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Ambient Intelligence and Its Applications

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ABSTRACT: The main aim of ambient intelligence is to enhance the way in which people interact with their surroundings to promote a better lifestyle. An example of AmI is a smart home, but the applications can be extended to the fields of transportation and hospitals. To achieve an effective ambient intelligent environment, we require not only a number of sensors but also intelligent software used for decision making. In recent times, the ambient technology is being implemented in our homes, offices, factories, hospitals and many more places by automation. As a student we need to think in broader aspects to use this technology in our classrooms. The stepping stone for improving the classroom environment was converting the normal boards into digital boards. Why not improve it even further by making the other classroom activities automated? This paper work is, about the advantages of using ambient intelligent technologies, especially in a classroom environment.

KEYWORDS: Ambient intelligence, sensors, networks, interface, automation.

I. INTRODUCTION

Ambient intelligence is an evolving area of computer science. Using AmI we can integrate intelligence in our environment which in turn makes it more interactive. Intelligence refers to the systems that can sense the environment, recognize and respond to the environment. The term AMI is defined by the advisory group to the

European community's ISTAG (Information Society Technology Program) and was originally developed by Eli Zelkha in the late 1990's along with his team at Palo Alto Ventures. This device helps the occupants of its environment in carrying out their everyday tasks and activities in an easy and efficient way by using the intelligence and information that is hidden in the network. As the technology grows more connected and integrated into our environment, only the intelligent user interface will be perceivable by the users i.e. it enables the inhabitants of an Ambient Intelligent environment to control and interact with the surroundings in personalized way.

II. RELATED WORK

Hospital Intelligence: Applications of AMI can be used in hospitals. In most cases, the patients have to be taken care of after surgery. In this case, AmI can be of help. It can be used to ensure the safety of the patients after surgery. AmI can be used to improve the technologies in the hospitals. It has been improved so much that, hospitals can now be connected to smart homes. This ensures that the safety, security and independence of the individuals are maintained. In the below example, we have a smart room wherein there is a bed, two television sets and a cabinet to store things required by the patient. The main users of this room are doctor, nurse and the patient. If in case, the patient has a medical condition where he cannot move or get up, he will be given an application that works on touch sensors. The patient will be able to control the lights, television sets etc using this application. He will also be in contact with the nurse as well the doctor using this application. There will be an application installed in the room that will alert and remind the patient to take medicines, food etc at the scheduled time. Ambient environment room and system architecture is shown in figure 2.1.1.

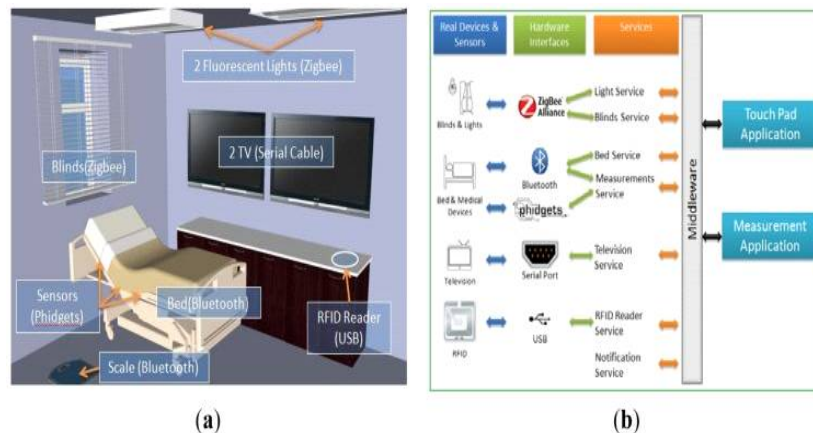


Figure 2.1.1: (a) Ambient environment room, (b) System architecture

The doctors will have an RFID card that will be installed in the room. This results in the following functions. The TV will be moved closer to the patient to see the selected channel and the other rear TV will give a detailed description about the patient, like blood pressure, sugar level, pulse rate, heart rate, ECG etc. If the patient is sleeping, it follows the same method; and also in some similar scenarios the earlier patient records can be obtained in the form of patient logs. This technology is also helpful if the doctors want to know the patient's condition. (Cook, Augusto & Jakkula, 2009: 277–298).

The hardware components that are used in the ambient environment are shown in the figure 3.14. Near to the bed system is fitted in the wooden cabinet. All the various equipments and the sensors are attached to this system. The television, lights, BP check-up machines and Oxymeter are connected to this computer and will make the measurements accordingly. The angle or the height of the hospital bed can be changed and it works based on the controls given through Bluetooth (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3478791/>, March 23, 2016). The main aim of hospital intelligence is to create a hospital that brings up smart work in all areas including emergency rooms, operating rooms and ICUs. They should also provide cost effective, widely applicable and efficient solutions to the patients. A smart patient room will benefit the users by allowing them to control the environment and hospital facilities when used efficiently. Patients will be instrumented with smart beds providing a secure environment which enables the doctors to monitor status of the patient. This environment is designed in such a way that it covers various needs that may evolve during the treatment of the patient. Pressure sensors and RFID sensors are primarily used in this environment. The information from these sensors is filtered and analysed and sent to a server by combining displays or smart devices and also the information in reports. In hospitals, the hardware which is used consists of processors, controllable fluorescent lights, blinds, smart beds, etc. High performance wireless networks help us to enhance information exchange and all users for real time communication.

Smart home: Ambient Intelligence (AMI) is an emerging technology that brings intelligence to our daily routines which is nothing but home automation.

Consider a scenario where coming back from work after a tiring day and the doors open automatically, lights and AC are turned on immediately when you enter the house where all you can do is sit back and relax! AMI provides us such enhanced, efficient and increased creativity for greater personal well-being. The home automation market was worth US \$5.77 billion in 2015, predicted to have a market value over US \$10 billion by the year 2020.

It involves control and automation of lighting, heating, and ventilation and security purposes. The remote monitoring and controlling is done through our home wireless networks (Wi-Fi).

Main application of smart home is the lighting system. This control system is an intelligent network which provides solution for lighting control where it is used at our residential place. Occupancy sensor is used for such lighting control systems. These sensors detect presence of people and automatically turn lights on and off including ACs by detecting infrared or heat energy produced by the occupants. Main advantage is to save energy as it controls it automatically.



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For security purposes, we use Passive Infrared Sensors, door sensors, glass break sensors and so on used in burglar alarms which are used to detect any unexpected person breaking through our houses. There are few environmental sensors like humidity and temperature sensors that detect the change in environment like physical presence of human.

Smart Roadside: As human beings spend a lot of time in travelling, it is important to make it convenient. AmI systems are provided in various transport systems like bus, cars and trains which monitors the system's performance. Image processing, GPS can be used in public transport to make inefficient. An example will be using AmI systems provide assistance to drivers so that damages can be avoided. (Cook, Augusto & Jakkula, 2009: 277–298). New technologies like Telematics and Intelligent Transportation System are used in the earlier roadway system and it makes use of various sensors for the assistance of drivers and traffic safety warnings. Telematics provides safety as well as location and information of traffic through wireless communication system. Intelligent Transportation System (ITS) was introduced in the year 1991 and mainly focuses on areas like reducing the travelling time, reduce delays and congestion, safety improvisation and reducing pollution. ITS can be divided into three steps – in step one, we examine and apply early ITS technologies and it continues for a few years. In step two, it mainly focuses on the streams like behavior of driver in transportation models and started work to understand the fundamental nature of driving. Step three involves that it should work together with urban areas and should have a network of technologies.

The two sensors currently being used in the smart roadsides are infrastructure based sensors and on-board diagnostic based vehicle sensors.

Currently, the public transport services consider only people who are physically stable and are aware of their surroundings. Specially challenged and elderly people require accurate and appropriate information in order to utilize the transport network efficiently. This information is critical for wide transit systems that cover a large area. The main goal here is to help develop and integrate information to this group of people using ambient intelligence.

Using ambient intelligence in transportation networks provide multiple benefits. Firstly, it is related to interactive devices that maybe either a mobile phone or fixed and specialized devices placed in the ambient environment where these devices help in the user needs such as voice synthesis, touch screen, etc. Second, these devices should be interactive and context aware i.e. they should be able to detect the behavior and situation to anticipate the user preferences. Lastly, the services are provided with high level of mobility, personal adaption, ubiquity and aids people in their daily activities. Along with these benefits, some challenges are raised for example, decreased interaction, lack of security and privacy, to maintain balance between manual and automatic control, etc.

III. PROPOSED IDEAS

Ambient intelligence is one of the important technologies used to make our environment smart and helpful to humans in many ways. In recent times, the ambient technology is being implemented in our homes, offices, factories, hospitals and many more places by automation. In order to improve the learning experience, AmI is used in classrooms. It can be used to keep track of student's test score and their attendance. An interactive whiteboard is used in classrooms, in which notes can be written using a digital pen. To recognize motion and speech, video and microphones can be used. All these features enable the children to respond well to natural interfaces. The teacher's activities, the audio and video are recorded. The URL's of the websites visited by the teacher is also stored. This can be used for the future purposes and also maintains the safety and security of all the individuals present in the class room. The students are given a smart phone or a tablet that is compatible with the software that the teacher uses. Students can write notes while watching the videos. These notes are converted to html at the end of the session. As a student, we need to think in a broader aspect to use this ambient intelligence in our classrooms.

The stepping stone for improving the classroom environment was converting the normal boards into digital boards. Why not improve it even further by making the other classroom activities automated? By doing so, we can not only make our work easier but also save a lot of time and energy.

There are many ways in carrying out the classroom tasks in a smarter way. Some of them are:

Taking the attendance of students is a usual practice that is carried out in our classrooms. A considerable amount of the time for the faculty is wasted in doing so, along with their energy. Imagine if there was no need for this and it is automatically done for you!



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We can use the ambient intelligence technology using PIR Sensors and Audio-visual sensors where these sensors detect a person entering the classroom and save the data of the respective person in the attendance server using networks which count our attendance while entering the classroom and vice-versa.

Not only attendance but we can also use the smart glass technology which automatically converts the glass of the windows from transparent to opaque by preventing the sunlight from entering the classroom when projectors are turned on. A sensor can communicate with another sensor if they are within the communicating range. Sensors that are connected to the projector are turned on when projectors are in use which contacts sensors from the smart glass and this in turn is turned on by making the glass opaque.

Humidity and temperature sensors are used to detect the temperature of the classroom environment. As soon as the sensors detect a change in the humidity or temperature, the fans and/or air conditioners must be turned on or turned off accordingly. This leads towards conservation of energy.

IV. CONCLUSION

Humans have used their technical knowledge in order to make the environment responsive. They have used the technology in such a way that interaction with the environment is lot more easy now. This has made AmI one of the exciting areas of computer science. Due to this development, in the coming years the interaction between humans and the technology will eventually change.

In this paper, we reviewed the concept of ambient intelligence in various environments, like our houses, hospitals, etc. The focus is on the area of distribution of technology intelligently which will allow an environment to benefit its users. AmI strongly focuses on reaching out and serving humans, but in order to benefit from these, the cooperation of the occupants of the environment is required.

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