the truth in the front of the Court in case that the hooligan does not recognize the facts.

2 Problem Formulation

The multi-channel access is considered the only one solution for implementing the functionalities described in the scenarios from the *Introduction*. The explanation is very simple: the agent in the area uses the mobile device in order to communicate to headquarter and the persons in charge has to share the processing results using the web browser, a desktop application or a mobile device.

This heterogeneous system involves some of the most popular technologies: J2ME for the mobile area, PHP and Flash for the web components, MySQL as the database server. In fact, the authors have been constrained to use those technologies because of the advantages they provide the developers with:

- J2ME MMAPI/AMMS API provides the developer with video capture capabilities and MIDP I/O package offers networking

features that extend the resources available on a network into the mobile space.

- PHP components implement the tool management, the authentication functionalities and invoke the processing block, when necessary. The PHP is also used for implementing the media library component.
- Popular libraries are used for implementing the image processing algorithm.
- Flash and ActionScript offers excellent graphics and the collaborative work functionalities are implemented using the Macromedia technologies.

2.1 MIDP-based client application

The agent has to prove the situation to headquarter by taking photos and recording short video sequences related to the status in the area. When using a mobile device, the agent, in different situations, has the advantages of the mobility and real-time processing. The MIDP-based client application must assure an image/video quality necessary for the processing but it is also responsible for the data communication - the best quality of the video or image means big amount of data transmitted via GPRS. This fact will be avoided and, for the first stage, the image snapshot will be realized at a resolution about 640x480 pixels. This way, the upload is done in 15 seconds and the space allocated into the media library will be about 55 KB.

From the users' point of view, the system is transparent – the agent takes the photo or records the video and presses the button OK, then puts the mobile device in his/her pocket and waits for the feedback. In fact, the client application manages the data transmission until receiving the acknowledgement. An *HTTPConnection* instance will be used for opening a connection to the PHP upload component and sends the data packets.

The feedback from the person in charge is also very important and sometime the agent in area can do nothing without the order from headquarter. The order can be sent to the mobile station via SMS, MMS, email or TCP socket.

2.2 Web-based client application

The web components implement the upload functionalities, the tool management, and the authentication features.

The client request arrives to the server block and the authentication component checks the access to the service. The client request consists of authentication information (access code and phone number). If the authentication routine enables the upload for the mobile device, the photo or the video sequence will be stored into the media library in the section dedicated to the specified mobile device.

The web access is also authorized by the authentication component – the person in charge uses a login name and a password when accessing the system.

Small amount of data like snapshots or short video sequences can be uploaded, via HTTP POST, and stored into the media library. The upload component also stores the uploaded photo/video sequence into the media library and invokes the processing component that matches the photo/important frames with the samples into the database.

The entire chain of events is shared between the persons in charge, using the web components. The person in charge accesses the system using the web browser: the graphical user interface loaded in the web browser consists of the HTML forms, dynamically generated by the PHP components and the Flash-based scenes that communicate to the media server via RTMP/RTMPT.

2.3. Flash-based client application for Pocket PC

If the situation needs more than a simple solution, more important persons will be invited to share the media content in order to get a fast decision. These persons can access the system using the desktop, web-based or Pocket PC client application. If those persons have no Internet access a Pocket PC Phone Edition can be used and the actors will access the system using a Flash-based client application that implements the same functionalities the web-based client provides with.

2.4. Media server

When the upload is completed, the processing component is invoked in order to match the photo/important frames with the samples into the database. The media content will be stored into the media library – each phone number has allocated a part of the media library for the uploaded photos and video sequences. This way, the media content can be easily shared between the persons in charge according to the collaborative work scenarios. The *shared objects* concept is used for implementing the collaborative work capabilities: each person in charge can access a predefined part of the media library where just his collaborators uploaded media content (photos and video sequences). Once the media content is uploaded, the person in charge is

notified about the reported incident. If this person in charge has problems when getting the decision, the chief of department is called in order to initiate a session that allows multiple access on the shared space, video conferencing capabilities, or designing facilities.

3 Problem Solution

The mobile-based client block consists of J2ME components running on Symbian OS or Windows Mobile and implements the graphics, capture and client-server communication features. MMAPI provides the developer with video capture capabilities and MIDP I/O package offers networking features that extend the resources available on a network into the mobile space.

The web components are hosted by the Apache web server running on a Linux machine and implement the tool management, the authentication functionalities, invoke the processing block and manage the media library.

Flash and ActionScript offers excellent graphics and the collaborative work functionalities are implemented using the Macromedia technologies. The Flash-based client application is platform independent and it can be loaded in the web browser on a PC (Windows or Linux) and a MAC station but also in the Internet Explorer on a Pocket PC (that supports Flash Player 7). The media content and the shared objects are handled by the Media Server block Adobe Flash Media Server/Flash Communication Server) or the new OS Flash Red5, an open source media server implemented in Java that allows the same functionalities the FCS/FMS provides with.

3.1 System architecture

The system architecture, proposes the following blocks: the web client, the J2ME client, the web server, the media server and the database server.

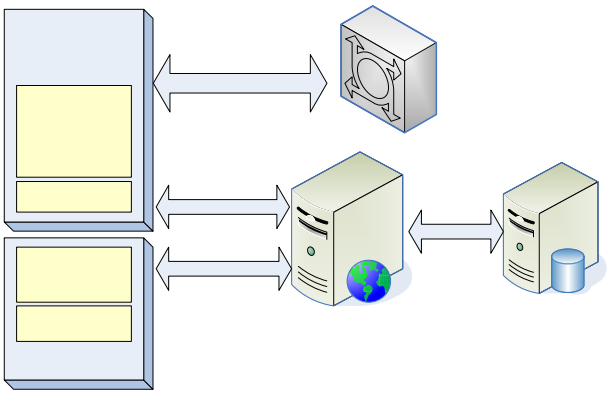

Fig. 1 – System Architecture

The *web client* is loaded in web browser and consists of the HTML forms dynamically generated by the PHP components and the Flash scenes interpreted by the Flash Plug-in.

The *web server* hosts the web components that implement both of information presentation and upload functionalities. The *template concept* is used: each web component consists of a static part defined by the *banner*, *menu*, and *bottom* areas and the dynamic part used for presenting the information to the end-users.

The *media server* handles the media content and stores it into the media library where it can be retrieved and shared within the shared space. The collaborative work environment is implemented using the *shared object* concept and it has to support both of the conferencing and sharing space capabilities that enable the persons in charge to get fast and optimum decisions.

Two protocols are used for data transport – Flash Plug-in communicates to the Media Server via RTPM (RTMPT – RTMP Tunneled) protocol, and the web browser communicates to the web server via HTTP. The J2ME client uses the HTTP protocol for uploading the photos/video sequences on the media server.

3.2 MIDlet client

The MIDP client is a J2ME application that allows the end-user to take photos or record short video sequences and upload them in the media library in order to be processed. It also receives the final decision from the person in charge and displays it on the mobile screen. This decision consists of a short text and an image that presents the evidence.

MMAPI provides the developer with video capture capabilities. Two components are used for implementing the video capture functionalities: *VideoPlayer* and *VideoCanvas*. The first one extends the *javax.microedition.lcdui.Form* class and implements the video player functionalities. The second one implements the video capture capabilities based on the *javax.microedition.media.control.VideoControl* interface.

MIDP I/O package offers networking features that extend the resources available on a network into the mobile space. The data packages will be uploaded via HTTP POST using the Base 64 encoding approach:

```
httpConnection = (HttpConnection)
Connector.open( uri );
httpConnection.setRequestMethod(
HttpConnection.POST );
```

```
httpConnection.setRequestProperty( "Content-type",
"application/x-www-form-urlencoded" );
String encoded =
Base64.encode(rawImage).toString();
String output = "file=" + filename + "&imgdata="
+ encoded;
httpConnection.setRequestProperty("Content-
Length",
Integer.toString((output.getBytes().length)));
out = httpConnection.openOutputStream();
out.write( output.getBytes() );
out.flush();
```

3.3 Collaborative Work Environment

The system offers a very flexible shared collaborative work environment with the following capabilities:

- Up to 10 persons in charge attending the session
- Unlimited number of simultaneous sessions
- Two video windows (320x240) for the session moderator and current speaker (if any). The session moderator moves speakers in and out of the speaker window.
- Raise Hand/Lower Hand button to request recognition by session moderator. The system indicates which attendees have raised hands.
- Shared space is built-in, allowing the collaboration by all attendees. This way, the photos and short video sequences are shared between the attendees.

The collaborative work environment respects the multi-tier architecture of the multimedia distributed systems:

- The *client block* consists of the Flash scenes (moderator.swf, attendee.swf, sharedSpace.swf) that communicate to the media server via RTMP protocol. The *shared objects* concept is used in order to implement the *shared scenes*. A suggestive example is listed bellow:

```
nc = new NetConnection(
"rtmp://confHost/sharedspace/");
vid_so = SharedObject.getRemote("course_so",
nc.uri, true);
vid_so.onSync = function(){
  d = vid_so.data.course;
  if (d!="" and d!="undefined"){
  wb_mc.loadFile_mc._visible = true;

wb_mc.loadFile_mc.loadMovie("myfiles/"+doc_txt.
text);
  }
}
vid_so.connect(nc);
```

If the end-user accesses the service using a client machine connected to the Internet via proxy or protected by firewall, the first code line in the example just above has to specify the RTMPT (tunneled) protocol:

```
nc = new NetConnection(
"rtmpt://confHost/sharedspace/");
```

- The *media server* handles the RTMP/RTMPT requests, processes them and provides the clients with the last updates in the shared objects attributes. This way, the session management can be implemented using the shared objects concept.
- The *web components* implement several management functionalities, from the authorized access or security routines to flow data management, complex statistics, billing capabilities or conference scheduling. The communication between the Flash scenes and the web components involves XML data structures.
- The information is stored into the MySQL tables and the system can be considered as safe because of the periodic backups. The communication between the web components and the database is realized using JDBC/ODBC protocol.

4 Conclusions

Current personal computers, workstations and servers are designed to handle traditional forms of data. Their performance is optimized for a scientific or transaction-oriented type of workload. Those systems do not perform well for multimedia data, requiring fast data retrieval and guaranteed real-time capabilities. The I/O capacity is usually a severe bottleneck.

There are several advantages that transform the environment in a very useful integrated platform. Some of them are remembered just bellow:

- Security agents can communicate to the persons in charge about problems in area and keep them in an electronic format (images and video sequences)
- Productivity loss is minimized when trying to get an important and fast decision about a situation in area – there are no longer meetings – the costs are null.
- Equipment needs are minimal and inexpensive. A web camera and headset/microphone are all that is required for the desktop and web-based client. The mobile devices (phones for the agents and

Pocket PCs for the persons in charge) are not expensive at all.

- There are no expensive communication requirements. Any Internet connection (cable modem or DSL) will allow the access to the services and the GPRS service is already used by the normal users.

The testing session allows us to check the system working properly and how the most important parameters respect the indicated values. We want to describe just a few of those parameters such as:

Minimal response time is a crucial factor for the success of multimedia services and can be defined as the response time the client got when using the system. For example, the system provides with a minimal response time up to 100 ms, the maximum limit for the video conferencing services.

Real-time delivery: The media server guarantees real-time delivery for individual streams as well as for all the streams combined together.

Quality of Service (**QoS**) **requirements**: The Quality of Service (QoS) is a set of parameters describing the tolerable end-to-end delay, throughput, and the level of reliability in multimedia communication and presentation. The media services adapt themselves to different QoS requirements, according to the characteristics of the client's terminal, the network connection and the requested data type. For example, the web-based client connection needs 140 kbps for a reliable communication channel that assures a very good quality of the sound, supports the visual components at 200x160 pixels and the real-time activities within the shared space. If the person in charge uses the Pocket PC phone edition connected to the system via GPRS, the communication channel supports the audio conversation and the real-time activities within the shared space. The video component is optional and can be started when using the WLAN connection.

Cost effectiveness: A very important requirement governing the future of the interactive multimedia services is the cost effectiveness. The technology providers changed the target focusing on the narrow bandwidth Internet connections and basic peripherals (cheap web cams and microphones). This means low cost for both of service providers and end-users.

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