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GPS and Bluetooth Based Object Tracking System

Rupen Paul V[1], Adithi Reddy[2], Sujith PS[3], Aneesh M[4]

Department of Computer Science, Christ University, Bangalore, India[1, 2, 3, 4]

Abstract: This paper presents an object tracking system to track the objects through GPS and Bluetooth technology. Objects are usually tracked by the implementation of signal strength based on GPS, GSM, RFID and Bluetooth. We make use of Global Positioning System (GPS) for tracking long range objects and Bluetooth technology for short range objects. The system allows a user to view the present position of the target object on Google Map through an android application. Hence each target object will have a tag that has both GPS and Bluetooth module. The experimental results suggest that many belongings lost through misplacement or robbery can be found within a short span of time by making use of the object tracking system.

Keywords: GPS, GPRS, RFID, Bluetooth.

I. INTRODUCTION

In our day to day life, people losing their belongings like keys, pen-drives, wallets and hand-purses have become a common issue. Either the belongings are lost through misplacement or through robbery. It takes a lot of effort to go in search of the lost belongings and even results in waste of time especially, when they are of utmost need.

On the other hand when there are robberies happening from homes, the owner depends on the police to find for their belongings like jewelry etc. The police never assure the owners a deadline for getting back their belonging because it's a long process that takes a long period of time. Sometimes even after a long period of searching, the police will never find their belonging. This again results in waste of time and effort.

A solution to overcome these issues is by using a system that will find our belonging in a short span of time without much human effort. In this direction, this paper presents a Global Positioning System (GPS) and Bluetooth based Object Tracking System that finds our belonging been misplaced in a short period of time without much effort. The system consists of Global Positioning System GPS for long range and Bluetooth module for short range. Here, a mobile application is created that can be used only on smart phones, as an interface between the wireless sensors and the user. The transmitter end sends a signal to the receiver sensor, which after being traced will start ringing if the object is in a short range from the user, to notify the user as to where the lost item is. A GPS system is used to locate the lost item if it is out of a specified range.

The paper is organized as follows. Section II is about related work which describes on different technologies used in object tracking system. Section III gives a brief system overview. Section IV describes about the various hardware and software specifications in the proposed system. Section V presents the system architecture and describes about the modules in the proposed system. Section VI describes the experimental results of the proposed system. Section VII concludes the paper.

II. RELATED WORK

In [1], the paper deals with the comprehensive study of GPS space segment and Control segment. A detailed overview of GPS navigation message format, satellite tracking and selection process, frequency planning, C/A code generation and timing is studied and illustrated. Also, the user end implementations of location measurement processing algorithms are discussed. In [2], the paper deals with asset tracking using RFID. Here, the proposed mobile device uses Radio Frequency Identification (RFID) to keep track of registered objects that are within range of the user. The assets are attached with RFID tags with unique identifiers for each tag by using EPC Gen2. [3] The paper discusses various techniques that have emerged for estimation of location and tracking of stationary and mobile objects both in the open terrain as well as inside a building. The objective of their research has been to provide a seamless, sensor fused tracking system in which data from various sensors may be processed using Kalman filters or more general Particle filtering algorithms. In [4], the paper proposes and implements a low cost object tracking system using GPS and GPRS. Here the system allows a user to view the present and the past positions recorded of a target object on Google Map through the internet and reads the current position of the object using GPS, the data is sent via GPRS service from the GSM network towards a web server using the POST method of the HTTP protocol.

III. SYSTEM OVERVIEW

The proposed system works in two phases: tracking phase and mapping phase. In the tracking phase the mobile device's application developed in Android using the mobile phone, the GPS receiver fetches the GPS location, after calculating the exact location it further creates a GPRS packet. The same application later sends this GPRS packet to the server which stores the data in a Mobile Object Database (MOD) developed in MySQL. The next phase is mapping phase in which the data is fetched from the database and is displayed on the Google map on the

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mobile application to find the object that is misplaced from the specified range. For the short range, the transmitter end sends a signal to the receiver sensor, which after being traced will start ringing, to notify the user as to where the lost item is.

IV. HARDWARE AND SOFTWARE SPECIFICATIONS

A.The hardware components used in the proposed system are as follows:

Global Positioning System (GPS)
A GPS is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or Internet-connected computer, using a cellular (GPRS or SMS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analysing the track later, using **GPS tracking software**. Data tracking software is available for smartphones with GPS capability.

Bluetooth
Bluetooth is a wireless technology standard for exchanging data over short distances. It is a packet-based protocol with a master-slave structure. One master may communicate with up to seven slaves in a piconet. All devices share the master's clock. Packet exchange is based on the basic clock, defined by the master, which ticks at 312.5 µs intervals. Two clock ticks make up a slot of 625 µs, and two slots make up a slot pair of 1250 µs. In the simple case of single-slot packets the master transmits in even slots and receives in odd slots. The slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long, but in all cases the master's transmission begins in even slots and the slave's in odd slots.

Arduino
Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. Arduino boards may be purchased preassembled or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch.

The present work is based on a family of micro-controller board designs manufactured primarily by Smart-projects in Italy, and also by several other vendors, using various 8-bit Atmel AVR micro-controllers or 32-bit Atmel ARM processors. These systems provide sets of digital and analog I/O pins that can be interfaced to various extension boards and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the micro-controllers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C and C++ programming languages.

Connecting Wires
The wires are used for connecting the fingerprint sensor to Arduino and from Arduino to the bread board. Only through these connecting wires, the power is supplied to the system and simultaneous operations are performed.

Bread Board
A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solder-less breadboard (AKA plug-board, a terminal array board) became available and nowadays the term “breadboard” is commonly used to refer to these. “Breadboard” is also a synonym for "prototype". Because the solder-less breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solder-less breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. A strip-board and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

B.The software specifications are as follows:
Arduino IDE
The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

Android Studio
Android Studio is the official integrated development environment (IDE) for developing for the Android platform.

V. SYSTEM ARCHITECTURE

The system architecture diagram is shown in Fig. 1. The design of GPS and Bluetooth based object Tracking System comprises of the following modules:

Bluetooth Module
The Bluetooth module is used to track objects in short range. Firstly the objects should be registered with the object name and id in the registration application. Then the Bluetooth module is used to receive signals from the GPS module. The signals are used to turn on a buzzer. Based on the sound of the buzzer the user will track the device.

GPS Module
In GPS module, we determine the long range position of an object by means of communicating with the satellite and sending the latitude and longitude coordinates to an android mobile. The coordinates are then mapped using Google Maps.

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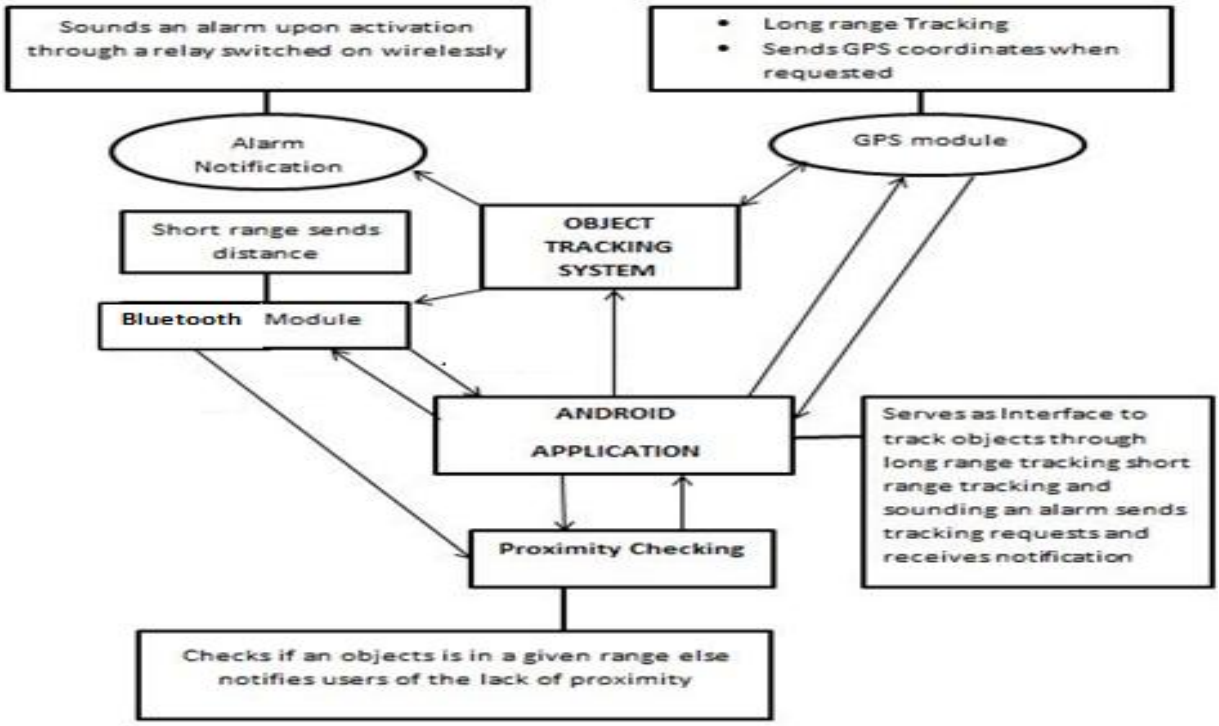

Fig. 2 System Architecture

The potential ability of Global Positioning System (GPS) to assist navigating and tracking application facilitates in determining precise object positioning on earth. In order to efficiently execute tracking operation, GPS is dependent on various parameters viz. reliability of RF communication link, satellite geometry, GPS antenna placement, parameters to decode NMEA (National Marine Electronics Association) format that the GPS receiver obtains etc. All the information gathered is then analyzed to accurately track the object in real- time.

VI. EXPERIMENTAL RESULTS

The system has been tested by finding many misplaced objects both in short range and in long range. The system is reliable, time consuming and requires very little effort. The algorithm used for finding the location of the misplaced object in a long range, is called the map matching algorithm.

Along with development of the GPS system, one of important performance parameters to evaluate a navigation system is how to match GPS track with the road in electronic map accurately. Now many systems use the shortest distance algorithm to match with the electronic map. But GPS's error, city environment and road complexity often lead to inaccurate matching. To solve this problem, a GPS-navigation-system-based combination map matching algorithm that combines the shortest distance algorithm and the assistant map matching algorithm which based the experience of the GPS navigation system. Then the correctness of the algorithm is tested by actual running, it can make GPS track and the electronic map to match accurately and reliably.

VII. CONCLUTION

This paper presents a low cost tracking system using GPS and Bluetooth, which is suitable for wide range of applications all over the world. The combination of the GPS and Bluetooth provides real time tracking. The cost is much lower since GPS is now available in almost all the smart phones. Free Google map reduces the monthly bundle cost for the individual user. It is expected that the full implementation of the proposed system would ultimately replace the traditional and costly SMS based tracking systems.

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