Conference Assistant: Bluetooth-based Context Aware Application

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Abstract

Context-aware computing is a rapidly growing field, with new applications cropping out daily. Context-Aware systems offer an exquisite opportunity for developers to collect the context information about the user, and use it to provide better services. Bluetooth is an easily available, robust, low cost and low power wireless communication technology. Thus, we provide a real-life application of context-awareness here, where the contextual data is collected using Bluetooth. The goal of this application is to provide context-aware services for conducting conferences, but this concept can find usage in various other fields too, like school or college administrations. The application aims to offer all the functionalities a standard corporate conference might require, providing necessary data to attendees, keeping their attendance records, and providing assistance for better expression of ideas.

Keywords: *Bluetooth, Context-awareness, Attendance recording, BlueCove, Conference Assistant*

1. Introduction

In most of the conferences, attendance is recorded by passing a sheet through the conference room which is to be signed by each attendee. These records are difficult to maintain as they are on paper. Further, manual entries for attendance can lead to specious marking of attendance too. Also, in case any software/file is required for the conference, it needs to be transferred to every employee manually. In doing so, a lot of valuable time is lost. This prompts a better, time and money-efficient and more importantly an automatic alternative to the existing system. For a similar situation in schools, wherein attendance of the students is a problem, a solution using the Bluetooth technology has been proposed in [1,2]. Now since every employee these days carries a cell phone, and most of the cell phones today support Bluetooth, the Conference Assistant uses this technology as a solution to provide automatic attendance recording as well as file sending.

Most of the times, a conference is followed by a question and answer session. Here, an employee at times may not be able to express his doubt lucidly, thus leaving him obscure of the topic. To avoid this, Conference Assistant provides the feature of controlling the slides from the employees' cell phones too. This way they will be able to switch back to the appropriate slides they have some query in, thus assisting in clearing the doubt.

A similar use case scenario has been mentioned in [3], although for larger conferences.

1.1 About Context Aware Computing

According to Schilit, Adams, & Want [4], Context Aware Computing is a software that examines and reacts to a user's surroundings. They classified context aware computing into 4 categories as mentioned in the Table 1:

Table 1. Categories of Context Aware Applications

	Manual	Automatic
Information	Proximate Selection and Context Information	Automatic contextual reconfiguration
Command	Contextual commands	Context-triggered actions

These four categories depend upon, what for the context aware application is used (Transfer of information or Performing some actions), as well as on whether the application is automatic or requires user actions.

Conference Assistant makes use of Context-awareness using Bluetooth, which falls in the very first category here i.e. proximate selection. One needs to turn on Bluetooth and search for devices, which is manual, and further, only sending of information takes place, i.e. the UUID of the Bluetooth device as well as file sending.

Further, along with the slide control feature, Conference Assistant classifies as a contextual command kind of application wherein there is manual transfer of commands.

1.2. About Bluetooth

Bluetooth technology is a wireless standard which is used to transfer data among Bluetooth enabled devices in a secured way. Bluetooth technology exchanges data over short distance using radio transmissions. It allows us to transfer voice, data, music, photos, videos and other information. [5]

1.2.1 Technical Specifications of Bluetooth

Bluetooth operates in the band of 2.4 GHz to 2.485 GHz, which is unlicensed in most of the countries. It sends data using spread spectrum, frequency hopping, full duplex signal at the nominal rate of 1600 hops/sec. There can be a maximum of 79 channels in Bluetooth network. Bluetooth technology sends information within the range of Personal Area Network (PAN) which is up to 100 meters. It may vary depending upon device implementation. All Bluetooth–enabled devices have unique address is of 48–bit, which is generally represented in Hexadecimal numbers.

Bluetooth is Master-Slave technology. One master may communicate with up to 7 slaves, this formation of network is called as Piconet. All devices in the Piconet shares the master's clock. Connection of more than Piconet forms a Scatternet, in which certain devices simultaneously play the master role in one Piconet and the slave role in another.[5]

The key feature of Bluetooth is robustness, low power (provides Power Management) and low cost.

2. Implementation

2.1 Context Awareness using Bluetooth

Context awareness can be implemented using various wireless technology standards available viz. Wifi, RFID tags, Bluetooth, Zigbee, etc. An omnipresent option is the Bluetooth. Every cell phone offers the feature of Bluetooth, and it does not require any additional hardware to implement. Hence, Bluetooth being the cheapest and at the same time, convenient option, we choose to implement the context-aware conference assistant using Bluetooth.

Here is the gist of how we have implemented context-aware attendance recording as well as file sending using Bluetooth:

1. There will be a central server (a laptop with a Bluetooth adapter) in a conference room. When the conference is about to start, the Bluetooth of this server will be turned on, as employees start coming.
2. The server then will keep on searching new devices in the conference room, and adding them to the database. Thus, marking their attendance.
3. If a person comes for the first time, he must be authenticated as an employee manually, and then from the next time his attendance will be recorded automatically.
4. The people will have to switch the Bluetooth of their cell phone or a laptop turned on. Every employee will be uniquely identified by his/her Bluetooth address.
5. Thus, the only thing the employees have to do here is to turn their Bluetooth on, rest all is taken care by the Conference Assistant. Thus, implementing context-awareness.
6. Further, as the conference progresses, any sort of information, agenda of the meeting, can be sent to the devices via Bluetooth using the Conference Assistant.

The slide control feature can be provided on the smart phones with the Android operating system. The direction control keys on the cell phone are assigned the function of controlling the slides. An application needs to be installed on the cell phone as well as on the server.
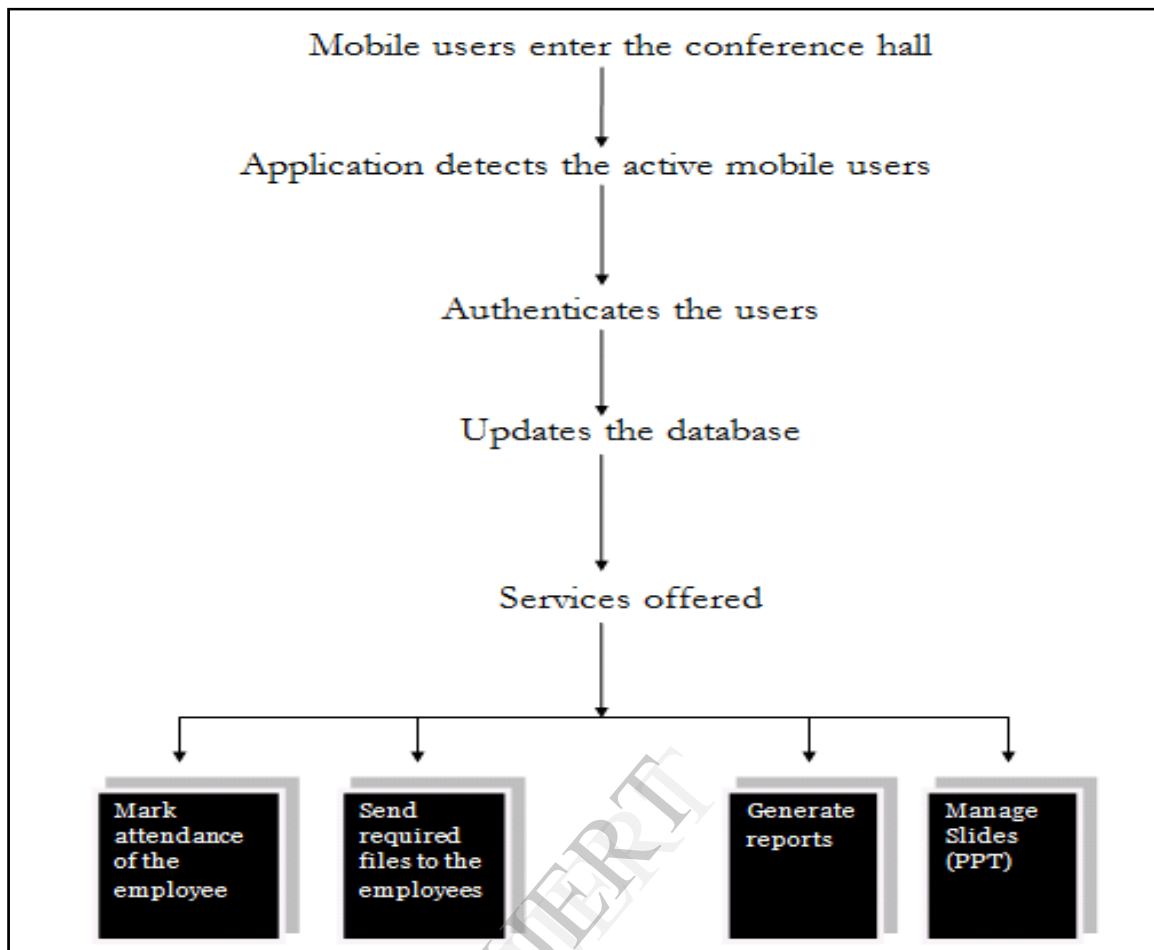
Figure 1. Overview of the application

2.1 Detailed implementation

The Conference Assistant is implemented as a Java Application. The front end of the application is designed using JFrames. The implementation of Bluetooth functionality in Java is obtained through the classes, functions and interfaces provided by the 'BlueCove' package i.e. the Java Bluetooth API. [6]

Bluetooth connectivity implementation in Java is carried out using following steps:[7]

- Stack Initialization
- Device Discovery
- Device Management
- Service Discovery
- Communication

2.2.1 Stack Initialization. Stack Initialization is necessary for the device to get ready. It is like loading a set of instructions, protocols and other software for performing further operations.

2.2.2 Device Management. This involves fetching information about the local as well as devices in the vicinity and using that information for the communication management. The information includes the unique address of a Bluetooth device known as the 'Bluetooth address'. This address is useful for performing communication with a particular device.

2.2.3 Device Discovery. Device Discovery involves identifying what types of Bluetooth devices are present in the vicinity. Devices can be any gadget with Bluetooth facility viz. laptops, cell phones, desktops, etc. These devices can be discovered via the interfaces and functions offered by Java API.

2.2.4 Service Discovery. This involves discovering the services offered by a particular Bluetooth device. Discovering services is useful as we know what service to demand from which device. Once discovered, services need to be registered before using them. After all this, the actual communication between devices can be carried out.

2.3 Features offered by the Conference Assistant

The Conference Assistant helps one to:
1. Record the attendance of the employees with timestamp
2. Send them a file
3. Generate reports of attendance for a particular date
4. Manage the slides (PPTs)

Firstly, the conference room is scanned for any devices by the central server. The devices found are listed as shown in the Fig. 2. Names, Bluetooth address are recorded along with the timestamp.

Name	BT Address	Time
Susmita	945103CC92EB	2013-08-09 23:51:27.843
Divyesh	8425DB2E2084	2013-08-09 23:51:27.85

Figure 2

Now, the backend database has the following tables. A table 'Names' for recording all the devices detected and another table 'Employees' for recording genuine employees.

In the first visit, once detected, a device will first be added to the 'Names' table. Now the device needs to be registered manually as an employee. This is done only after ensuring his authenticity as an employee. Thus, he is added to 'Employees' table manually. Now in the

consequent visits, his attendance will be automatically recorded.

This way, the attendance for every day will be stored in the 'Employees' table. Note that here a combination of timestamp and the Bluetooth address uniquely identifies an entry in the database. Thus, one can easily have a look at the reports of attendance for a particular day.

One more additional feature the Conference Assistant offers is that of file sending. Only thing the person at the server has to do is to click a button in the application. As a result, the desired file will be automatically transferred to all the employees present in the conference room. One can forward files to selected employees too.

3. Modelling Diagrams and Screenshots

Following are some screenshots of the application, as well as certain modelling diagrams.

3.1 Home Screen of the Application

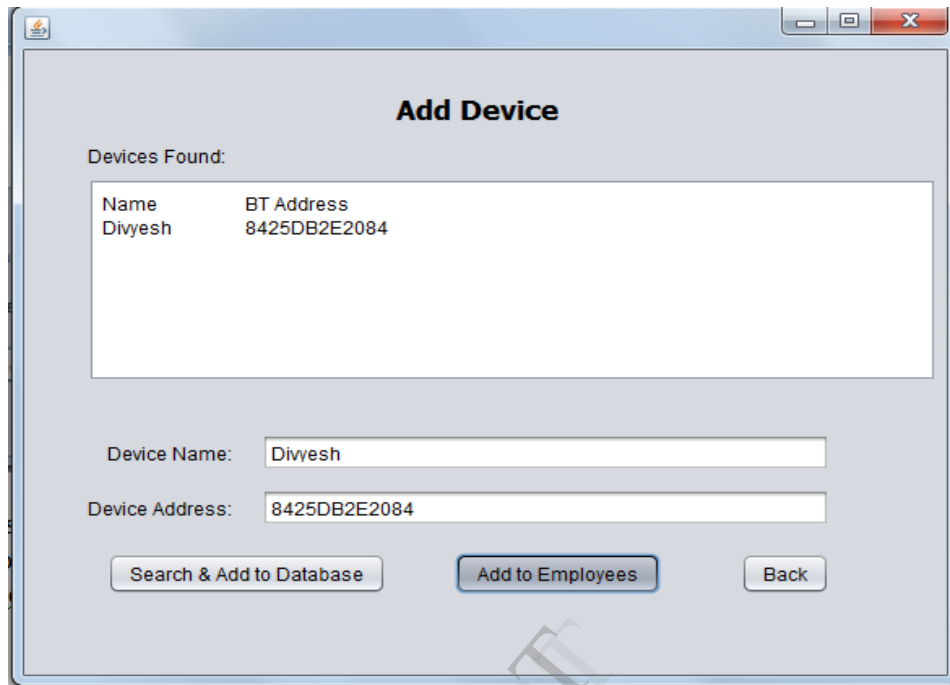**Figure 3. Screenshot 1**

3.1 Device Search dialogue box

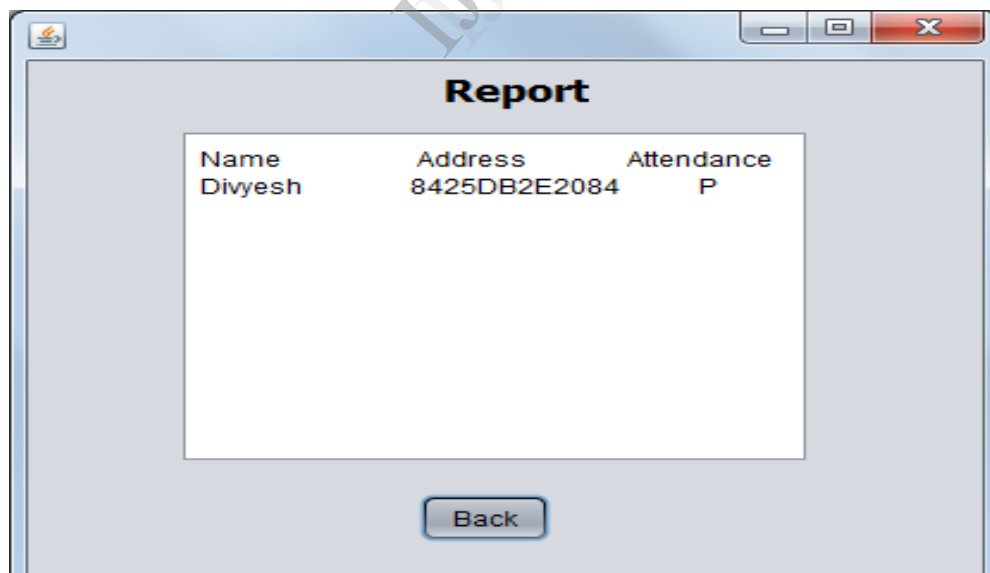**Figure 4. Screenshot 2**

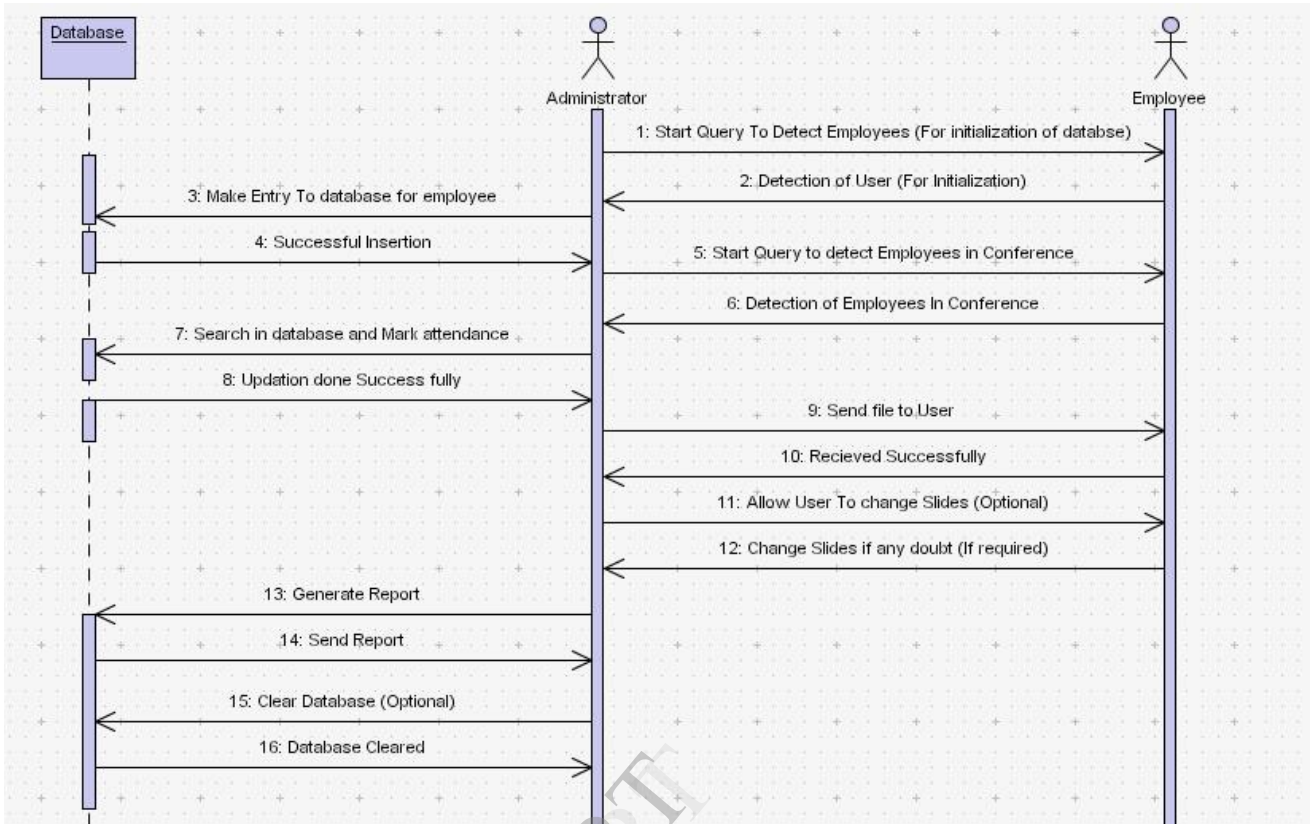### 3.3 Reports Screen

Figure 5. Screenshot 3

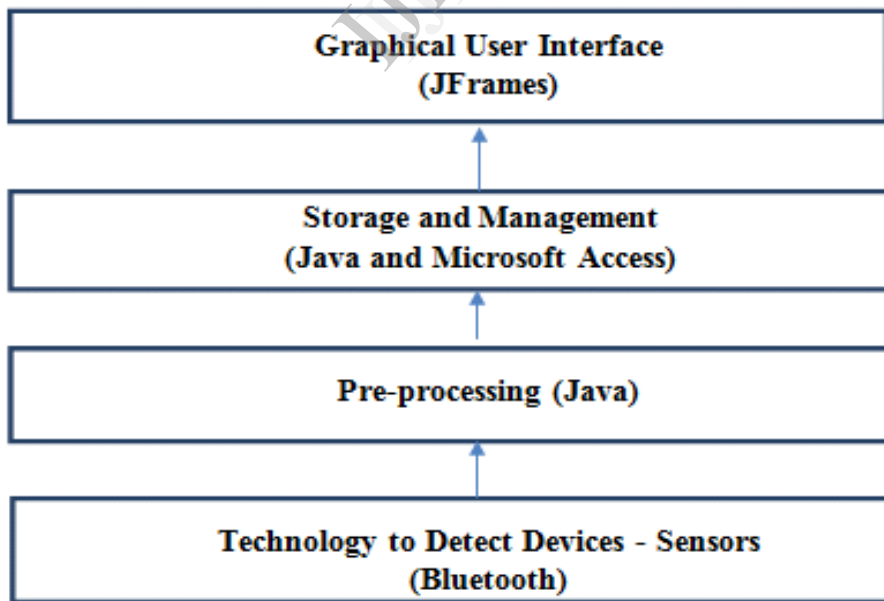**Figure 6. Sequence Diagram**
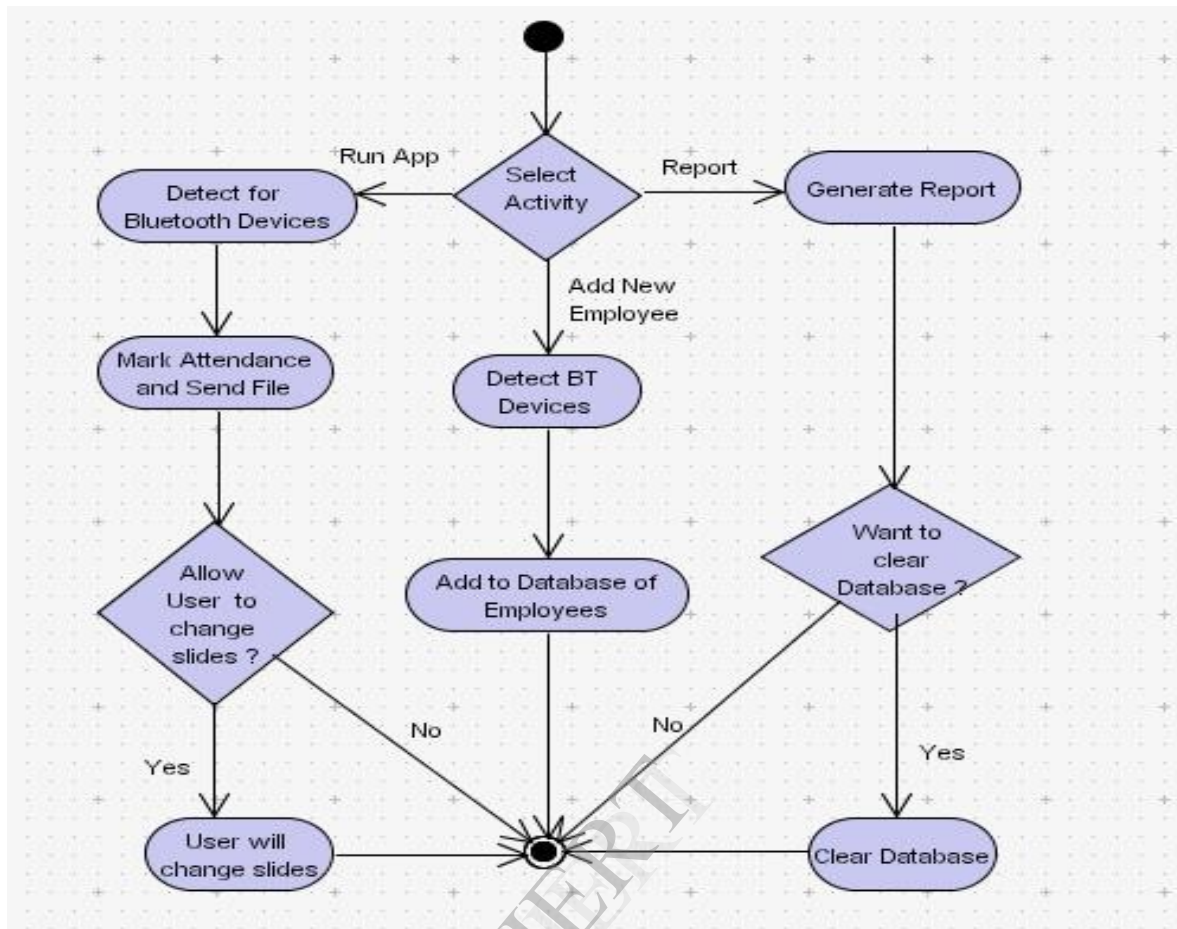

Figure 7. Architecture

Figure 8. Activity Diagram

4.   Conclusions

4.1 Conclusion

An application with context-awareness capabilities was designed to help corporate companies manage their meetings and conferences efficiently. This software can become a very efficient tool for companies, while using little resources.

Context-aware computing is gaining importance in almost every sector day-by-day, and this project gave us a chance to study the nuances of a field, which, like the name itself, will be ubiquitous in near future.

Thus, considering both the good side as well as the limitations of this application, we hope that with some modifications, this idea can be converted to a full-fledged corporate application in future, which can serve especially the small-scale companies very effectively.

4.2 Limitations

This version of Conference Assistant makes use of Bluetooth technology for collecting contextual information. A major restriction due to this is that, all the attendees of the conference/meeting have to keep their Bluetooth switched on, while coming to the conference.

But, given the ubiquitous availability of Bluetooth and its zero-cost, this limitation is considerable.

4.3 Future Scope

- This same idea can be expanded on, more effectively in the future, using more powerful devices like Zigbee and RFID sensors. This would also solve the current limitation of the system being able to operate only in a small area, but then would increase the overall cost of the hardware required.

- Specially designed interfaces can be provided to the non-Android cell phones.

- Implementation of tighter security measures to protect the integrity and confidentiality of data, as the system is to be used by corporate organizations.

5. References

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