Embedding of Ambient Intelligence in Mobile Phones

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Abstract: *The paper describes about applications of mobile phones that are being used in ambient intelligence environment. Ambient Intelligence is an advanced technological environment with a core emphasis on use, and an interactive world where computing devices are likely to be present everywhere. Ambient intelligence is a world where human being can interact with world environment in an intelligent way. An ambient intelligence environment is highly dynamic in many aspects. These environments are aware of the need, requirements and behaviour of humans. The diversity of ambient intelligence is such that can be used at public places.Ambient intelligence environments are so diverse that these intelligence can be used in public places. The aim of ambient intelligence is to develop smart environment, allowing better support to human being and providing sufficient knowledge to make better decision when inter-acting with these environments. This paper can be referred as model application as mobile centric in ambient intelligence environment.*

Keywords: Ambient intelligence, Computing devices, Sensors, Smart environment

1. Introduction

Ambient intelligence is a type of intelligence that builds intelligence to our environment and make it sensitive to us.. It can be also called as multi-displinary approach and its aim is to enhance human interaction with the environment. The aim of this area is to make place good to live in The goal of this area to make the places we live and work and beneficial to us [2, 6]. Mobile phone is the most commonly choice of ambient intelligence application for some of the reason: it is mostly available at almost every place and people carry it most of the time. The main aim of ambient intelligence is to develop user with many other ways to interact with machines. Ambient intelligence is network of intelligence that sures about our presence and make environment to respond to our needs. With ambient intelligence, the technology may disappears to environment ,but intelligence will be present everywhere an that are always working [1].

One of the technologies for ambient intelligence is environment using sensors. The object mobility should be reliable enough to be addressed by sensorized environment. The sensors are required to consume power with the technology. The environment needs integration with wireless networks to provide ambient intelligence to build a platform.

A sensor network consists of stations for multi detection known as sensor nodes which area small, lightweight and portable. The principal feature of a Wireless Sensor Network is to transmit wirelessly the data, acquired by sensors in different environments. With the use of WSN (Wireless Sensor Network) application of ambient intelligence with use of mobile can be achieved.

Much research has been carried out to build an human interactive environment. Ambient Intelligence vision is to develop invisible technology, are present everywhere when we need it with simple and effortless interaction. Ambient intelligence can be applied to almost every field and in more intelligent way. It is clear that the ambient intelligence vision requires the integration of many different improved technologies to build intelligent environment.Such technologies may span from efficient energy, high performance computer platform and powerful media processing hard and software to intelligent sensor and actuators, and improved user-interface designs (vision ,speech, gestures) [8].The paper explores about the technologies that are build using mobile phone using various technologies. Development of ambient intelligence application is user driven not technology not technology driven but obviously technology makes an important domain which is realizing these applications.

2. System Flow

There are many ways in which intelligent system can be built. The sensors and devices are needed to surround the occupant of environment that provides feedback to the system on different context with continuous developing. Through network the collected information are transmitted. With higher level of reasoning it helps in making decision to the occupant of environment. To make decision easier or beneficial Finally to make easier decision or beneficial to occupant to environment they need higher level of reasoning which will be diagnosis and assist by human which have responsibility on the operation of the system. Some elements like Database may be included where the events

Finally to make decision making easier or more beneficial to the occupant of the environment they will have higher level of reasoning which will accomplish diagnosisand advice or assist other humans which have the final responsibility on the operation of the system. Some elements that may be included example a Database where the events are collected to record sensor and then to response it and other technique to take decision. As interator will perform its own task and some of it will trigger the sensor and in return it will activate the resoning system.

The system can be improved by its learning.[2]

3. Mobile phone Platform in Ambient Intelligence Application

Mobile phones can be used as an interactive tool in ambient intelligence to build environment and. its advantages are high penetration, user acceptance, less cost, small size, both local and long-range wireless connections, provides access to a wide range of services through the Internet, data storage possibility, and local computational capacity[3].In this architecture mobile phone searches and analyse the sensing, forward it and store data to get context information, hosts sensor ,network application and forward the actual data to server in the internet provides functionality and tags can be integrated in independent modular subsystem that application in mobile phone can interact with. The architecture make use of mobile phones capability of running software and providing various sensors
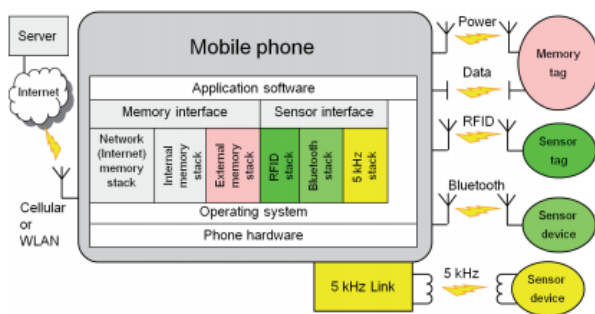

Figure 1(Ref[3])

The user can communicate with surrounding environment by embedded to wireless sensor network objects and environment itself. Other than some measurement can be collected and processed by relevant applications on mobile devicesThe mobile devices can connect through internet to exchange data.The information, applications or services provided by the system are read or activated by touching or scanning tags and sensors with the mobile device, provides easy interaction methods to the users. The main challenge with mobile phone centric is when added to RF(Radio Frequency) memory tag solution resides on the rules2 of the added functionality. Another challenge is minimizing changes in existing system .RF memory tag solution affects only the external memory stack block. With this design, the affected entities within the mobile phones and RF memory tag should be minimum and independent from rest of the system architecture[11]

4. Sensors Used

The design of ambient intelligence is done for world, physical environment, use of sensors are important. Without physical component that allows ambient intelligence we are only left with algorithm that does not have any physical use Sensors are important that link computational problem with application. When analysing sensor data ,ambient intelligence system may develop a centralized or distributed model. [4].

The technology that is used to communicate with sensor in mobile phone is Bluetooth. Bluetooth because it is mostly available in almost every cell phones. Classic Bluetooth are

not able to communicate with wireless sensor networks. The Ultra low power Bluetooth mainly known as Zigbree, the low and addition to Bluetooth. Zigbee which is particularly designed for sensor network and are inexpensive and bit rate, low power and short range RF data link.[1] To transfer amount of data can be one of the factor for radio technology . Also,the data that are transferred, could be one of the factor for selecting radio-technology , which in case of large amount approves Bluetooth. For communication with resistant sensors or passive information device NFC(Near Field communication) or other RFID(Radio Frequency Identification) technologies can be used.

4.1 Wireless Sensor Network

Wireless sensor network architecture research provides three main topologies available for ambient intelligence application that are mesh, star and extended star. The star topology are usually used in body area network. The IEEE standard 802.15.6 endorses star or extended star topologies. ZigBee technology uses all three topologies. As wireless sensor should be small and cannot be changed oftenly, low energy is key parameter in developing network .Network both protocols and radio interface, should consume little energy as possible. Low price is prime importance to use architecture. In mobile phones Bluetooth can be used as wireless sensor network. Bluetooth is an compulsive radio technology for mobile phone sensor solution, as phone provide

Figure 2: Current use of blutooth connectivity with mobile phones

Bluetooth radio. Bluetooth sensor, such as heart beat sensor for mobile phone based architecture are still present. Low power sensing devices cannot take the cost and power consumption associated with classic Bluetooth, however are not required in full duplex. Bluetooth low energy solves the problem of cost and power by introduction of minor power saving chips. It gives less cost and provides functionality to Bluetooth. Bluetooth Low Energy is part of Bluetooth low standard. Some chips are already available such as Bluegiga BLE112, 8 μENERGY CSR1000, Nordic Semiconductor19 nRF8001 (singlemode Bluetooth Low Energy), and CSR8000 (full Bluetooth 4.0 including the low energy mode) series.

5. RFID Platform

The vision of ambient intelligence for future that it will be available everywhere without knowing the surrounding information technology. Communication is done between single person and objects or between two objects. The communication is acquired by single intelligent device. Devices can receive, sense ,carry and distribute information in the environment .RFID i.e Radio frequency Identification can be referred as technology used for local connectivity. RFID IntelliSense Project develops the technical and market and technical value of RFID technology by developing multiple protocol device and capability of sensing. The environment and communication at different bands can be sensed easily. The RFID IntelliSence Project develops multi protocol RFID devices with the capability of sensing by operating at multi frequency band. devices can be connected with an objects,or a person or location through unique id and can be measured and data can be obtained by users behaviour and his environment creating an intelligent environment on the bases of environment by invisible intelligent devices.

RFID technology uses small range wireless communication in radio frequency (RF) to transfer data to reader from low cost and disposable tags(microchips).It automatically relate objects or people with RFID tags that can be anywhere far from place. Transmitted tag data act as input to further data processing. RFID communicates between interrogator and active database and information management system.

Disadvantage with RFID chip is it provides lack of security .Any reader with defined RF signal may possible learn the content of RFID chip. The encryption of RFID transmission or data cannot be read by third party .Moreover RFID are viewed by many "Spy chip technology"[9,10].

6. Mobile Phone- Readable Memory Tags

This describes about architecture enabling mobile phones to read and write resistant RF memory tags.In this demonstation high data rates upto 112 Mbits have been achived ,showing implementation of mobile phone redable RF memory tag.The architecture can be used providing capability of mobile to run software and providing other user interface. From networking point of view ,a tag can provide point to point network with mobile phones.In case of several tags,the network uses a star network to communicate with selected tag.

6.1 Hardware Architecture

The hardware architecture is developed to enable mobile phones to read and write and is based on three technologies: Network on Terminal Architecture (NoTA), phase change memory (PCM) and a novel wireless interface, UWB Low End Extension (UWBLEE)[19]

NoTA subsystem structure takes into account possibility to add different type of server or application subsystem to the architecture .Mobile reader and writer see the content of the memory of RF memory tags when the connection is established.

PCM is in favour of any memory technology and its benefits are: to estimate the High number of read/write cycles,low powered requirement and aleratability.

6.2 UWB Low End Extension

The technology provided by wireless access technology are currently available in mobile phones. To get higher data rates, a wider frequency band or higher frequencies to be used. As a function of centre frequency wireless power transfer decreases. Due to high speed communication while providing wirelessly to the tag a dual based radio can be used[21]. One narrowband signal on RFID frequency is used to provide power to tag and to provide reference at both the communication link is based on UWB technology to provide communication bandwidth and scalability for higher rates.

RFID frequencies are close to frequency range ,in the reader there is possibility of integrating the WPT function to the existing phones radio subsystems. Phone radio subsystems are designed so that WPT can request for direct access to control the narrowband transmitter .For RF memory tag no network implementation is needed only point to point interaction is handled on Medium access layer.

7. Mobile Phone Centric Sensor Network

The design of MIMOSA architecture is designed to be modular and expandable .The architecture is based on three layers : context layer, sensor layer and lower connectivity layer. The API of this layer are open for third parties.
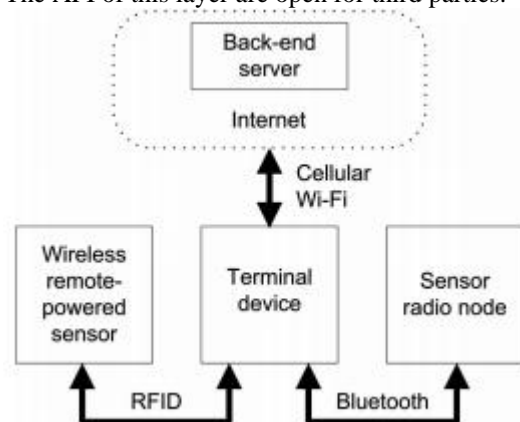

Figure 3

The architecture defines four types of entities:[1]Terminal device i .e mobile phones that are built in sensors. [2]Sensor radio nodes[3]wireless remote powered sensor and[4]Back end server .The terminal device is one of the factor to run application that are based on sensor data and in cellular network connection that consists of Bluetooth and RFID(Radio Frequency Identification) radio interface. Back end server are computer that provides data storage, data processing and services. The factor where power usage and price requirement in various intelligent application,two classes of sensor devices: sensor radio that are wireless remote powered sensor that are RFID tags with sensors.

8. Mobile Application in Ambient Intelligence

Several possibilities of ambient intelligence exists in the way people interact and their significance on our lives . In this paper we are discussing about application that are used in ambient intelligence using mobile phones

[1]People do not have to worry about the things they carry most of the time, because they will get notification about things. If things are lost at someplace with help of ambient intelligence things are tracked using Radio Frequency Identification (RFID) technology and it can receive notification one ones cell phones using tag readers .This can be helped to those thing which mostly gets un noticed. These things may appears to person like everything ones own sense of loyalty of his/her.

[2]When ever ones enter Non Smoking Zone one get notified by ones cell phone and navigate application and then a depending on preference by showing the nearest smoking zone.

[3]Similarly whenever entering into meeting hall or any silent place using WSN (wireless sensor network) ones mobile phone get to silent mode.[4] Smart phones can also be used as giving information about medicine that may help you feel better by taking multiple symptom into account or whether to see a doctor or it can also fix a appointment with doctor or reserve a place in hospital emergence room.

[5] While shopping it can also make list of item to buy and search for nearest store for home delivery .an also work for cases that can fall of un noticed.

[6] A customer can request step by step direction to shop through navigation through phone.
The person can be directed through arrows until he reaches to the destination.

9. Future Scope

From future perspective ambient intelligence is to be available everywhere and to simplify human life. Its vision is to make an environment that can be natural, informative and caring from human point of view. Ambient intelligence values people and their experience and finally the technology disappears into our surroundings until the user interface remains visible to users [7]. Researches in this domain are done and outcomes are very promising.

The scope of ambient intelligence is more than it reaches the personal level. Mobile device can trap the ambient data such as temperature, location, moment of user, schedule, habit of user and engagement. Developers' are consists of new capabilities and source of data to create more advance applications. The opportunities are immense and there is an increase in building future applications and allow more expectable user experience. All these feature require the use of one or more AI technologies [5].In future mobile device can be used as conjunction with(RFID, Bluetooth and wifi) and GPS for example check in icon automatically turn on mobile phone when entered in hotel lobby with the use of the technology.

10. Conclusion

In this paper, we have discussed the concept of ambient intelligence the area of science related to ambient intelligence. Many new techniques and method for ambient intelligence are introduced.We have also looked at how various technologies are introduced or are being used and some application that can be implemented to build smart interactive environment.

Ambient intelligence has strong importance to provide service to humans. Mobile phones are one of the main medium with which we use Ambient intelligence to establish a smart environment. Sensor network are used everywhere which itself is an add on to build smart environment. Moreover mobile phones are building a gap between sensor network and Internet. Using WSN (wireless sensor network) technologies like RFID, Zigbee or Bluetooth are used with mobile phones to build an interactive environment. Furthermore we looked in detailed architecture of building mobile phone platform. Some observation can be made after this paper. One is that the functionality of ambient intelligence is realizable through advance in hardware, sensor techniques, functionality with simple data and reasoning .Other is that full potential cannot be realized with adequate knowledge, reasoning and technologies. Artificial intelligence technologies can offer in processing and in making decision on data received by sensors. We have concluded that there are many application using mobile phones that exist to make smart environment and there are many more ways in which we can build interactive environment with the use of ambient intelligence.

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