V0.6

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Usage Area: Content

Q1 - Scenario

A Day in the life of a Construction Engineer

John is a 45 year old senior construction engineer. Today he is visiting the country hotel being built for Tomas and Mary. His role is to check on the ongoing construction to ensure that it complies with the building and insurance regulations and also that it is on schedule. He represents both the owners and the insurers. The hotel is being built on a number of levels and currently is only partly built with outer walls completed. The building process is well defined and John makes comprehensive checks at each specific stage completing a check list and adding notes and comments. He uses a tablet based augmented reality Assessor™ software application to assist him. At an earlier stage technicians in John's office have produced a 3D model of the building and aligned the model with the surveyed position of the actual site. John puts on his augmented reality (AR) head mounted display (HMD) which is equipped with other sensors to allow his head motion to be determined. It also contains a camera. John enters the building and views the projected 3D AR model. Today he is particularly concerned with examining progress to the wall level. With the assessor application running he can invoke a context specific drop down menu for the top-of-wall inspection stage. He does this by gesture based input to invoke the drop down menu and by moving his head so that he is looking at the top-of-wall. The system uses the camera in his headset to recognise gesture input and the various sensors to calculate the part of the model he is currently looking at. In this way John moves through the check list. At various points he makes audio or visual annotations by means of a small camera which he carries with him. All of these devices form a multi-modal on body device ensemble to ensure that the data are captured and recorded. During the survey John notices that one of the windows looks somewhat different than the others and he is concerned as to whether it meets the safety requirements. He uses the camera to take a close up image and then transfer the image to the insurance company image archive over the network. There the image is compared to an archive of window images, its classification and associated data are retrieved and the relevant specification details are sent to John. He quickly sees that the window meets the specification. He then moves to a different part of the building. As he moves the application determines that this part of the building model has not yet been downloaded and so it

prompts the server system in the office to stream the relevant parts of the 3D model. It then updates its own version of the model and renders, aligns and displays the model of the room that John has now moved to.

Having completed the examination he then meets with Tomas and Mary to review the progress. Mary has heard about a new triple glazing porch product being made in Scandinavia and would like to know more. John opens a session to his office and request via voice and text a search for manufacturers of related products. The system returns a recommended list of potential suppliers. He then streams a manufacturer's 3D demo video of the product. In order to get the best viewing possible he enters Tomas and Mary's home which automatically triggers a device federation between his tablet and the large plasma TV on the wall. The streaming video is seamlessly handed off from the tablet to TV. The resolution of the video is automatically adjusted to take advantage of the better capabilities of the TV and the video is streamed via a multi-path connection over both a WiMax and 3G network to the TV set top box. After showing the video he returns to the office where he transfers the recorded information to the main application back-end.

After lunch at the office John gets called to a meeting to discuss problems that have occurred on a major project on which his company is working. This is construction of a new engineering block for a university some distance away. Problems have occurred with leaking of water through the roof fabric in atrium of the new building. A telepresence conference has been set up involving the architects, electrical contractors, site surveyors, engineers from the building's owners and insurance company. A 3D building information model is projected so that all can clearly see the impacted parts. Michael, a colleague of John's streams a live feed from the actual building so that all can see the problem. The 3D model and the 3D video are integrated and presented in the same display. People can view the merged 3D model from different perspectives. After some discussion a solution is proposed and the architects make some manipulations to the 3D model to show how the solution can work. Michael is able to select particular views from the 3D stream as he cannot receive the full stream, having only limited connectivity at the site. After some further discussion all agree on the solution and the session is ended- with the session record being logged and distributed to all parties.

John is scheduled to give a construction class in the nearby technical college. As he walks into to the class room, his mobile phone detects new wireless networks in the campus. The phone automatically connects to the network according to the preset policies. The college network detects that the lecturer is in the classroom and then the podium computer is turned on with today's lesson displayed. In this lesson, John is going to teach students how to assess constructions. In the class room, every student has a computer with the construction Assessor^{TM} software installed. John has pre-recorded 3D videos and sensory trace of his movement while working. He uses his mobile phone to connect back to a 3D video database in his company. He searches and picks an onsite 3D video taken while he was working in a building and correspondent sensory trace data. He also selects a 3D model related to the 3D video. John uses his mobile phone to setup sessions to connect the 3D video, sensory trace data and the 3D model with all the Assessor application running in student's experimental computers. The application normally receives video feed from camera, the sensory data from local sensor and the augmented 3D model from local disk. Now it is receiving video from the remote video server, the sensory data and the 3D model data from remote databases. As John's mobile phone detects that there is an audio-visual system in the classroom. He uses the mobile phone to duplicate the audio-visual output of the Assessor application in a student's computer to

the audio-visual system in the classroom. Now John can explain the assessment procedure through the recorded 3D video and the augmented 3D model layer on the large screen of the classroom. While watching the integrated 3D video and 3D model, students can pause the video and observe the problems in the construction from different view angles by manipulating the 3D model.

One student is sick and could not come for the class. He participates in the lecture remotely. He sets up a telepresence conference through his large 3D TV at home. His identification is authenticated by the college identity management system. After John runs the "Assessor" software, the student asks John to duplicate the output of the "Assessor" software to him because no "assessor" software is installed in his computers at home. John takes out his mobile phone and logs in to the classroom management system in which he can see all attendees including remote students. The classroom management system can also show the relationship diagram of all multimedia devices in the classroom. John selects the output of the "Assessor" software on a computer, and drags and drop it to the remote student. The student sees an incoming session from the classroom on his laptop. He first transfers the current telepresence conference from the 3D TV to his laptop, and then he directs the incoming session to the 3D TV.

Whilst walking to the car, John's mobile changes from the college WiFi to the cellular network. He uses his AR glasses to catch up on e-mails he has been expecting. Once he arrives at his car, using his AR Glasses, he requests, browses and selects a recipe for his dinner this evening. Based on information taken from camera sensors in his fridge, he is notified that he does not have all of the required ingredients. He gets a notification that a shop on his route has a special deal on the groceries he needs. He browses through his options in the shop using his AR glasses. He places an order and the amount is deducted from his credit card. One message tell him that the sequel to his favourite film is premiering at a film theatre on his route with a number of celebrities present. Having picked up his food order he drives to the theatre where meets his favourite actor and streams his introduction to a number of his friends who watch in envy. When John arrives home, the HD TV automatically starts streaming the live football game of his local team. As he moves to kitchen, audio is transferred to the speakers while he starts preparing his meal. He watches the rest of the game and goes to bed.

Q2 – Innovative Functionality and Technology

The following is a list of representative technologies that are required for the scenario described.

- Augmented Reality
    - Capable mobile devices
    - Easy to use light Head Mounted Devices (HMD)
- 3D Video streaming
- Heterogeneous Wireless and Application Handover
- Context Awareness – in the 3D graphic streaming and in the multi-modal device interaction.
- Device Federation
- Multi-path networking
- Multimedia Search
- Scalable Video processing
- Context based content adaptation

- (Ad-Hoc) Service Composition
- Real-time data transmission
- Multi view streaming
- 3D graphic streaming
- Advanced multimedia system (multimedia session management, device capabilities negotiation, media adaptation)
- High speed networks
- Immersive multimedia experiences

Q3 – Internet Core Platform Technologies to support Use Case

The following list is taken from section 6 of the EFII White Paper

Usage Area – Content

- Context Awareness
- 3D Multimedia
- Multimedia Searching
- Heterogeneous Networking and Mobility
- Multi-Modal Devices
- Self-Healing Networks
- High Capacity Networks
- Network Management and Optimisation

The following are the enablers identified

- Entities naming
- Service Repository
- Service Composition
- Context Management
- Recommendation System
- Identity and Access Management
- Dynamic adaptability of content
- Device Description Repository
- Generic Rating /Charging
- Large scale media delivery
- Real time logging
- Usage accounting
- One to many communication support
- Nomadic and mobility support
- Permanent and non permanent connectivity support
- Dynamic Multi-Homing Support
- Dynamic TCP stack composition

Q4 – Experimentation Environment

The experimental environment in the general area of content usage will need to contain at least the following capabilities

- Be comprised of a large number of network and devices with varying capabilities. This will range from multimedia sensor networks through heterogeneous access networks to high speed back-bone networks – reflecting the diversity of forms and formats in which media is produced and consumed. The network of networks will also need a broad geographic spread e.g. at a national level, in order to emulate real network environments. This scaling factor implies the potential need for test-bed federation.
- Content caching, storage and adaptation facilities and the capability to flexibly add new capacity of this type in order to anticipate new algorithms, architectures and approaches to media distribution
- Comprehensive multimedia search capability to allow users to seamlessly access content across the network.
- Service composition framework to allow the discovery and creation/mash-up of composite services, at both design time and run time. This requirement inherently includes the usual non-functional attributes of scalability etc.
- Facilities for controlled experimentation to asses users feedback and usability ratings as e.g. to determine QoE for new multimedia services in a variety of delivery scenarios.
- Context awareness support
- Multimodal device federation and interaction
- Content delivery networks with a capability to stream scalable video and 3D video.

Q5 – Organisation Role in FI-PPP Usage Area

SRI at AIT works primarily with mobile multimedia communications. Through industrial collaboration with SME's we have gained experience of the use these technologies in a number of fields including the construction industry, the logistics sector and the eHealth area. We can contribute through the knowledge gained in these collaborations and also through ongoing collaboration with our industrial partners during the course of the project.