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A Review on Comparative Analysis of Indoor and Outdoor Positioning Technology

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ABSTRACT:In this paper, we propose a systematic approach to Real-Time Location Systems (RTLS) using radio frequency identification (RFID) technology and Global Positioning Solutions (GPS), are all examples of location-based services (LBS). While most people are familiar with GPS based Smartphone applications that offer outdoor location tracking, enterprise-grade location technologies including RTLS are employed in a variety of markets, such as retail, manufacturing, hospitality, and healthcare. Location tracking is basically divided into two types- 1. Indoor Positioning Technology 2. Outdoor Positioning Technology.

Here in this review paper, we describe how GPS Tracking System works and where it is useful in real world environment. We analyze the design criteria of RFID and present the design of the RFID reader in detail to support Industries and will improve the work quality in industries. We also jointly consider the scheduling of the read attempts and the deployment of RFID tags based on the navigation requirements to support seamless navigations. The estimation of the person position and its accuracy are also investigated.

KEYWORDS: RTLS, RFID, GPS, Location based system

I. INTRODUCTION

In recent years, the Global Positioning System (GPS) has been commonly employed for outdoor positioning and location tracking. On the other hand, there has also been growing interest in developing indoor location tracking systems. Advancements in radio frequency identification (RFID) technology make it a promising technology for use in indoor location tracking systems. In this project, the comparison of indoor an RFID-based location tracking system network architecture, which can provide flexibility for system implementation and cost-effectiveness for system maintenance and outdoor GPS system will be analyse. The proposed system employs active RFID technology to estimate the location of users/objects. It can be used for various purposes, such as asset management and customer relationship management.

A. GPS (Global Positioning System)

Global Positioning System is globally used for the tracking and navigation purpose.In this project it describe how GPS Tracking System works and where it is useful in real world environment.The Global Positioning System (GPS) technology is a satellite-based navigation system that has been use since fortyyears. It was designed for military purposes. It is being used for geology, navigation, farming, precision mapping, surveying, and additional applications are on stand growing.

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Fig 1. Object Tracking System Using GPS and GSM

Now a days, also smart phone provide the built in facilities for the navigation and tracking. So there is reduction in the size of the GPS receivers and the integration of GPS with mobile phones

B. RFID (Radio Frequency Identification)

Nowadays, RFID has been recognized as an emerging technology for ubiquitous positioning (UP), especially in an indoor environment. The development and implementation of RFID-based positioning technology are very fast. This project provides an overview of state-of-the-art RFID technology, particularly for the purpose of indoor positioning. As intelligent RFID technology continues to develop, in conjunction with intelligent sensor technologies, RFID has been becoming the core technology of the Internet of things (IoT).

C. Objectives

1) Exploring Comparison of indoor and outdoor tracking systems.
2) Developing separate tracking system using GPS and RFID
3) Analyze the results for both system and compare RFID and GPS based on obtain parameters.

II. LITERATURE REVIEW

Yuntian Brian Bai et.al. [12], The development and implementation of RFID-based positioning technology are very fast, whilst according to the literature, little comprehensive review and convinced assessment for the latest RFID technology have been conducted, and some of the main features of the latest RFID technology have rarely or unclearly been presented in the literature, for example, the longest reading range of RFID systems, the smallest tag size and overall commercial application fields. This paper provides an overview of state-of-the-art RFID technology, particularly for the purpose of indoor positioning. It includes a review of historical and current development of RFID technology and its applications, an evaluation of up-to-date RFID-based positioning techniques and their performance as well as a prediction of future trends of RFID-based indoor positioning techniques. This paper can be a valuable guidance and solution for researchers and other end users to better understand RFID and critical factors considered on system requirements, hardware selection and positioning performance for various applications.

Abha Damani et.al. [13], Global Positioning System is globally used for the tracking and navigation purpose. GPS is mainly used in the military, farming, civil, transportation and commercial users around the world. Here in this review paper, we describe how GPS Tracking System works and where it is useful in real world environment. We compare different algorithms like Localization algorithm, kalman filter algorithm and methodologies like GPS, GPRS, GSM, GIS, GSM and RFID. We have identified some problems of GPS.

Felix C. P. Hui et.al. [14], the Global Positioning System (GPS) has been commonly employed for outdoor positioning and location tracking. On the other hand, there has also been growing interest in developing indoor location

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tracking systems. Advancements in radio frequency identification (RFID) technology make it a promising technology for use in indoor location tracking systems. In this paper, we present an RFID-based location tracking system using a peer-to-peer (P2P) network architecture, which can provide flexibility for system implementation and cost-effectiveness for system maintenance. The proposed system employs active RFID technology to estimate the location of users/objects, and ZigBee to build a P2P network for communication purposes. It can be used for various purposes, such as asset management and customer relationship management.

III. BLOCK DIAGRAM AND FUNCTION

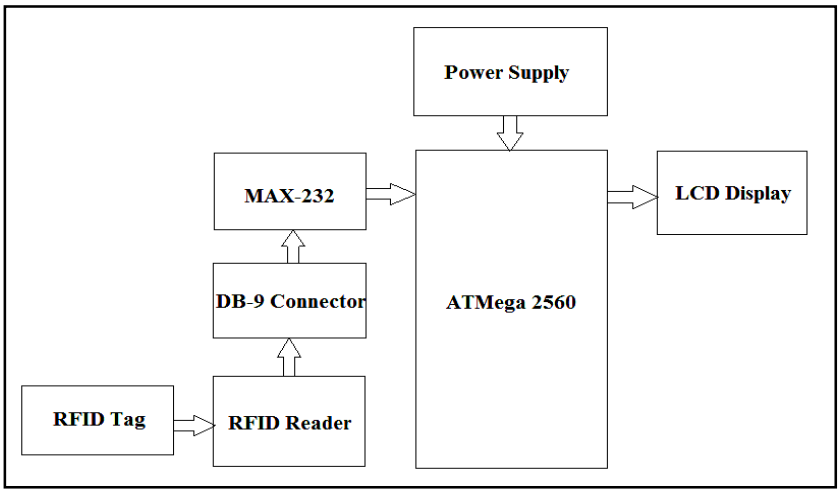

Fig2. Block diagram of outdoor positioning system

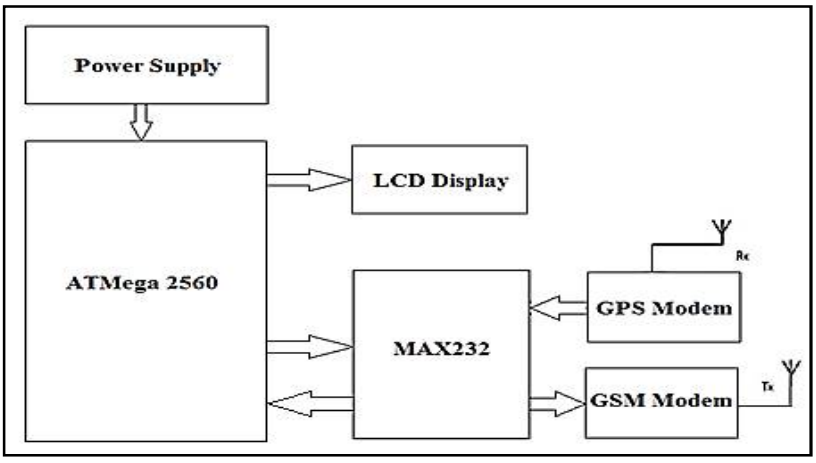

Fig 3. Block Diagram of Indoor Positioning System

1) ATMega2560- The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 256KB ISP flash memory, 8KB SRAM, 4KB EEPROM, 86 general purpose I/O lines, 32 general purpose working registers, real time counter, six flexible timer/counters with compare modes, PWM, 4 USARTs, byte oriented 2-wire serial

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interface, 16-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device achieves a throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts.

2) GSM modem (Global System for mobile communication): GSM is a digital mobile telephony system. It operates at either the 900MHz or 1800MHz frequency band.

4) **GPS-SIM18C-** A GPS navigation device or GPS receiver, commonly referred to simply as a GPS, is a device that is capable of receiving information from GPS satellites and then to accurately calculate its geographical location. The Global Positioning System (GPS) is a global navigation satellite system (GNSS) made up of a network of a minimum of 24, but currently 30, satellites placed into orbit by the U.S. Department of Defense. GPS module continuously transmits serial data in the form of sentences according to NMEA standards. The latitude and the longitude values of the location will be sending. Table for NMEA output sentence is as shown below-

Table I. NMEA Output

Option	Description
GGA	Time, Position and fix type data
GSA	GPS receiver operating mode, active satellites used in the position solution and DOP values
GSV	The number of GPS satellites in the view satellite ID numbers, evevation, azimuth and SNR values.
RMC	Time, date, position, course and speed data. Recommended minimum navigation information.
VTG	Course and speed information relative to the ground

4) RFID Module-

RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies, but the most common and widely used & supported by Reader is 125 KHz. An RFID system consists of two separate components: a tag and a reader. Tags are analogous to barcode labels, and come in different shapes and sizes. The tag contains an antenna connected to a small microchip containing up to two kilobytes of data.

A. Principle of RFID Technology

RFID technology is an emerging technology that allows for mobility tracking of objects or people. There are mainly three types of RFID systems: passive, semi-passive and active systems. A typical RFID system contains tags (also referred to as transponders, smart tags, smart labels, or radio barcodes), a reader (also called writer, decoder, interrogator, transmitter, receiver, or transceiver), and a host computer and software/infrastructure.

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Figure 5 shows the work principles of a typical passive RFID system. The power source of a passive tag is provided by the reader. When a radio signal is sent from a reader, when the tag enters the signal field of the reader, it will be powered on by the signal; the reader then captures the ID and data from the tag and sends this information to the host computer. The computer, with RFID middleware installed on, processes the data and sends it back to the reader; the reader then transmits the processed data to the tag. Passive RFID systems are normally used for applications in shorter reading ranges.

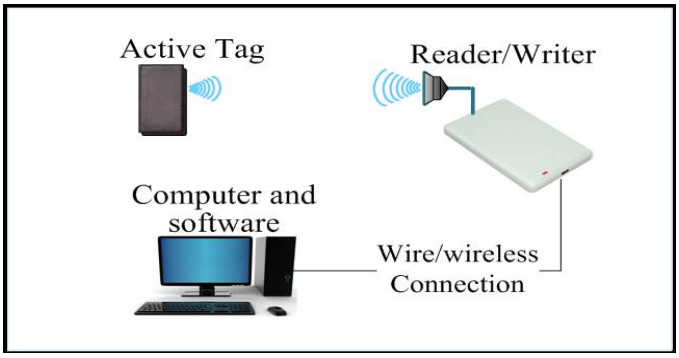

Fig 4. A typical Passive RFID System

The principles of an active RFID system are slightly different from a passive system as shown in Figure 6 An active RFID system usually uses active RFID tags (with a battery built in) and each tag periodically transmits its data which may contain identification and other application-specific information such as location, price, color, and date of purchase. The RFID reader will cross-reference the tag's data within its self-contained database. Compared to a passive system, an active RFID system can simultaneously read several tags in the field, its reading range is longer and its power required is less.

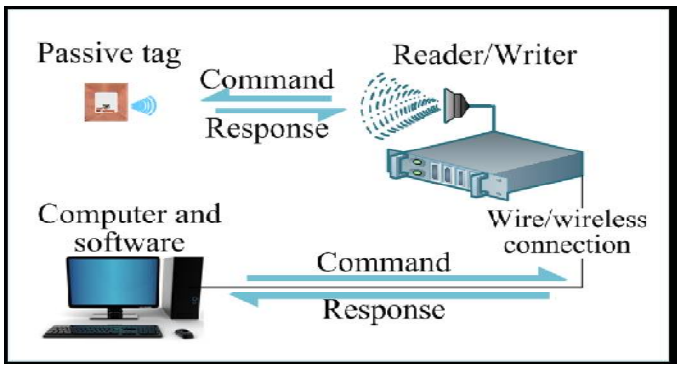

Fig 5. A typical Active RFID System

The principles of a semi-passive RFID system are similar to that of the passive system, except that there is a battery embedded in the semi-passive tag. The battery provides an on-board power source for the telemetry and sensor asset monitoring circuits of the tag so that the tag have more power to communicate. However, the on-board power is not directly used to generate radio frequency (RF) electromagnetic energy.

RFID Tags

RFID tags can be also classified into three types: passive, active and semi-passive (also known as battery-assisted passive, or BAP). A typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate. The microchip can store data from 26 bits to 128 kilobytes.

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Although both active and passive tags use RF energy to communicate with a reader, they are fundamentally different in the method of powering the tags. An active tag uses an internal power source, usually batteries, within the tag to continuously power the tag and its RF communication circuits, whereas a passive tag completely relies on RF energy transferred from the reader. This distinction may have significant impact on the functionality of the system. Semi-passive tags overcome two key disadvantages of pure passive RFID tags, one is the lack of a continuous source of power for the circuits and the other is the short reading range. Semi-passive tags are ideal for rapid development of customized RFID tags.

RFID Readers

An RFID reader reads data from RFID tags and it acts as a conduit or bridge between RFID tags and the controller or middleware. The most important feature of a reader is its reading range, which can be affected by a number of factors such as the frequency, the antenna gain, the orientation and polarization of the reader antenna, the transponder antenna and the placement.

Table II

Band	**LF**	**HF**	**UHF**	**SHF**
Frequency	30 –300 kHz	3–30 mHz	300 mHz-30gHZ	3-30 gHz
Wavelength	10 – 1 km	10 – 10 m	1 – 0.1 m	10 – 1 cm

IV. CONCLUSION

In conclusion, we have presented an RFID-based indoor location tracking system and outdoor GPS based Tracking system. The proposed system makes use of active RFID technology for identifying and tracking people and objects. Global Positioning System satellites transmit signals to equipment on the ground. GPS receivers passively receive satellite signals; they do not transmit. GPS receivers require an unobstructed view of the sky, so they are used only outdoors and they often do not perform well within forested areas or near tall buildings. In this system the comparative analysis of Indoor and Outdoor is analyzed.

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Advantages and Disadvantages of Tracking System

1) **GPS**

1. Easy of navigation and localization
2. Search based on area
3. Weather information is determine
4. World Wide availability

2**) RFID**

1. Not require to line of sight should be clear.
2. Easily perform the data updation.
3. Human interaction is not requiring.
4. RFID tags is easily install in any place

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5. Its size and weight is small then easily carry out to anywhere.

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