An Enhanced Wireless System for Enterprise Tracking and Monitoring

Subrata Roy[1], Kamal Kumar Sharma[2], Sharad Chouhan[3]

[1]Student, M. Tech, E-Max group of Institutions, Ambala
[2]Professor, Dept. of ECE, E-Max group of Institutions, Ambala
[3]Assistant Professor, Deptt. of CS, E-Max group of Institutions, Ambala

Abstract: This paper will describe the design and implementation of an Enhanced Wireless Systems using Bluetooth for enterprise tracking and monitoring. The proposed system will be implemented for the academic institutions, but it can also be used in different sectors, such as company premises, canteen, stadium etc, just after some modification of the Bluetooth protocol. The report will contain the algorithm and data structure as well. This system will enable the institution authorities to reduce human effort and cut off the daily wages. Bluetooth is one of the major wireless medium of the new era. Bluetooth has been chosen as the wireless medium due to its high availability, low-cost and low-power. During the design of this project my main aim will be to make the system low-priced and easy to maintain. Each person associated with the college will be equipped with a Bluetooth badge. The Bluetooth scanners located in the entry-exit gate and different sectors of the college will scan the nearby persons and will store a record for each of them. So by the use of this enhanced Bluetooth based system the entire institution premise can avail the automation

Keywords: Wireless Systems, WPAN, Bluetooth, Automation.

I. INTRODUCTION

Institution authorities need to maintain & track huge number of data and information regarding all students, staffs and teachers. On the other hand teachers need to notice the students if they spend a long time outside of the class. The guards need to be careful and alert to track each person who enters into the college. The Librarians and other staffs need to maintain huge number of data manually during the issuance and submission of the books. All these works are time-consuming and requires lot of manpower.A system can be developed which works automatically and reduce the human efforts with accuracy. The system is implemented using Java to track, maintain and manipulate data using Database and access the Bluetooth features.

Bluetooth wireless technology is a de-facto standard for low-cost, short-range, radio links between mobile PCs, mobile phones, and other portable devices.The specifications are
released by the Bluetooth Special Interest Group (SIG)

The IEEE 802.15 Working Group for Wireless Personal Area Networks(WPAN) started a project to promote, publish and approve a standard derived from the Bluetooth specification

II. RELATED WORKS

Several wireless or mobile commerce applications depend on the knowledge of customers positions. For example, advertisers may want their advertisements to reach customers in a specific location. This is possible if the locations are estimated correctly. The required precision of estimated locations varies with applications. For example, a system that selects which Advertisements the customers should receive based upon their positions within a shopping Mall, may require more accurate location estimation than to target people who are driving towards that mall. This is achieved if the locations are estimated correctly. The required precision of estimated locations varies with applications. Location tracking systems are usually designed to provide location information of the tracked person/item.

Following two categories have been used:- (1) Tracking systems based on Triangulation method and (2) Tracking systems based on Scanning technique

Tracking systems based on Triangulation method-The RADAR [2] is a triangulation based location tracking system. This system uses radiofrequency (RF) for locating and tracking users inside buildings. RADAR operates by recording and processing signal strength information at multiple base stations positioned to provide overlapping coverage in the area of interest. It uses signal strength information gathered at multiple receiver locations to triangulate the users coordinates another system based on triangulation is described in [6]. This paper describes the empirical test results for different indoor scenarios. The system uses received signal strength indication (RSSI) to measure distances of the devices. RSSI can be affected by wall, water and other obstacles. That can reduce the signal strength. This limits the effectiveness of the RSSI-based system.

Tracking systems based on Scanning technique- The Active Badge system was an early adoption in scanning based location tracking systems. In this system, sensors

placed at known positions within a building pick up the unique identifiers emitted from the IR badges and relay these to the location manager software. Though this system provides accurate location information, but it has some drawbacks as well.Another popular technology used for personnel and/or asset tracking is radio frequency identification (RFID), which works by means of electromagnetic induction.

A Bluetooth based tracking system is described in. This system uses mobile phone terminals to build a virtual networking by combining GPS and Bluetooth technology with mobile Internet. The Bluetooth scanners perform Bluetooth discovery process and assign location information to found Bluetooth IDs based on GPS coordinates. During the SARS outbreak in November 2002, Industrial Technology Research Institute (ITRI) of Taiwan implemented a RFID based personnel tracking system to track hospital staffs within the facilities. Each employee was given a RFID tag associated with a distinct ID number. RFID readers were located in different areas of the hospital, connected to the local area network. Every time an employee was within the range of a reader, the reader created a record including the ID number, the area, and the time. Even though this system provided information about the location of an individual at any time, it failed to inform who the person was in contact with.

The Defense Science and Technology Agency of Singapore developed Hospital Movement Tracking System (HMTS) during the SARS outbreak as well. Unlike ITRIs tracking system HMTS not only tracked hospital staff, but patients and visitors as well by providing a RFID tag to every person within the hospital facilities. Even though this approach provides more data about people visits to a certain place than the ITRI system, it failed to inform who the person was in contact with.

Epidemic Communication- Data Transmission protocols play an important role in building these tracking systems. In ad hoc networks, the power supply of individual nodes is limited and wireless bandwidth is limited. Moreover, since nodes can be mobile, routes may constantly change. Thus to enable efficient communication, robust routing protocols must be developed. Distributing dynamic information across a large number of computers is a central problem in distributed systems design. Epidemic protocols offer a mechanism for information distribution without relying on central servers. Their simplicity, scalability, and good performance characteristics have made them suitable for information dissemination in ad hoc networks. Epidemic refers to information exchange mechanism where each node can be a source of information, and is capable of information transfer. The use of epidemic algorithm was introduced for database replication within networks composed of several servers. As the database is modified in a certain site, the update is replicated to other sites until it arrives to a server. Different algorithms based on epidemics, such as anti-entropy and rumor mongering, are used to spread the updates in the database to other sites. This paper also introduces the idea of infective messages, which are the updates propagated to other sites describes a partial replica update protocol for distributed databases. The protocol is based on epidemic dissemination of information throughout the network. In order to receive the update, a site communicates with another site and sends it information. The Bayou system presented the idea of sharing data, i.e. calendars, notes, etc., among mobile users. Every user carries a database and as this is modified, the updates are replicated and propagated to other users using the infra-red port of the portable computer. The update eventually arrives to the servers database and the appropriate modifications are performed. Then the server propagates this update to all the users within to network so that they are aware of this change and describes an approach based on epidemic protocol to build a semantic overlay for 7 content-based searching. This approach uses epidemic protocol to cluster peers with similar contents. It also describes the use of epidemic protocol to disseminate information among sensors or nodes. The SPIN protocol efficiently disseminates information among sensors in an energy constrained wireless network. SPIN uses the concept of meta-data negotiation to eliminate the transmission of redundant data throughout the network.

III. SYSTEM DESIGN USING BLUETOOTH

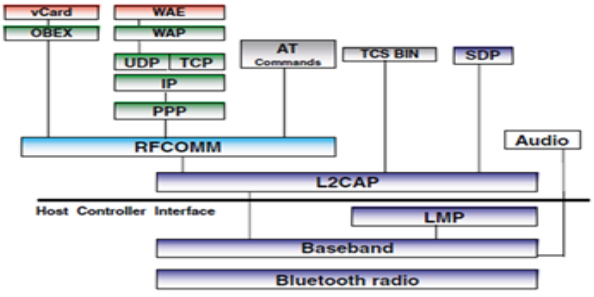
Bluetooth is a wireless technology using low power radio wave which connects computers and phones over short distance about 30ft to 150 ft.

Bluetooth protocol stack contains a Bluetooth core of Bluetooth-specific protocols:Bluetooth radio, baseband, link manager protocol (LMP), logical link control and adaptation

protocol (L2CAP), service discovery protocol (SDP).

Bluetooth radio provides the physical links among Bluetooth devices and baseband layer provides a transport service of packets on the physical links.The LMP sets-up and manages physical links.LMP also implements security capabilities at link level.The radio, baseband and LMP are used in the Bluetooth device. The device will be attached to a host, thus providing that host with Bluetooth wireless communication.

The L2CAP services are used only for data transmissions.



Bluetooth Protocol Stack

This system will be developed by the use of an enhanced new age communication protocol based on RFCOMM layer of Bluetooth stack. The protocol will be designed along with the security measurements. The security features will make the system more secure from the outside attacks and vulnerability.

The following encryption algorithm will be used to implement the security measurements.

Encryption Algorithm used:

DES(Data Encryption Standard): DES is a block encryption algorithm. It is a symmetric algorithm, means same key is used for encryption and decryption .It uses one 64-bit key. From 64 bits, 56 bits make independent key, which determine the exact cryptography transformation, 8 bits are used for error detection DES.

AES(Advanced Encryption Standard): AES is also known as the Rijndael algorithm is a symmetric block cipher. It was recognized that DES was not secure because of advancement in computer processing power. It can encrypt data blocks of 128 bits using symmetric keys 128, 192, or 256. It has variable key length of 128, 192, or 256 bits; AES encryption is fast and flexible.

The system can be designed using enhanced Bluetooth protocol as:

IV. PROPOSED METHODOLOGY

The proposed solution would comprise the following enties or modules:

At Main Gate-A scanner which scans each nearby person who enters into the gate is placed in the entry gate of the college. Person enters one by one & each and every person in college has a Bluetooth badge, the unique MAC ID of the badge is the person's college id. Scanner checks the database and if the detected MAC ID is found in the database then the scanner welcomes the person and stores the entry time of that person. If any unauthorized person tries to enter then the scanner shows "You are not authorized and go to college office!". A camera placed in the main gate takes a snapshot of the unauthorized person and the snapshot is stored automatically in database. By this procedure college authority can implement security in main gate without having any human effort. Likewise in the exit gate there is also an exit-scanner which performs likewise.

In Class-Every class is equipped with a scanner which tracks the entry, exit time of each student. College authorities can check every student's attendance and total time spent in class. Scanner stores these records automatically in college database.

Teacher Appointments-Students can request for an appointment with a particular teacher using their handheld devices. The requests for the appointments are stored in database automatically and the teacher can check and approve or deny those appointments using the proposed system.

Managing Library-The system can check the availability and location of the available books in the library.The system also provides information about the issuance date and return date of any particular book. On the other hand in library entrance there is also a programmed scanner. Each book has an attached Bluetooth badge. When each person exits from library the book's MAC ID and person's MAC ID are stored in database automatically. So by this way the issuance of the book is made autonomous.

V. TOOLS/TECHNOLOGIES/UTILITIES USED

Hardwares:

*Bluetooth enabled batch for all the authorized person
*Special Bluetooth stickers from the books
*Display screen for the main gate
*Desktop/Laptop with Bluetooth communication device at administrator.
*Bluetooth enabled computers for sending request to admin for appointment or other purpose, which can be further enhanced to some Bluetooth enabled hands on device like a mobile phone.

Softwares:

*Java Platform
1. Bluetooth enabled laptops and desktops
2. JDK
3. BLUEZ API
4. Bluetooth 2.0

*SQL Database
*JDBC

VI. CONCLUSION AND FUTURE WORK

Security features need to be imported within this system in order to prevent vulnerabilities and secure the information from the outside attackers. Further work might explore the exceptions that could hinder the proper functioning of the system and once detected can be easily removed by some simple changes in the program code. We hope that the implementation details and the design concept of this protocol will aid the wireless technology community in future. With some due work this system could become practically implacable and a huge success.

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