Tracking for Heterogeneous Networks using Wireless Sensor Networks

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ABSTRACT
Wireless communications has emerged as one of the largest sectors of telecommunication industry. At present, there are so many problems regarding the crowd control, medical emergencies, security issues, identification and tracking of the people in the large areas. This paper is used to avoid such type of problem. In this method, Tracking the movement of people or vehicle and recognizing them for example Tracking of lost vehicles, people during skating, exact position of student in a college is crucial for the authorities. This proposed project is about building a real-time tracking system to track the people those who can’t contact directly. The system relies on a dedicated delay-tolerant wireless sensor network (WSN). Energy efficiency, robustness, and reliability are key factors in the design of the system.

A real-time people tracking system has been designed and implemented. This paper deals with GPS and GSM technology which describes the design and implementation of a system for tracking and monitoring the people, vehicles, etc. The system consists of transmitting and receiving sections. The transmitting section consists of GPS module, GSM modem, microcontroller, camera and the mobile phone or computer as a transceiver. To speed up the process and reduce the complexity, we use number of clusters which are placed in a wide area. GPRS module is used sending images. The Cluster made up of a microcontroller and Wi-Fi module. Microcontroller used to control GPS module and Wi-Fi module. The location data send through Wi-Fi transmitter and receiving the location data at Wi-Fi receiver, the exact location and the image of the object is sent to computer/mobile through GSM modem through Short Message Service.

II. RELATED WORKS

It is a Real time tracking system to track the people those who can’t contact directly. GPS and GSM technology which describes the design and implementation of a system for tracking and monitoring the people, vehicles, etc. The main objective of the system is to implement a real time people tracking embedded system by using GPS and GSM modules. This section gives the idea about the previous works. The main points and aim of the previous work is added and the disadvantage of the current system is also mentioned. Some of the related works are given below.
And the next section describes what is tracking and their advantages. These works is obtained from the five different reference papers. Related works are

In [1], every year Muslims from all over the world gather in the Holy areas for Hajj. With the increased number of pilgrims every year, the problems and difficulties facing the pilgrims and the Hajj authorities have also been on the rise - especially in crowd control and the prevention of accidents. In this paper, a solution based on RFID technology to help the Hajj authorities in the identification of pilgrims is developed.

In [2], every year, and for five days, about three million pilgrims gather in the small city of Makkah, Saudi Arabia, to perform the rituals of Hajj (Pilgrimage). Tracking the movement of such a large number of people is crucial to the pilgrims themselves and the authorities managing the whole event. This letter reports a real-time pilgrim tracking system that has been designed and implemented. Each pilgrim is given a mobile sensor unit which includes a GPS chip, a microcontroller, and antennas.

In [3], a huge number of people who are suffering from Alzheimer disease or mental and developmental retardation were reported missing every year. Thus, in order to enhance the quality of life for these particular individuals, a high quality people tracking system with low price is needed. The purpose of this project is to integrate the Global Positioning System and Global System for Mobile Communication technology for real time people tracking using Google Maps. This embedded system was divided into two parts, which are the tracking part and the displaying part.

In [4], in this paper, Vehicle tracking and locking system installed in the vehicle, to track the place and locking engine motor. The place of the vehicle identified using GPS and GSM. These systems constantly watch a moving Vehicle and report the status on demand. When the theft identified, the responsible person send SMS to the microcontroller, then microcontroller issue the control signals to stop the engine motor.

In [5], this paper describes a system developed for the tracking and identification of pilgrims in the Holy areas, in Makkah-Saudi Arabia, during Hajj (Pilgrimage). The area is already covered by a sophisticated 3.5G network by several service providers. Upon request or periodically, the mobile phone sends its UID, latitude, longitude, and time stamp. A server maps the latitude and longitude information on a Google map or any geographical information system. If the Internet connection is lost the mobile phone stores the location information in its memory until the Internet connection is restored, then it sends all stored location information and clears this information from memory. The developed system can be used to track a specific pilgrim

III. PROPOSED MODEL

The solution methodology is very simple. The main objective of this project is to develop a position data acquisition system for tracking purpose. The signal received from satellite is sent to hardware devices for further processing and finally the signal is sent to the PC for displaying on the Google Map. This project is divided into two parts which are the tracking part and a displaying part. The tracking part is responsible for obtaining the user location while the control and displaying part is for displaying the detected location on the Google Map through a C Windows Form application. The proposed model consist of 3 sections
1. Monitoring Station
2. Clusters
3. Transceiver

A. Monitoring Station
An object that carries the monitoring station and the transceiver will communicate with the monitoring station through clusters. The monitoring station contains GSM modem, Wi-Fi module, camera interface and one processor, etc. The Wi-Fi module is used to communicate the monitoring station and the clusters.

B. Clusters
Clustering is a grouping of similar objects or sensors in our context. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group are more similar (in some sense or another) to each other than to those in other groups (clusters). One cluster contain more than 2 nodes. If a system fails, cluster resource service provides the means to reintroduce or rejoin systems to the cluster and restore their operational capabilities. Clusters are the group of nodes and their interconnect. Each cluster is interact through the gateway node. The gate way node in wireless sensor network is interfaced to the Internet through gate ways. Nodes divided in virtual group according to some rules. The goal of clustering is to determine the intrinsic grouping in a set of unlabeled data. Nodes belonging in a group can execute different functions from other nodes. Clusters are capable of performing multiple complex instructions by distributing workload across all connected servers. The internal Diagram of one node is shown in figure: 3

Figure 1: Monitoring Station
Mobile or personal computer is used as a transceiver. Both transmission and reception takes place in the transceiver. When the transceiver, the information or call send to clusters and at the end the exact images is received in transceivers. Wi-Fi is a wireless network technology that can provide the wireless internet and network connection through radio wave. It determined the user’s location based on the Wi-Fi signal strength. People tracking system by using Wi-Fi technology is more economical because most of the communication devices are equipped with the wireless network. With a Wi-Fi receiver, the communication device can be used to determine a location. However, Wi-Fi only can determine the user location at areas that have wireless reception, so it is not suitable to use in the rural area and this technology also needs an extensive mapping and high power consumption.

D. Tracking

A tracking device is an electronic tag that can be used to monitor the location of an object or people by using the radio signal or satellite signal. Basically, the design of the tracking devices is depending on several factors such as the nature of the object being tracked, the information needed by the tracker and the budget of the tracker. The indoor location tracking is available with various technologies such as ultrasonic, mechanical, infrared, and inertial or radio signal measurement. The GPS is the most effective outdoor tracking system with high accuracy. The tracking devices can be categorized into two groups which are globally and locally. For local tracking system, it does not require the global coverage such as GPS. It operation based on the local technology such as Wi-Fi, Bluetooth and RFID. While for global positioning system, satellites have to be used in order to obtain the required information. The tracking system can also be divided into passive or active device. The active tracking devices will send out a constant signal continuously while the passive tracking system only will send out a signal when the user require the data.

E. Clustering

Clustering is grouping of similar objects or sensors in our context. Cluster analysis or clustering is a task of grouping a set of objects in such a way that objects in the same group are more similar (in some sense or another) to each other than to those in other groups (clusters). One cluster contains more than 2 nodes. If the system fails, cluster resource service provides the means to reintroduce or rejoin systems to the cluster and restore their operational capabilities. Clusters are the group of nodes and their interconnects. Each clusters are interact through the gateway node. The gateway node in wireless sensor network is interfaced to the internet through gate ways. Nodes divided in virtual group according to some rules. The goal of clustering is determine the intrinsic grouping in a set of unlabeled data. Nodes belonging in a group can execute different functions from other nodes. Group of independent servers interconnected through a dedicated network to work as one centralized data processing resource. Clusters are capable of performing multiple complex instructions by disturbing workload across all connected servers.

The main advantages of clustering are simple and outputs a hierarchy, a structure that is more informative, it does not require us to pre-specify the number of clusters. The disadvantages are selection of merge or split points is critical as once a group of objects is merged or split, it will operate on the newly generated clusters and will not undo what was done previously. Thus merge or split decisions if not well chosen may lead to low-quality clusters.

IV. METHODOLOGY

This chapter will discuss about the current system, its working and process flows used to complete this project. Each of the hardware devices and programming is involved in this section.
The system consists of 3 sections. They are
- Monitoring station
- Clusters
- Transceiver

The monitoring station consists of a single board computer, GPS module, GSM modem and Wi-Fi module. The transceiver is used as a mobile phone. The clusters consist of no: of nodes and each node consist of GPS module, Wi-Fi module, camera and a microcontroller.

Initially remote desktop software installed on single board computer and then the receiver monitoring single board computer. Remote desktop is used to access the remote desktop. Inside single board computer, which process is run and that process is controlled by transceiver. When the transceiver send object id to the clusters. Each cluster has number of nodes. The object is present in cluster1 then the location of cluster1 is send to the monitoring station through the Wi-Fi module. Received in monitoring station and attached to SBC. At monitoring station, the GPS location of the monitoring station is send to transceiver through the GSM module. The actual location is getting in transceiver. When the image of location is get, a request is send to each clusters and the camera capture the image of location and send to transceiver through the monitoring station.

V. SIMULATION AND ANALYSIS

The output of the project is the actual location and image of the object. The figure shows the location of the one cluster. The output of the GPS module is shown in Google map with their particular latitude and longitude.

VI. CONCLUSIONS

A WSN is wireless network that use sensors to monitor physical environment and monitors location. Using Wi-Fi module, GSM, GPS modules get an exact images. A very efficient in terms of communication cost and in terms of prolonging network lifetime can be achieved as a conclusion; this work explores the foundation of GPS, GSM, Arduino and C programming and uses all of these concepts to prototype a real time people tracking system. The design and simulation of this system has been successfully completed. The software integration meets the requirements and works as expected. Besides that, all the objectives of this project were achieved.

REFERENCES