Pilgrim Assistance Using RFID Technology

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Abstract-Now a days**,** science and technology is at the tomb of its expansion. There are so many problems regarding the crowd control, medical emergencies, security issues, identification and tracking of the pilgrims in the holy areas. Especially during pilgrimage, the risk of the problem is at the extreme. . The paper deals with RFID technology which describes the design and implementation of a system for tracking and monitoring the pilgrims. The system consists of three sections-Pilgrim's unit, Reader unit and Server unit. The pilgrims will have the RFID tag. The pilgrim section consists of RFID reader, microcontroller and heart beat sensor unit. Every pilgrim will have a unique ID. The reader unit will send the current location and unique ID to the server unit using zigbee transceiver. The server unit consists of zigbee transceiver, microcontroller and PC unit.. The received location and unique ID will be stored into the server periodically. A heart beat sensing unit is connected to the pilgrim section to monitor the medical condition in case of emergency. The pilgrims can be thus tracked and sent the medical assistance in no time.

Keywords: Radio Frequency Identification (RFID), Zigbee module, RFID tag, RFID reader, medical assistance

I. INTRODUCTION

As an emerging technology, WSN (Wireless Sensor Networks) have lot of applications like health, security, military and several other in various domains [9][1]. Object tracking, which is also called target tracking, is a major field of research in WSNs and has many real-life applications such as wild life monitoring, security applications for buildings and compounds to prevent intrusion or trespassing, and international border monitoring for illegal crossings. Furthermore, object tracking is considered one of the most demanding applications in WSN due to its application requirement [6]. As the number of pilgrims visiting holy places has been increased, the problems faced by the pilgrims also increased.

The following are some of the common difficulties faced by the pilgrims and the authorities alike:
• Identification of pilgrims.
•Medical emergencies.
• guiding lost pilgrims to their camps.
• Crowd control.

The growing number of pilgrims has brought serious safety and health care challenges to the authorities. These pilgrims are from diverse background, social status, gender and ages. RFID is fast and reliable. It is a technology used to identify tagged objects using radio frequency mainly composed of an electronic tag attached to the object[10]. Radio Frequency Identification(RFID) technology has emerged as a practical solution to aid automatic object identification and tracking .These wireless system enable non-contact reading from a distance and their deployment is highly effective in manufacturing and other hostile environments where the employment of bar code labels was infeasible. Being a non line-of-sight technology, RFID triumphs over the bar code labels for tracking mobile objects because they can be read regardless of their orientation [5].

II. RELATED WORK

There has been quite a number of tracking and monitoring systems being developed, each of its own various means and facilities and has their own way in increasing the effectiveness of the system.

Most researches in the area of tracking systems was conducted a few years ago using dedicated GPS as trackers [12]. Wide range of these systems were used in tracking vehicles. Some of these systems uses short range message service to send location data from GPS receiver to monitoring side. Other systems used general packet radio service (GPRS) for the same purpose. After the wide spread use of mobile phones with embedded GPS receivers; several researches proposed the usage of smart phone with GPS receiver for tracking purposes. The system considered the usage of mobile phone with embedded GPS receiver or dedicated GPS devices with small size keychain patterns as trackers. All what they need is to install the application on their smart phone[3]. Many researchers avoid use of dedicated GPS devices because of cost issue. The researchers proposed a pilgrim locator system, where they suggest building special networked antennas to locate the pilgrims. The main objective of the system was to solve the crowding problem using antennas [3].

Likewise transportation control is also a main issue in crowded areas. There is an integrated solution to the problem of pilgrimage transportation control while tracking the shuttle bus from its starting point till its final destination .The application identifies a particular bus by the RFID tag fixed on it. The passengers boarding or getting down the bus are identified on the basis of RFID cards they have and finger identification [11]. One of the most widely recognized is the tracking via RFID chips. Another approach is by having object recognition where a picture, usually a landmark, is taken, using a built-in camera in any common mobile phone, to identify their location based on the picture taken. It also used the GPS to read the actual position if available and if the data cannot be obtained, it uses an approximate estimation of the cell information of the phone -network provider. As good as the system might get, it relies solely on Internet connectivity [4].

Another approach is by implementing a low cost tracking system using GPS and GPRS. The system allows a user to view the present and past positions recorded of a target object on the Google Maps through internet. It reads the current position of the object using GPS, the data is sent via GPRS service from the GSM network towards a web server. It also argues that using SMS as a means of communication with the server is expensive. The other approach for tracking and monitoring system, every pilgrim is given a mobile sensor unit that includes a GPS unit, a microcontroller, antennas and a battery .A network of fixed master

units are installed in the holy area. Upon request or periodically, the sensor unit sends its UID (User Identification) number, latitude, longitude and time [4]. The close by master unit receives the information and passes it to a server that maps the latitude and longitude information on a Google Map or any geographical information system.

All the above discussed approaches provide a means of tracking the pilgrims. In this paper, RFID technology is used to track and monitor the pilgrims in which every pilgrim will be given an RFID tag and readers are used to read the tags, including the need of urgent medical service.

III. PROPOSED SYSTEM USING RFID TECHNOLOGY

Even though many projects have been done based on the specified technology, this paper is presented with an advantage. In the proposed system, a heartbeat monitoring system is attached to the pilgrim's side. The main objective is to provide the medical assistance in no time.

Radio Frequency Identification usually incorporates a tag into an object for the purpose of identification using radio signals. RFID based localization and tracking technologies may include tag based, reader based etc. These technologies mainly use the readily available resource of radio signal strength information to localize the target objects. The challenges include multipath propagation, interference and localizing objects among others [7]. The continued increase in the number of pilgrims causes many problems such as overcrowding which results in delaying a large number of pilgrims at the main ports. Many people may get lost, especially elders, which adds to the burden of authorities to search for them. Health authorities are also facing difficulty to know the health status of the patient pilgrims when there is no document showing the health status and disease they suffered[2].Cases of missing Hajj pilgrims are not uncommon although several tracking and navigation devices have been introduced. Such a framework for tracking pilgrims in a crowded environment is the Hajj Locator [8].A typical RFID system is shown in figure 1

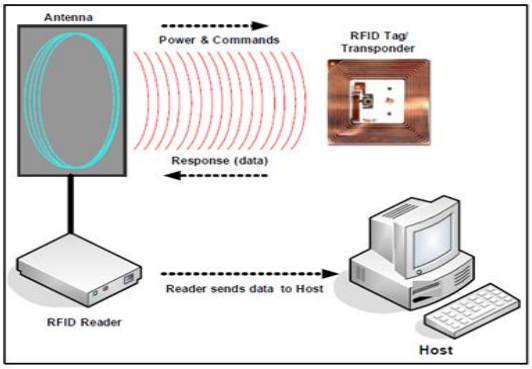

Figure 1.Typical RFID System

3.1.COMPONENTS OF THE PROPOSED SYSTEM

A) RFID Tag: An RFID Tag is a tiny silicon microchip composed of an antenna, a wireless transducer and an encapsulating material. It contains the unique ID of the pilgrims and whenever the tag detects a reader, it transmits the information stored

in it to the RFID reader in wireless mode. The components of RFID tar is shown in figure 2.

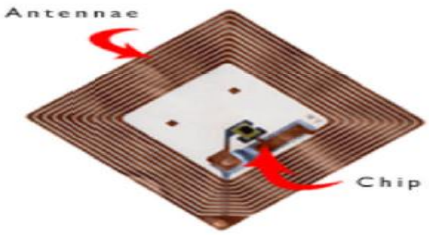

Figure 2. Components of RFID Tag

B) RFID Reader: An RFID Reader is an electronic device used to generate and receive RF signals. It can have various capabilities including reading and writing data to tags. These readers have to be deployed in every place where the pilgrims need to be monitored.

C) Heart Beat Monitoring System: This unit detects the heart beat of a pilgrim and stores the best pulse in the RFID card. The heart beat sensor generates the digital pulses which corresponds to pilgrims' heart beat. By using external interrupt in PIC, the pulse is counted and written to the RFID tag.

D) Microcontroller: The microcontroller is the main part of our system. It transmits the pilgrims' unique ID and heart beat through zigbee. In this project, the hardware is modeled to process multiple pilgrims' medical status. The controller will prioritize the data transmission according to the receiving heart beat values of pilgrims.

E) Server Unit: The server unit receives the pilgrims information via zigbee and show that to PC using RS232 connection.

F) Zigbee Module: Zigbee unit is used to transmit the reader information to the server.

3. 2. BLOCK DIAGRAM:

The block diagram can be described as three units namely : Pilgrim's unit, Reader unit and Server unit. The pilgrim unit comprises of RFID tag, RFID reader, LCD display**,** microcontroller (PIC16F877A) and heartbeat monitoring system. A heart beat monitoring system is connected to the transmitter side to detect the heart beat of a pilgrim. . The heart beat value along with the unique ID is displayed in the LCD. The block diagram of the pilgrim unit is shown in figure 3

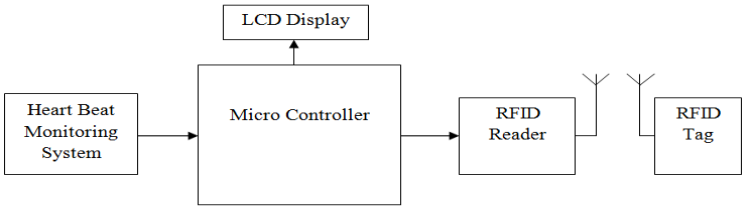

Figure 3.Block Diagram of Pilgrims unit

The reader section comprises of RFID Tag, RFID Reader, microcontroller, LCD display and zigbee module. RFID Tag contains the unique ID of the pilgrims and whenever the tag detects a reader, it transmits the information stored in it to the RFID reader in wireless mode. The PIC microcontroller will continuously send the read command to the reader to collect the pilgrims information. The block diagram of the reader unit is shown in figure 4.

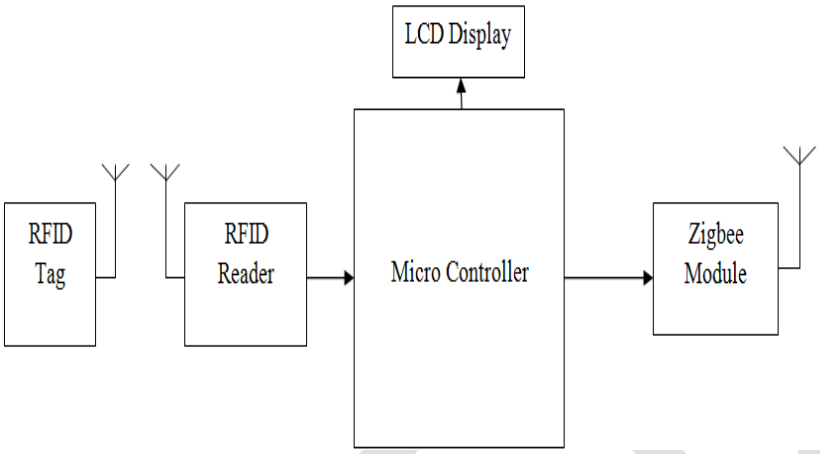

Figure 4.Block Diagram of the Readers Unit

The server unit comprises of microcontroller, zigbee module, PC and alarm. Zigbee module will receive the pilgrims information along with heart beat**.** Here an alarm can be used as an indicator. The controller will prioritize the data transmission according to the receiving heart beat values of pilgrims. The block diagram of the server unit is shown in figure 5.

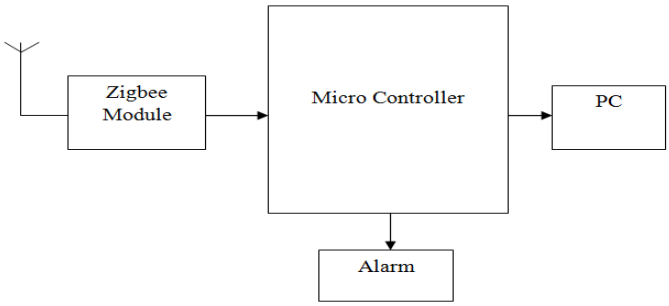

Figure 5. Block Diagram of the Server Unit

3.3 CIRCUIT DIAGRAM

The circuit diagram for the transmitting section and receiving section is shown in figure 6 and figure 7 respectively.. The circuit diagram of the transmitting section is shown in figure 3.5. The power supply unit supplies a 220v current flow through the step down motor to get12v. Then the rectifier converts the 12v AC to 12v DC .Capacitors C1 and C2 are used to avoid ripples. LM7805 regulates 12v DC input to 5v DC output.C3 is used to avoid the backup current.

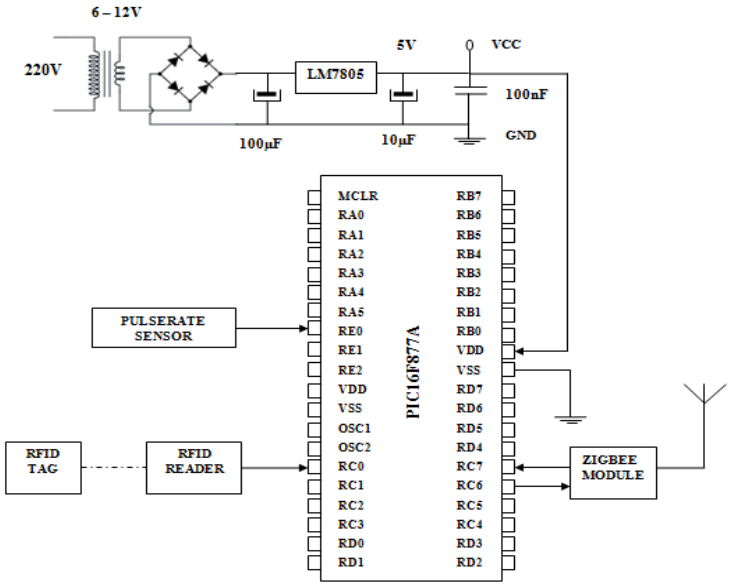

Figure 6 Circuit Diagram of the Transmitting Section

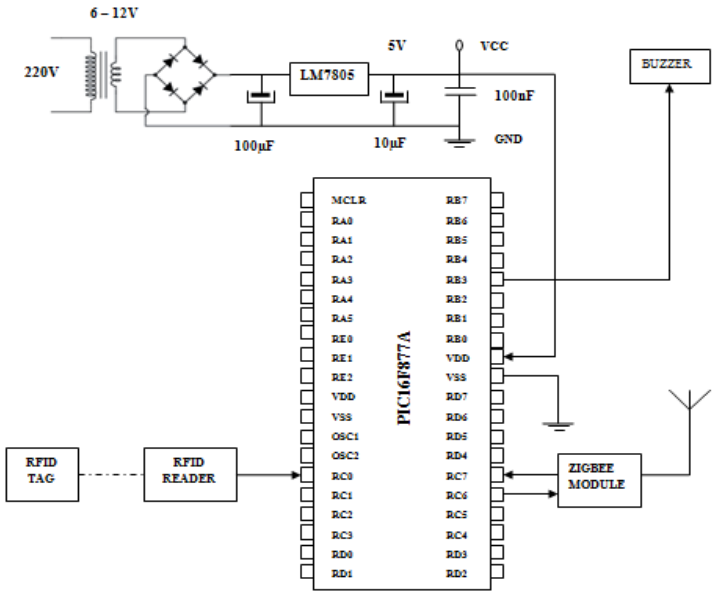

Figure 7. Circuit Diagram of the Receiving Section

IV. SYSTEM DESIGN

As proposed, the system consists of three units: Pilgrim Unit, Reader Unit and Server Unit. The pilgrims will have the RFID tag. Every pilgrim will have a unique ID. The reader unit will send the current location and unique ID to the server unit using zigbee transceiver.

The server unit consists of zigbee transceiver, microcontroller and PC unit. The received location and unique ID will be stored into the server periodically. So the information can be collected for every second.

A) Pilgrim Unit:

The pilgrim unit comprises of RFID Tag and Reader, Microcontroller and heart beat sensor unit. The heart beat sensor generates digital pulses that corresponds to the heart beat. The generated pulse is then stored into the tag. Figure 8 represents the hardware model of pilgrim unit.

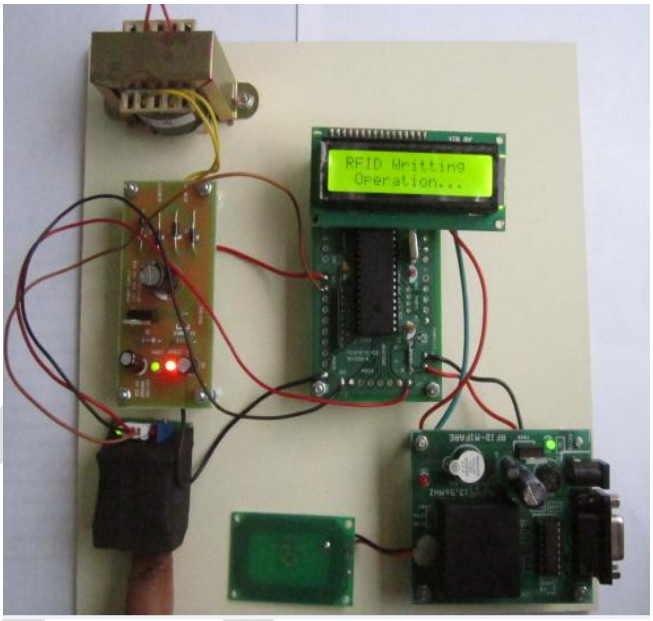

Figure 8.Pilgrim Unit

The RFID Reader will write the heart beat value to the pilgrim's RFID Tag with regular intervals. The controller used is PIC16F877A.By using external interrupt in PIC, the pulse is counted and written to the RFID Tag. The figure 6 represents the hardware model of the Pilgrim Unit .

B) Reader Unit

The reader unit comprises of RFID Tag and Reader, Microcontroller, LCD display and Zigbee module..The reader unit is placed at specific locations of the streets. Whenever a tag is detected by the reader , the unique ID(Tag ID) along with pulse rate is displayed on the LCD. Mifare card and readers are used .It is a contactless smart card technology which are just memory storage devices. Mifare card is 1k offering 1024 bytes of data storage. The main features of mifare card/reader is fast data transfer, high data integrity and true anti collision. Figure 9 represents the hardware model of the reader unit.

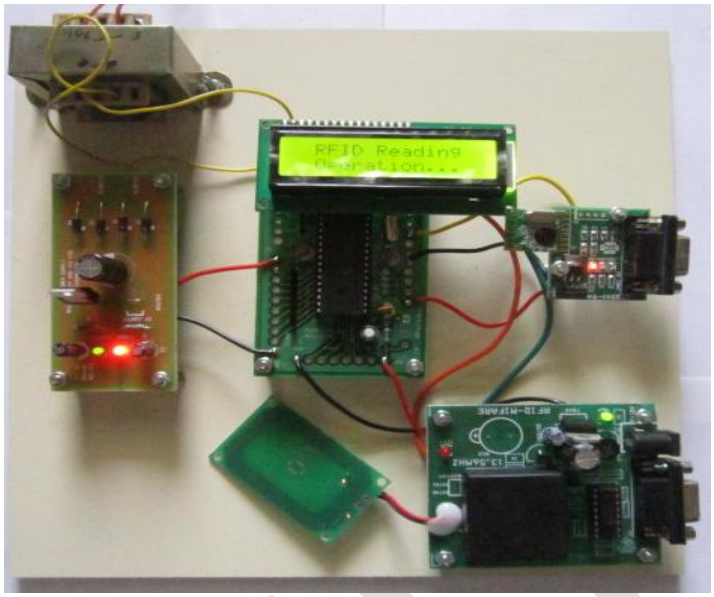

Figure 9.Reader Unit

C) Server Unit

The server unit comprises of microcontroller, Zigbee module and server.The figure 10 represents the hardware model of the server unit.

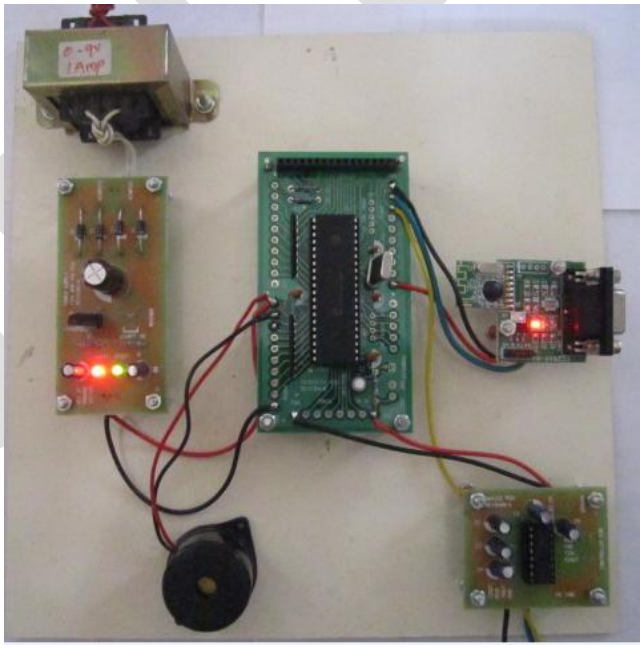

Figure 10.Server Unit

The zigbee will receive the pilgrims' information and displays it on the PC using RS232 connection. The alarm indicates the presence of an abnormal pulse rate with a beep sound. The controller will prioritize the data transmission according to the

receiving heart beat values of pilgrims. It transmits the pilgrims unique ID and heart beat through zigbee.

V. RESULT

The pulse rate in the range from 60 to 90 is considered as normal. The pulse rate can be measured by the heart beat sensor unit. The result can be thus verified by comparing two conditions: the pulse rate of the pilgrim under normal condition and abnormal condition. Figure11.1(a) shows the pilgrim pulse rate under normal condition.

Figure 11.1(a) Pilgrim pulse rate under normal condition

Each tag will be having unique ID. Here the tag ID refers to pilgrim. The tag ID corresponding to the obtained pulse rate(figure 11.1(a)) is thus displayed in the reader section.

Figure 11.1(b) Tag ID Detected

Figure 11.1(c) Corresponding Pulse Rate

Figure 11.1(b) represents the Tag ID detected and the figure 11.1(c) represents the corresponding pulse rate obtained.

The pulse rate obtained is 82.Since it is below 90, it can be opted as a normal value. Similarly, an abnormal case is also measured.

Figure 9.2(a) Pilgrim pulse rate under abnormal condition

Figure 11.2(a) represents the pilgrim pulse rate under abnormal condition. Here the pulse rate is above 90.

Figure 11.2(b) Tag ID displayed

Figure 11.2(c) Corresponding pulse rate

Figure 11.2(b) shows the Tag ID detected and figure 11.2(c) shows the corresponding pulse rate.

Thus two sets of value is obtained from different conditions. The tag data is then compared. The result of comparison is obtained at the server unit. Figure 11.3 represents detected tag IDs along with the pulse rate. The controller will prioritize the data transmitted according the receiving pulse rate of the pilgrims. Therefore the pulse rate value 92 appears first followed by the next pulse rate value,82.Also, an alarm serves as an indicator in case of an abnormal condition. It produces a beep sound when an abnormal situation is met.

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245A8D77 HB:082

245A8D77 HB:082

245A8D77 HB:082

245A8F96 HB:092
245A8D77 HB:082

245A8F96 HB:092
245A8D77 HB:082

245A8F96 HB:092
245A8D77 HB:082

245A8F96 HB:092
245A8D77 HB:082

245A8F96 HB:092
245A8D77 HB:082
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Figure 11.3Detected tag IDs along with the pulse rate

The result is thus verified.

VI. CONCLUSION

Many difficulties may occur when a large group of people gather under an area .Especially during pilgrimage, crowd control, health and security issues rise to an optimum point. Most of these problems can be solved with the help of those technological means which are acceptable in society. There is no reason for employing these technologies to solve current issues of human sufferings. Even though provisions exist, the security systems lapse due to people's ignorance. Apart from tracking, the proposed system has a great advantage. It presents an option for a pilgrim in case of medical emergency. The developed system automatically monitors the body conditions of the pilgrim which helps in getting medical aid in no time. Thus the system can satisfy the need of pilgrim without any objection.

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