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J.P. Shim
Mississippi State University, jshim@cobilan.msstate.edu

Upkar Varshney
Computer Information Systems
Georgia State University, uvarshney@gsu.edu

Sasha Dekleva
DePaul University, sdekleva@condor.depaul.edu

Robert C. Nickerson
San Francisco State University, rnick@sfsu.edu

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WIRELESS TELECOMMUNICATIONS ISSUES: CELL PHONE TV, WIRELESS NETWORKS IN DISASTER MANAGEMENT, UBIQUITOUS COMPUTING, AND ADOPTION OF FUTURE WIRELESS APPLICATIONS

J. P. Shim
Department of Management and Information Systems
Mississippi State University
jshim@cobilan.msstate.edu

Upkar Varshney
Department of Computer Information Systems
Georgia State University

Sasha Dekleva
School of Accountancy and MIS
DePaul University

Robert C. Nickerson
Department of Information Systems
San Francisco State University

ABSTRACT

This paper is a summary of a 2007 Association for Information Systems Americas Conference on Information Systems (AMCIS) panel discussion regarding current mobile wireless issues and technologies. The invited panelists are four faculty members specializing in information systems from the United States. The covered topics included cell phone TV and misconceptions surrounding it, wireless networks in disaster management, ubiquitous computing including “anatomy of a mote” and sensors, and the adoption of future wireless applications.

First, we present wireless cell phone TV as a functioning multipurpose computer, or a “Swiss army knife,” of media devices. The misconceptions are stated, influenced by preconceived notions by the media critics as well as users. Next we discuss a range of wireless technologies including wearable computing, ad hoc and mesh wireless networks as a means of providing communications for first respondents during a natural or man-made disaster. Then we examine the anatomy of motes and RFIDs, including sensors, in an era of ubiquitous computing and a world of (inter-)connected objects. Finally, we discuss the socio-cultural constructs impacting users’ intentions to adopt future wireless applications.

Keywords: cell phone TV, wireless networks, disaster management, first responders, motes, sensor networks, intended use of wireless technology

Wireless Telecommunications Issues: Cell Phone TV, Wireless Network In Disaster Management, Ubiquitous Computing, and Adoption of Future Wireless Applications by J.P. Shim, U. Varshney, S. Dekleva, and R.C. Nickerson

I. INTRODUCTION

Since 2003, the Americas Conference on Information Systems (AMCIS) has included panel sessions that brought together leading researchers with expertise in wireless and mobile telecommunications. The 2007 annual wireless panel was the fifth in the series. Previous panels have been well received by academicians and researchers in the field of wireless and mobile telecommunications. Themes in 2007 included four distinct topics: standards and misconceptions about cell phone TV; wireless networks in disaster management; ubiquitous computing; and the Wireless People Research Project on the use of wireless technology and applications in the future. In fact, looking into the future of wireless mobile technologies is what all four topics have in common. This paper consists of six sections: Following this Introduction, Section II discusses the current status of cell phone TV standards and misconceptions about cell phone TVs. Section III discusses wireless networks in disaster management. Section IV discusses motes, sensors, and applications in ubiquitous computing. Section V discusses people's intentions to use wireless technology and applications in future scenarios. The paper ends with a short conclusions section.

II. CELL PHONE TV AS "SWISS ARMY KNIFE"

The cell phone has evolved from its original voice communication form into a functioning multipurpose computer, a "Swiss army knife" of media devices, with numerous technological capabilities. The availability and diversification of cell phone functionalities, from Internet access, MP3 player, text messaging, camera, video, game consoles, email, and TV, are fueling user demand. With a plethora of applications and usage constantly changing, users likely do not fully understand all data services and applications (e.g., RFID-embedded), despite increasing expectations of communication and entertainment functionalities. While 3G and 3.5G mobile networks already offer broadband transmission in most developed areas of the world, telecommunication vendors and service providers are collaborating to develop a true broadband cellular system. In the rest of this section, the authors present the current status of cell phone TV standards and explore related misconceptions.

CURRENT STATUS OF CELL PHONE TV STANDARDS

Three cell phone TV standards currently dominate the markets: digital video broadcasting – handheld (DVB-H), digital multimedia broadcasting (DMB), and MediaFLO (Forward Link Only). In addition, Japan launched its own service based on the ISDB-T standard in 2006 to broadcast digital terrestrial television to mobile handsets. DVB-H technology is either going through trial stages or is already being marketed in Australia, the United States, Europe, and Asia. MediaFLO is in experimental stages across Europe and North America as several carriers plan to deliver cell phone TV services in 2007. In other countries, such as UK, India, and Germany, cell phone TV carriers are considering the adoption of terrestrial DMB (T-DMB).

The current standardization war, similar to that of HD-DVD versus Blu-ray is expected to continue. Given some EU countries' favoritism towards DVB-H, the European Union issued a recommendation to the European countries to adopt a single technology standard [Ward, 2007]. While it has been suggested that the standardization issue could be eased with the development of multimode handsets [Sandham, 2006], the industry is expected to face fierce competition over the next few years in addition to fragmentation in the standards, and technical difficulties, such as the shortage of radio frequency spectrum.

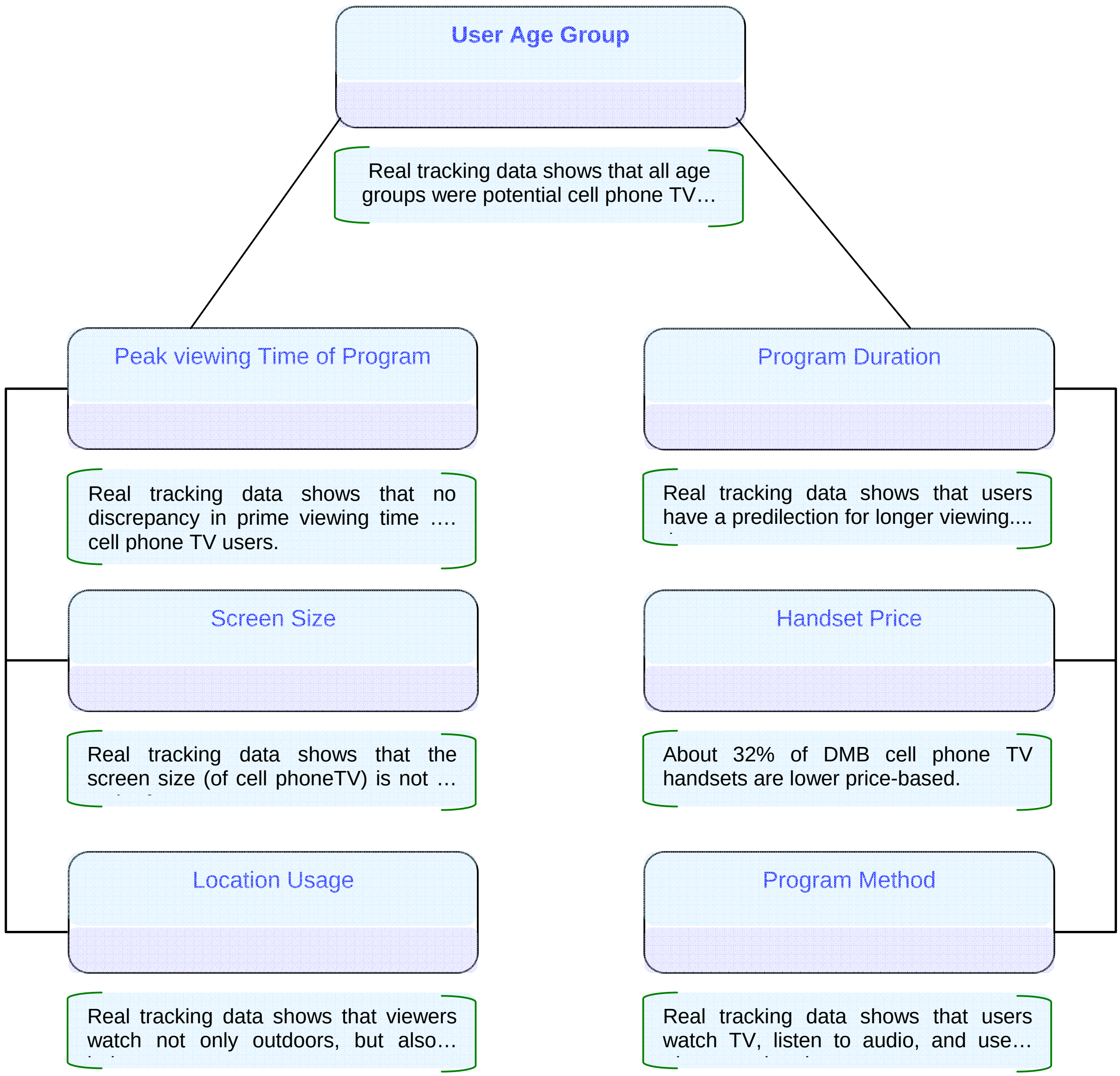

Figure 1. Misconceptions on Cell Phone TV

Prevailing and yet unchallenged misconceptions still exist in the market, influenced by preconceptions by the media critics as well as the users. One of them is an assumption that people would not watch TV on cell phones [Shim et al., 2007]. Earlier research studies on the cell phone TV market tend to agree on factors affecting cell phone content [Shim et al., 2006]; evidence pointed to the younger generation as a specifically targeted user group. Figure 1 lists seven misconceptions about the cell phone TV [Shim et al., 2007].

MISCONCEPTIONS ABOUT CELL PHONE TV

User Age Group Misconception

The younger generation was assumed to be the core target group as the fastest growing adopter of cell phone TV. However, by tracking the data on users' real viewing time [Shim et al., 2007], the numbers demonstrate that all age groups were potential cell phone TV users.

The Peak Viewing Time of Programs Misconception

When compared to a regular TV's prime viewing time, the tracking data on users' real viewing time [Shim et al., 2007] show no discrepancy in prime or peak viewing times for cell phone TV viewers. It was assumed that the cell phone TV programs would be often consumed during "dead" times, filling the idle time with news and entertainment. On the contrary, none of the data points to a specific peak time during a 24-hour period.

Screen Size Misconception

The miniature size of cell phone screens was assumed to create an unsatisfactory user experience, due to the users' preference for the traditional big screen media experience of the home cinema. On the contrary, the tracking data on users' real viewing time [Shim et al., 2007] shows constant usage of the cell phone TV throughout the day. This helps to explain that the screen size is not a primary obstacle for the adoption of cell phone TV.

Location Usage Misconception

Outdoor areas were originally assumed to be the sole viewing locations for cell phone TV users. Therefore, as an attempt to attract more cell phone TV viewers in the United States, providers rescheduled some TV programs to show them during the heaviest cell phone TV viewing times [Carew, 2007]. However, the real tracking data on users' real viewing time [Shim et al. 2007], show that viewers watch not only outdoors (35%), but even more so indoors (65%).

Program Duration Misconception

Several carriers in the United States have begun to offer short program content (e.g., Verizon Wireless's v-clip and "mobisodes"). It was originally thought that users would prefer to view short program clips. However, the data on users' real viewing time [Shim et al., 2007] show that users have a predilection for longer viewing times (e.g., sports and soap operas).

Handset Price Misconception

The prices of cell phone TV handsets vary from low- to higher-priced handsets. According to the recent survey done by Shim, Park, and Shim [Shim et al., 2007] on cell phone TV handset pricing, about 32% of satellite DMB cell phone TV handsets are, surprisingly, low priced.

Program Method Misconception

An assumption was made that users would use the cell phone TV mainly to watch TV programs. However, the phone users also listen to audio (radio) and use data-related applications (e.g., SMS, e-mail), in addition to watching TV.

III. WIRELESS NETWORKS IN DISASTER MANAGEMENT

Increasing dependence on network infrastructure amplifies a critical need for continued access to networks during disasters and subsequent recovery. We define disasters to broadly include both natural and man-made events. Recent disasters have exposed both the technical as well as human weaknesses in managing the network infrastructure [Kwasinski et al., 2006]. In this section, we discuss how a range of wireless technologies, including sensors, wearable computing, ad hoc and mesh wireless networks, can be employed to enable communications in disaster recovery.

INFRASTRUCTURE FAILURE

When a disaster strikes, networking and electrical infrastructure could partially or completely fail or could become unusable (due to walls, debris, water, or mud). The electrical failures could occur due to power cable cuts and falling of electrical towers, and also due to natural power shut-off in specific cases. The electrical failures could increase the level of failures in networking infrastructure as the majority of networking components are electrically powered and any back-up systems, even if available, may not last beyond a few hours. Even with the best intentions, most utilities and communications companies may not be able to bring back the infrastructure to a “usable” level for days, weeks or even months. This would seriously affect how a recovery after a disaster is managed.

In disaster recovery, we are likely to be without the electrical power-grid, Public Switched Telephone Networks (PSTN), and infrastructure-oriented wireless networks, which include wireless networks with fixed switches and base stations such as cellular and 3G wireless. However, satellite communications may sometimes be possible in some locations.

CHARACTERISTICS OF EMERGENCY MESSAGES

The need for emergency communications at the disaster site and nearby locations is likely to increase dramatically. Both the number of messages and their level of criticality significantly increase, however, the duration of these messages is quite short, limited to a few words or sentences. A large number of people would be trying to reach their loved ones, friends, or anyone they know (estimates range from five to 100 calls per person per day in a disaster). Most of these messages are short (“I am fine,” “I am on the second floor,” “Please help me, I am at this address,” “I need ambulance”). If parts or all of wireline telephone system (PSTN) are still up, chances are that these will become one-way, where people in and around a disaster area will be allowed to call out but no one (except police and rescuers) will be able to call in. This is a “regular” and “pre-programmed” algorithm in PSTN for managing the extreme level of network congestion immediately after the occurrence of a disaster, natural or man-made. So, there is a need to provide some access to networks to support short messages with very high reliability of message delivery. The delays should be low and should be of the order of seconds.

Challenges

As a part of disaster recovery, we are confronted with several challenges including; (a) how to locate people and animals, (b) how to enable communications for people in difficult situations, (c) how to provide medical help to people, (d) how to co-ordinate the needed help with people’s locations, and (e) how to stop people from reacting inappropriately. These challenges require technical, organizational, social, medical, and individual support. We focus here on the technological support for emergency communications. This includes locating and tracking people, supporting communications to and from people, and providing healthcare services including telemedicine and tele-counseling services. The requirements are:

- ability to setup communications quickly
- interoperability of diverse devices for communications
- ability to maintain communications for some time even when continuous communications is not possible
- location tracking of people

Proposed Solutions

To support communications, we propose that wireless communications capabilities can be built, although in a more ad hoc and temporary fashion, using the battery and communications power of vehicles, toys and 2-way radios, sensors, wearable computers, and smart homes. Some of these, such as vehicles, radios and toys, exist with batteries and must be fitted with network communications functionality (network cards) and necessary intelligence in software for communications to similar entities, people, and emergency personnel.

In this futuristic scenario, a variety of sensors that are installed standalone for measuring or detecting one or more conditions (such as temperature, moisture, and vital signs of people) or integrated in appliances, devices, homes, and offices, can be programmed to form one or more wireless networks and communicate necessary information.

Vehicles could form partial mesh networks (at minimum an ability to reach to another vehicle). Many of today's vehicles have considerable computing functionality and electrical battery power. The vehicles could be programmed to sense different types of disaster conditions and create ad hoc or mesh wireless networks with nearby ambulances, vehicles, and emergency personnel. Sensors inside a vehicle could also communicate information related to the condition of any person inside the vehicle. In a more distant future, vehicles could become more autonomous and self-aware of their surroundings, thus assisting even more in disaster recovery.

Wearable computers (such as a smart shirt) could be programmed for emergency communications. These are normally designed for military communications (such as detecting if a soldier has been shot at some place and then use this information along with his/her location to notify others). These have been also used in the monitoring of patients (measuring vital signs and creating alerts to healthcare professionals if necessary). It is possible that the functionalities could be expanded to include support for disaster recovery. Wearable computers have sensors, battery power, and intelligence to create ad hoc or wireless mesh networks along with location information. The use of a smart shirt would require that people be wearing it and not keeping it locked in an unreachable place. Currently, there are many challenges with availability, usability, battery chargeability and networkability of wearable computers.

Smart appliances and smart homes could sense and derive the current context (emergency) and send emergency signals to similar entities and/or personnel. As smart appliances are not mobile, they are suited as nodes in point-to-point, point-to-multipoint or wireless mesh networks. The amount of battery power would in this case limit the communications range.

Implementation and Implications

The addition of wireless networking features in existing and/or emerging devices could be implemented as proactive vs. reactive deployment (city distributing two-way radios or smart shirts in advance before a disaster occurs). We observe several usability considerations such as how to enable these features, how to use them, and problems with power and range of the devices supporting these features.

In addition to some future possibilities, it may be possible to integrate "disaster communications features" with existing wireless devices (pagers, cell phones, computers, PDAs). Some users could use these features for regular wireless communications in normal (non-disaster) conditions, which could have serious impact on regular wireless phone service and business models of wireless carriers. Due to these reasons, it may be harder to convince wireless carriers to introduce, implement and support "disaster communications" capability unless some opportunity for additional revenues from customers, government, and the private sector can be created.

IV. UBIQUITOUS COMPUTING

Although widely discussed in engineering circles, the dawn of an era of ubiquitous computing has not been widely noticed by the community reading this journal. The intent of this brief section is to provide an orientation to the world of (inter-)connected objects and spread the awareness of this aspect of wireless evolution. In the world of wireless communications, people have been mostly focused on cellular telephony. About 2.8 billion phones are now in use [Mellor, 2007], and cell phone production is forecast to exceed 1 billion units in 2007 [Gartner, 2006]. About 10 times as many microprocessors will be sold in 2007, but most of them will not be equipped with radios. However, as the cost of wireless communication units keeps dropping, this is changing, and researchers predict that in 15 years a trillion or even trillions of objects will be interconnected, most of them wirelessly [Forrester, 2002]. A person will be associated with hundreds of smart devices. The sheer number of such devices will prevent an individual to control them all. Networks of smart objects will have to be empowered as autonomous decision makers in order to support and provide for people. Swiss researchers [Gutbrodt, 2006] colorfully commented: “Humans will no longer have to lift a finger, enjoying more time in their deck chairs, the sun shining and the drinks cooled, at least for some.”

Engineers are adding a new dimension to the wirelessly connected world. They are extending networks connecting people anywhere at any time to also connect anything. In other words, people are being connected to things, and things themselves are being interconnected. Industrial products and other objects will become smart or at least assume identities that can be queried remotely. This vision has numerous different names including proactive computing, augmented reality, smart dust, Internet zero, Internet of things, mediated spaces, pervasive computing, ubiquitous computing, ubiquitous society, perceptive networks, smart environments, collective intelligence, real-world Web, invisible mobile, and many others.

ANATOMY OF A MOTE

A mote, short for remote, is a wireless transceiver that is typically combined with some type of a sensor to form a remote sensor. A transceiver, short for transmitter-receiver, is a two-way radio that combines both a radio transmitter and a receiver. The following is a more complete list of a mote components, but not all of them need to be included in a particular design:

- Microprocessor
- Memory
- Radio transceiver
- Operating system and other software
- Power source
- Sensor(s) and actuator(s)
- Analog-to-digital converter
- GPS receiver

The most minimalist version, and technically not really a mote, is an RFID (radio frequency identification) tag, which contains only the first four components from the list. An active RFID device, such as that attached to windshields in cars for toll payments, also contains a battery. Since most sensors are analog devices, while other components are digital, a mote may include an analog-to-digital converter. A GPS receiver is only included when applications require the information about the location of the interconnected motes. The processing power, memory capacity, radio range, bit rate, and energy consumption vary widely, depending on the design, but all of them are typically very limited. For example, a passive RFID tag may only store 96 bits of data, while a more powerful mote may have memory capacity of 1MB. All of these limited capabilities require new hardware designs, software applications, and network architectures. To preserve energy, motes are dormant most of the time. They only awake periodically to submit a measurement, respond to a query, or forward a data packet hopping through the network.

Another characteristic of such set-ups is that motes dynamically form ad hoc mesh networks, which allows the addition or removal of nodes and automatically reconfigures around broken or blocked paths and is self-healing. The nodes in a mesh network can connect to each other via multiple hops and form a very reliable network.

Batteries are often physically the largest component of a mote and represent a difficult miniaturization design challenge. Scientists integrated all other components into a sub-cubic millimeter device, but the volume of power sources remains a problem. Attempts to use alternatives such as light, sunlight, heat, and natural vibrations, which are in some cases available, are promising and could provide permanent solutions.

SENSORS

Sensors are of many types, and several can be integrated or attached to one mote. A list of most popular sensors includes those detecting:

- Pressure
- Position
- Vibration and acceleration
- Force
- Temperature
- Humidity
- Photo optics (e.g., pulse oximetry)
- Piezoelectric film (producing voltage proportional to compressive or tensile mechanical stress or strain)

At the time of this writing, a week after the bridge collapse in Minneapolis, a case for the use of wireless sensors to detect cracks was discussed in the media [McConnon, 2007]. Commentators referred to a 2001 study by the Federal Highway Administration, which reported that visual inspection, currently the predominant examination method, correctly identified fatigue cracks only 3.9% of the time. Coaster-sized motes offer a better way to perform structural inspections. They can monitor vibration, temperature, and corrosion, and relay data to the appropriate transportation department. In fact, researchers from UC Berkeley deployed a system with 64 motes on the Golden Gate Bridge to determine the response of the structure to both ambient and extreme conditions and to compare actual behavior to design predictions [Kim et al., 2007]. The network measured ambient structural accelerations from wind load at closely spaced locations, as well as string shaking from a possible earthquake. Other promising structural health monitoring solutions are in developing or testing stages. With sensors continually checking for the first signs of wear and tear, engineers can detect cracks sooner, do the right maintenance at the right time, and possibly prevent massive failures [Photonics, 2007].

APPLICATIONS

Variations of motes and RFIDs have been experimentally or fully implemented in many different domains including the following:

- Structural damage monitoring (as mentioned above)
- Meter reading
- Preemptive maintenance of machines and equipment
- Tracking and controlling micro climates, such as vineyards
- Sensing battlefield conditions
- Tracking location or activity
- Supply chain management
- Habitat monitoring, such as nesting habits of endangered birds
- Wearable computing
- Security
- Traffic flow control
- Telematics and automotive monitoring and control
- Occupancy monitoring, such as availability of conference rooms
- Detecting counterfeits, as in pharmaceuticals
- Vending and point-of-sale payment
- Building control, such as HVAC (heating, ventilation & air conditioning) and lighting

In order to stay concise, we cannot dwell on each of these and other application areas, but let us just look at one example of how ubiquitous computing may improve both transportation and homeland security. Imagine a large cargo ship loaded with containers, each equipped with a mote and loaded with pallets carrying goods packaged in boxes. Each box has an RFID tag, and each pallet a mote with an RFID reader. The motes attached to cargo containers form a mesh network and can also communicate with motes attached to the pallets. An inspector approaching the ship can see on a laptop what cargo has been loaded on a ship and where, as well as when each container has been last opened and its content changed, perhaps suspiciously. If the motes on container walls have appropriate sensors, a shipping agent can also query which containers were exposed to extreme temperatures, bumping, and humidity, for example.

V. ADOPTION OF FUTURE WIRELESS APPLICATIONS

Wireless technology has developed rapidly in the past decade and new mobile applications are continually being proposed. The previous sections of this paper report some of the most recent advances in the wireless arena. This trend will surely continue into the future, but will people use the new technology and applications? Ultimately the most important question to address may be: What do people really want to do anytime and anywhere? [Tarasewich et al., 2002]

This question is difficult to answer. We cannot just walk up to someone on the street and say, “Would you like to do *X* with your mobile phone?” People may have a hard time understanding what *X* is, or they may just say that it sounds like a good or bad idea without really thinking about it. We present a different approach in this section, one that we are using to investigate people’s intentions to adopt future wireless applications.

A FUTURE WIRELESS SCENARIO

Consider the following future wireless scenario:

> *The refrigerator in your house sends you a text message (SMS) on your mobile phone warning you that a product is about to expire or has expired. You send a confirmation to the refrigerator, and the refrigerator orders the product from your favorite supermarket.*

Is this scenario interesting to you? More specifically, how would you respond to the following questions about this scenario?

1) Would you also like to be able to send a message to your refrigerator when you are away from your house to determine if some products you need for dinner with friends are missing and have the refrigerator order those products?

2) Could you better organize your day with this scenario instead of spending your time in the supermarket?

3) Would your mother find this scenario difficult to use, and would you waste too much time explaining to her how to use it?

4) Would this scenario be a trendy novelty to show to your friends?

5) Would you not use a refrigerator of this type because you fear that the supermarket could use information about what you eat without your authorization or could sell information about you to third parties?

6) Would you also like the refrigerator to send messages to advertisers to provide customized advertisements on your television for products that you prefer?

Each of these questions, and others like them, relates to one primary socio-cultural construct in the list of twelve constructs shown in Table 1. Ultimately we would like to answer the question of how these constructs influence the intention of the user to adopt new wireless technology and applications. We adopt the [Venkatesh et al., 2003] basic conceptual framework for technology acceptance models where intention to use information technology is a key variable and note that "The role of intention as a predictor of behavior (e.g., usage) is critical and well established in IS and the reference disciplines."

Table 1. Socio-cultural Constructs

1. Convergence – use of multi-featured wireless technology
2. Efficiency – use of wireless technology to complete tasks quickly
3. Effort – difficulty learning and using wireless technology
4. Fashion – use of wireless technology to appear to be on the cutting edge
5. Privacy – ability to keep personal affairs private while using wireless technology
6. Quality of life – the impact of wireless technology on the general quality of life and wellbeing
7. Security –protection from loss when using wireless technology
8. Ethics – use of wireless technology ethically
9. Entertainment – use of wireless technology for entertainment
10. Edutainment – use of wireless technology for entertaining education
11. Tribalization – use of wireless technology by groups of users ("tribes")
12. Social network interaction – use of wireless technology to interact with others socially

THE WIRELESS PEOPLE RESEARCH PROJECT

To address our research question, the Wireless People Research Project is being undertaken by a consortium of six universities in Europe and the United States:

IULM University, Italy

Université Paris Dauphine, France

Universidad de Huelva, Spain

Universidad de Sevilla, Spain

Universidad de Evora, Portugal

San Francisco State University, USA

Our methodology is to present users with fourteen scenarios about potential future uses of wireless technology (mostly involving mobile phones) and to ask their reaction to statements about each scenario. Each statement relates to one primary socio-cultural construct in Table 1. We analyze the data to see which constructs are most or least likely to be of concern to the potential users. The results help us understand how these constructs impact user intentions to adopt these technologies and applications.

A Web-based survey was developed and students at the researchers' universities listed previously where invited to complete it. As an example of our results, we present a simple analysis of preliminary data collected from 79 respondents in the US. Each of the six refrigerator scenario questions above was phrased as a statement, and users were asked their strength of agreement with each statement on a 1 (strongly disagree) to 7 (strongly agree) Likert scale. Here are the average responses to these six statements along with the primary socio-cultural construct represented in the statement:

1) Convergence - 5.4
2) Efficiency - 4.9
3) Effort - 5.1
4) Fashion - 5.2
5) Privacy - 3.8
6) Quality of life - 2.4

We can see that, for this scenario and this limited set of data, people are positive about the use of multi-featured technology (convergence), the impact of the technology on their daily routine (efficiency), and the appearance of being on the cutting-edge (fashion), but they are concerned about the difficulty of getting inexperienced people to learn and use the technology (effort) and the possible intrusion of the technology into their lives (quality of life). Interestingly, they seem ambivalent about the impact of this technology on their privacy.

Analysis of the twelve socio-cultural constructs related to the statements about the fourteen scenarios will identify those constructs that positively or negatively impact users' views of future wireless technology and applications. This analysis will be conducted for the combined data from all countries and for each individual country's data, providing the opportunity to compare the results in different parts of the world.

This short paper does not provide space for the complete questionnaire, but we list a few additional scenarios in Table 2. We are only looking at B2C applications in these scenarios and not at B2B or B2E applications.

Table 2. Sample Scenarios

- You are on public transportation (a subway, a bus, a tram, etc.) in your city when you see an interesting person who you would like to talk to, but you do not want to give your phone number. You turn on your mobile phone and begin to chat with him or her, but the phone does not disclose your phone number, and you cannot learn the other person's phone number.
- You are in a new pub that has an innovative service. Inside the pub you can phone anyone and anyplace without costing anything. The only requirement is that every two minutes you and the person you are calling must listen to a short advertisement about the pub.
- You have just finished your courses for the day at the university, and you are wondering what to do. Using your mobile phone you see a small map of the university and the surrounding area that shows where other students who use the same service are located.
- You go to your medical doctor for a check-up. When you enter the clinic, a chip in your health card transfers all the data about your medical history to the doctor's computer. During your visit, the doctor updates your health data. Before you leave the clinic, all the new data is transferred back to the chip in your health card.

People use many wireless technologies and applications now and will use more in the future. Predicting what they will want to do without regard to time and location, however, is difficult. The Wireless People Research Project described in this paper is one attempt to gather information about the socio-cultural constructs that may impact users' intentions to adopt wireless technology and applications.

VI. CONCLUSION

The intent of this recapitulation of the AMCIS 2007 wireless panel discussion was to present four distinct, but interesting perspectives on the future of mobile wireless applications and technologies, and to present wireless strategies and innovative capabilities.

One not yet fully comprehended direction in the wireless mobile evolution is the integration of TV programming and cell phones. Recent statistics show that the global market for cell phone TVs is projected to reach $27.4 billion by 2011 [BBC, 2007; AMERITRADE, 2007]. Given the accelerating pace of cell phone TV trends, understanding misconceptions about cell phone TV will help the industry players [Shim et al., 2007]. Since the cell phone TV market is now in its nascent stage, it is hard to predict which of the cell phone TV standards will end up dominating the market.

The communications in cases of disasters is another application of wireless technologies that opens a range of new opportunities we have only started to consider. It is likely to be negatively impacted by partial or complete failure of electrical and conventional communications infrastructure. Such communications can, however, be supported with a generalized technological solution using several current and future wireless technologies. More specifically, we suggest the use of wireless networks formed among vehicles, toys, and wearable computing, in addition to smart appliances and smart homes.

Another important extention still in an early evolutionary stage is to network various objects wirelessly. While we are currently mostly focused on cellular telephony, the majority of wireless networks in the future will connect processors known as motes. They may include sensors and activators, energy sources, GPS receivers and other components. Such networks, sometimes called the Internet of things, ubiquitous computing, perceptive networks, smart environments, collective intelligence, and many other names, is predicted to make an impact comparable to that of the Internet itself.

The above are but three technology-driven changes, which will affect how we live and work. However, we should not forget about the all important human side. Will people accept and sanction these new possibilities? Will they use them to improve or enrich their lives, or be threatened and abused by them? As people are more exposed to the countless number of wireless technologies and applications, they have a stronger stake in understanding the future of technology. Predicting what they will want to do without regard to time and location, however, is difficult. The Wireless People Research Project is one attempt to gather information regarding the socio-cultural constructs that may impact the users' intentions to adopt wireless technology and applications.

REFERENCES

EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers, who have the ability to access the Web directly from their computer or are reading the paper on the Web, can gain direct access to these references. Readers are warned, however, that

> 1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
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> 2. the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.

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AMERITRADE Streamer (2007) “EU Backs DVB-H as Bloc’s Single Mobile TV Standard”, July 18.

BBC (2007), “Mobile TV Predicted to be a Hit,” May 9.

Carew, S. (2007) “Update 1-Verizon Wireless kicks off mobile phone TV”, Reuters, March 1.

Forrester (2002) “Invisible Mobile Reignites Mobile Telecom,” TechStrategy Report, http://www.hi-point.com/Forrester Report- RFID and wireless.pdf (current Aug. 13, 2007).

Gartner (2006) “Forecast Analysis: Mobile Terminal Production and Semiconductor Market, Worldwide, 2003-2010,” Research ID Number: G00142690, Sep. 18.

Gutbrodt, F., N. Krishna, and S. Bellucci (2006) “Exploring the Business and Social Impacts of Pervasive Computing,” Report by IBM Zurich Research Laboratory, Swiss Re Centre for Global Dialogue, and TA – SWISS, March, http://www.ta-swiss.ch/a/info_perv/060506_DIV__Pervasive_computing_brochure_e.pdf, (current Aug. 13, 2007).

Kim, S., S. Pakzad, D. Culler, J. Demmel, G. Fenves, S. Glaser, and M. Turon (2007) “Health Monitoring of Civil Infrastructures Using Wireless Sensor Networks,” IPSN’07, April 25-27, Cambridge, MA, http://www.eecs.berkeley.edu/~binetude/work/ipsn07_ggb.pdf (current Aug. 13, 2007).

Kwasinski, A., W. Weaver, P. Chapman, and P. Krein (2006) “Telecommunications Power Plant Damage Assessment Caused by Hurricane Katrina: Site Survey and Follow-Up Results”, In Proc. IEEE 28th Annual International Telecommunications Energy Conference (INTELEC06), Sept. 2006, pp. 1-8

McConnon, A. (2007) “How to Sense Impending Doom,” BusinessWeek, Aug. 13, http://www.businessweek.com/technology/content/aug2007/tc20070810_143036.htm (current Aug. 13, 2007).

Mellor, B. (2007) “A world of connections,” The Economist, Apr. 26, http://www.economist.com/specialreports/displaystory.cfm?story_id=9032088 (current Aug. 13, 2007).

Photonics (2007) “Sensors Detect Bridge Flaws,” photonics.com, Aug. 7, http://www.photonics.com/content/news/2007/August/7/88659.aspx, (current Aug. 13, 2007).

Sandham, D. (2006) “What next for mobile TV?”, IET Communications Engineer, April/May, pp. 10-12.

Shim, J. P. (2007) “Tutorial: Cellular TV and Emerging Issues in Wireless Mobile Environment,” IADIS Multi Conference on Computer Science and Information Systems, Lisbon, Portugal, July.

Shim, J. P., S. Park, and J. Shim (2007) “Cell Phone TV: Misconceptions Associated with the “Swiss army knife,” working paper, Mississippi State University.

Shim, J. P., U. Varshney, and S. Dekleva (2006) “Wireless Evolution 2006: Cellular TV, Wearable Computing, and RFID,” *Communications of Association for Information Systems,* 18, pp. 497-518.

Tarasewich, P., R. C. Nickerson, and M. Warkentin (2002) "Issues in Mobile E-Commerce," *Communications of the Association for Information Systems,* 8, pp. 41-65.

Venkatesh, V., M. G. Morris, G. B. Davis, and F. D. Davis (2003) "User Acceptance of Information Technology: Toward a Unified View**",** *MIS Quarterly,* 27(3), pp. 425-478

Ward, M. (2007) "Mobile TV Warned to Standardize", BBC News, March 16.

ABOUT THE AUTHORS

Sasha Dekleva is Professor at the College of Commerce, DePaul University in Chicago. He has over ten years of industrial experience in engineering, systems analysis and management at IBM and other companies in Slovenia. Besides being on faculty at DePaul University since 1985, he had taught at the Universities of Iowa, Maribor, and Ljubljana. His papers appeared in journals such as *MIS Quarterly*, *Information Systems Research*, *Communications of the ACM*, *Data Base*, *Information & Management*, *Journal of Software Maintenance*, *Journal of Systems and Software* and many others. His current research interests include wireless communication technologies and applications, IT management, and valuation of IT investments.

Robert C. Nickerson is Professor and Chair of the Department of Information Systems and Director of the Center for Electronic Business in the College of Business at San Francisco State University. His areas of specialization include wireless/mobile systems, electronic commerce systems, global information systems and technology, database design models and methodologies, and collaborative computing and groupware. In addition to publishing numerous research papers in these and other areas, he is the author of fourteen major textbooks on information systems, computers, and programming. He is a regularly invited professor at the University of Paris Dauphine, the University of Nice-Sophia Antipolis, and the University of Mannheim, and he has been an invited speaker at other European universities and research institutes.

J. P. Shim, Professor of Business Information Systems and John Grisham Master Teacher, is the Director of International Business Strategy Program at Mississippi State University. He serves as a chair for several university research and award committees. As a part of MSU's International Initiatives, he was appointed as MSU's Ambassador to the Far East. He received Ph.D. from University of Nebraska and completed Harvard Business School's Executive Education Program. He taught IS at Georgia State U, New York U, and Chinese U of Hong Kong while on sabbatical. He serves on SE, AE, and editorial board for IS journals. He serves on Wireless Telecom Symposium as program chair and fellow chair. He has received various awards, grants and distinctions, including NSF, Microsoft, Booz-Allen & Hamilton/ASE, and Mississippi IHL. He is a nine-time recipient of outstanding faculty award, including Ralph Powe Research Excellence. He has written over 150 research papers and served as a program chair for US-Japan e-business conference and as a keynote speaker at international ubiquitous and embedded conference. He has lectured in the France, UK, USA, Greece, Korea, Kuwait, Hong Kong, Taiwan, Japan, Jamaica, Portugal, and China.

Upkar Varshney is Associate Professor of Computer Information Systems at Georgia State University. He received B.E. in Electrical Engineering with Honors from University of Roorkee, and, MS in Computer Science and Ph.D. in Telecommunications & Networking from the University of Missouri-Kansas City. He has written over 120 journal and conference papers on m-commerce, ubiquitous computing, pervasive healthcare, and wireless networking. Several of his papers are among the most cited in mobile commerce, including Mobile Networks and Applications (MONET)'s most viewed paper (2005) and the most downloaded ACM transactions paper (2004). He is the co-founder and co-chair of International Pervasive Healthcare Conference. Upkar received Myrone T. Greene Outstanding Teaching Award (2000 and 2004), and RCB College Distinguished Teaching Award (2002). He is or has been an editor/member of editorial board for IEEE Transactions on IT in BioMedicine, IEEE Computer, Decision Support

Systems, International Journal of Network Management, IJWMC, CAIS, and IJMC, and has guest edited major journals including ACM/Springer Mobile Networks and Applications (MONET).

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