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Intelligent Tracker

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Abstract-- This project "Intelligent Tracker" is used to find the misplaced or lost or stolen objects with the use of a radio frequency identification tags which frequently sends the messages about the location of the object to the mobile on which the "Intelligent Tracker" app is installed from the play store. This app is generally used to find the smaller objects like wallets, keys, spectacles and any other objects which we generally used to misplace. The "Intelligent Tracker" is used to find the position or the exact location of the object with the use of Radio Frequency identification tags.

Keywords-- *Radio Frequency Identification Tags, Intelligent Tracker App, Alarming device*

I. GLOBAL POSITIONING SYSTEM

A. Introduction

The "Global positioning system" or GPS is a satellite-based navigation system which is used to track the exact location of the person with the use of the hand-held devices or laptops which uses the GPS devices. This works 24 hours a day and is used in all climatic conditions.

B. Calculating a position

There are four satellites in each of 6 orbital planes. Each plane is inclined 55 degrees relative to the equator, which means that satellites cross the equator tilted at a 55-degree angle. The system is designed to maintain full operational capability even if two of the 24 satellites fail. GPS satellites complete an orbit in approximately 12 hours, which means that they pass over any point on the earth about twice a day. The satellites rise (and set) about four minutes earlier each day. The four satellites obtain the location of the GPS device, computes the average distance of the GPS device from each of the four satellites which gives out the exact location of the GPS device.

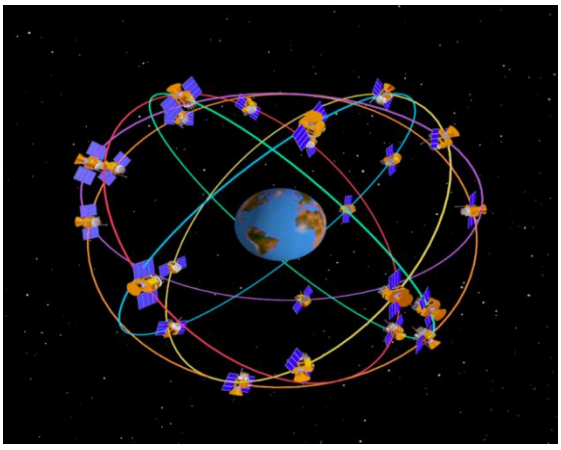


Figure 1: Global Positioning system

C. Disadvantage

The GPS signals are restricted only to the open surfaces and is not available in the closed atmosphere, since the waves from the satellites cannot travel into the closed regions(i.e.) buildings or dense forests or roof tops. Since the GPS does not work in closed atmosphere there arises a difficulty in tracking the exact location of the object inside the buildings. For this purpose, radio waves ,magnetic fields or acoustic signals are used to track the position of the device within the buildings.The "Indoor positioning system" is used for this purpose.

II. INDOOR POSITIONING SYSTEM

Indoor positioning systems (IPS) is used to locate people or objects inside a building using radio waves, magnetic fields, acoustic signals, or other sensory information collected by a smartphone device or tablet. These systems are used to detect and track a position of the object. The sensors such as gyroscope, compass, accelerometer and altimeter are combined with the Wi-Fi and Bluetooth to find the exact location of the object indoor.

1. The one way of using the indoor positioning system generally is that requires the indoor maps with the start, middle and the end points to be recorded on to the mobile phones. Once it is recorded and is stored in the database then IPS tracks the device indoor.
2. The other method of using the IPS is by using the magnetic positioning. Magnetic positioning can offer pedestrians with smartphones an indoor accuracy of 1–2 meters with 90% confidence level, without using the additional wireless infrastructure for positioning. Magnetic positioning is based on the iron inside buildings that create local variations in the Earth's magnetic field. Un-optimized compass chips inside smartphones can sense and record these magnetic variations to map indoor locations.

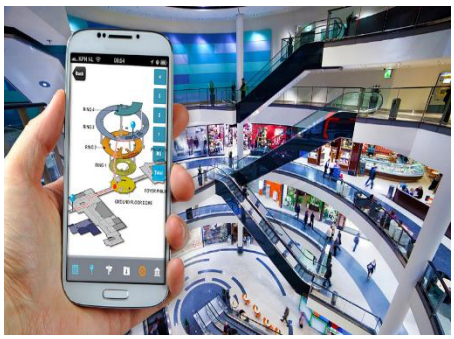


Figure 2: Indoor positioning system

The IPS also uses WIFI to find the position of the person within the building with the use of WIFI hotspots or with the use of the WIFI routers. This finds the mobile with the use of the triangular signal strength within the range of the hotspots.

III. RADIO FREQUENCY IDENTIFICATION

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader 's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader.

The RFID tags are incorporated into the product or animal or person for the purpose of identification of tracking using radio waves.

Figure 3: Small RFID chips

These are small transponders (combined radio receiver and transmitter) that will transmit identity information over a short distance. The other piece to make use of RFID tags is an RFID tag reader. Most RFID tags contain at least two parts.

1. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions.
2. The second is an antenna for receiving and transmitting the signal.

The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur. The action could be as simple as raising an access gate or as complicated as interfacing with a database to carry out a monetary transaction.

The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.

IV. RFID TAGS

A. Active Tags

Active RFID tags have a transmitter and their own power source (typically a battery). This tags periodically transmits ID signal. The power source is used to run the microchip's circuitry and to broadcast a signal to a reader (the way a cell phone transmits signals to a base station).

B. Passive Tags

Passive tags have no battery. Instead, they draw power from the reader, which sends out electromagnetic waves that induce a current in the tag's antenna. Passive tags wait for a signal from an RFID reader. The reader sends energy to an antenna which converts that energy into an RF wave that is sent into the read zone. Once the tag is read within the read zone, the RFID tag's internal antenna draws in energy from the RF waves. The energy moves from the tag's antenna to the Integrated chip and powers the chip which generates a signal back to the RF system. This is called backscatter. The backscatter, or change in the electromagnetic or RF wave, is detected by the reader (via the antenna), which interprets the information.

C. Semi-Passive or Battery-assisted Passive Tags

Semi-passive tags use a battery to run the chip's circuitry, but communicate by drawing power from the reader.

V. READER ANTENNA

RFID readers and reader antennas work together to read tags. Reader antennas convert electrical current into electromagnetic waves that are then radiated into space where they can be received by a tag antenna and converted back to electrical current. Just like tag antennas, there is a large variety of reader antennas and optimal antenna selection varies according to the solution's specific application and environment.

The two most common antenna types are linear- and circular-polarized antennas. Antennas that radiate linear electric fields have long ranges, and high levels of power that enable their signals to penetrate through different materials to read tags. Linear antennas are sensitive to tag orientation; depending on the tag angle or placement, linear antennas can have a difficult time reading tags. Conversely, antennas that radiate circular fields are less sensitive to orientation, but are not able to deliver as much power as linear antennas.

Choice of antenna is also determined by the distance between the RFID reader and the tags that it needs to read. This distance is called read range. Reader antennas operate in either a "near-field" (short range) or "far-field" (long range). In near-field applications, the read range is less than 30 cm and the antenna uses magnetic coupling so the reader and tag can transfer power. In near-field systems, the readability of the tags is not affected by the presence of dielectrics such as water and metal in the field. In far-field applications, the range between the tag and reader is greater than 30 cm and can be up to several tens of meters. Far-field antennas utilize electromagnetic coupling and dielectrics can weaken communication between the reader and tags.

VI. READERS

RFID systems can be classified into three types.

1. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only). The reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0–600 m), allowing flexibility in applications such as asset protection and supervision.
2. An Active Reader Passive Tag (ARPT) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags.
3. An Active Reader Active Tag (ARAT) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.

Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly-defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be hand-held or mounted on carts or vehicles.

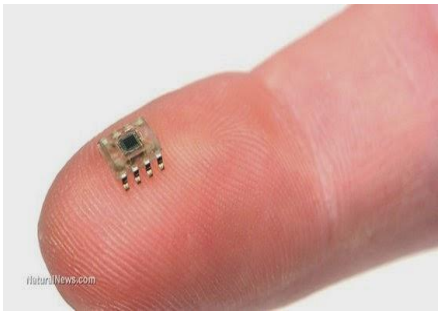
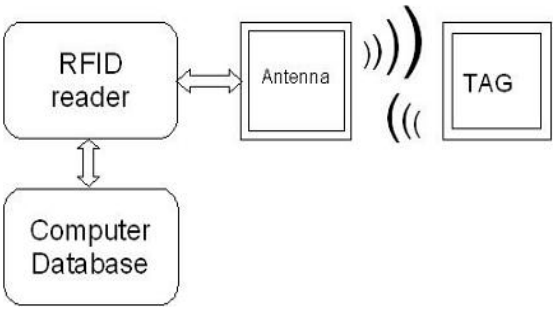


Figure 4: RFID tags

VII. WORKING OF RFID

The tag's chip or integrated circuit (IC) delivers performance, memory and extended features to the tag. The chip is pre-

programmed with a tag identifier (TID), a unique serial number assigned by the chip manufacturer, and includes a memory bank to store the items' unique tracking identifier (called an electronic product code or EPC).



The electronic product code (EPC) stored in the tag chip's memory is written to the tag by an RFID printer and takes the form of a 96-bit string of data. The first eight bits are a header which identifies the version of the protocol. The next 28 bits identify the organization that manages the data for this tag; the organization number is assigned by the EPCglobal consortium. The next 24 bits are an object class, identifying the kind of product; the last 36 bits are a unique serial number for a particular tag. These last two fields are set by the organization that issued the tag. The total electronic product code number can be used as a key into a global database to uniquely identify that particular product.

The RFID has a transponder or a tag, an antenna which is connected to a computer and software or an infrastructure(i.e.) an integrated circuit for processing and storing information. The RFID antenna or reader sends the radio wave signal and the transponder in turn receives the radio wave signal, induces an electrical current and sends the response as radio waves back to the reader. For this purpose, no physical connection between the tag and the reader is needed.

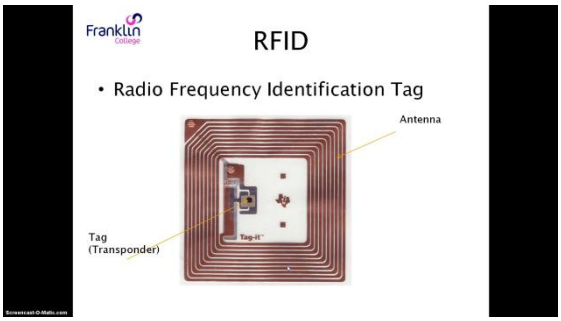


Figure 5: RFID tag structure

VIII. RFID IN INTELLIGENT TRACKER

The RFID tags are fixed onto the objects such as spectacles, wallets, keys, watches or on any other objects. Download the "Intelligent Tracker" app and then fix the mobile phone and the RFID chip reader together. Once if the app is downloaded, it is registered and the details are stored in the database and the confirmation message is sent to their respective e-mail. Once the confirmation is done the process of the object detection starts. Scan the vicinity of the area. Although each RFID chip reader is different, RFID chips will generally emit a frequency that will cause the chip reader to produce a beeping noise to indicate the presence of RFID chips. Follow the signal strength with the increase in the series of beeps from the RFID chip reader. If your RFID chip reader has the ability to detect the direction of the frequency, the device will be able to tell you exactly what direction the RFID chip is located.

Figure 6: RFID Chip reader attached to mobile phones

The RFID reader is used for tracking the tags within its range. The "Intelligent Tracker" app which is installed in the mobile phones displays the list of RFID tags fixed to the objects which lies within a particular range. Since each RFID tags has a separate ID number, a list of different ID numbers is displayed. Tapping on the ID numbers asks the user to select whether to find the object or to rename the ID or to track the objects. Once the user taps to rename the ID number he just replaces it with the name of the object. To track the object the user is asked to select the name of the RFID tag or the ID of the RFID tag and once it is selected it checks for the radio frequency of the selected object and tracks the object in accordance to the frequency and this is used to find the particular object from the list of object indoor. Another method used is the "Near Field Communication (NFC)" which is available in the mobile phones is also enabled and this also displays the radio chips available in the area. There are two ways this can work: use the phone as an NFC-TAG or use the phone to read NFC-TAGs. An NFC-TAG can take any shape or form and can attach to almost any surface. This TAG can contain information about the tagged location, object, or task associated with it. Then use the NFC-tracker to manage all of the retrieved information.

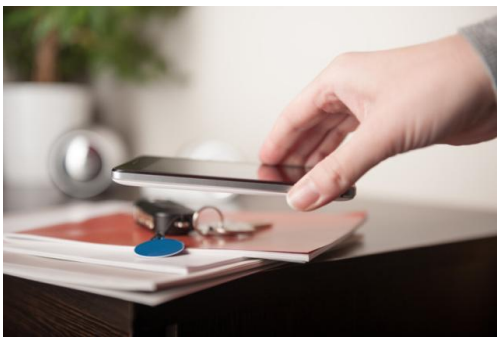


Figure 7: NFC

The greatest disadvantage with NFC is that it is restricted to a very small area(say about 2.5mtrs),but the use of chip reader can work about 30 metres.Thus, we use the RFID Reader for the detection of the objects.

Once the person has lost his/her object , then the id number or the name of the respective object disappears from his / her RFID list in the mobile and it also sends a notification that "The connection between your device and the object is lost" to the registered mobile. If the person voluntarily places the object away from the device then the user can press the OK button and can ignore the notification, if not the mobile starts ringing until the device is found. Say if the object "watch" is lost or misplaced and if it loses the connection with the RFID reader, then it sends the notification that "The connection between your watch and the mobile is lost".

The users data is fed into the memory space in the RFID which is stored in a database. Once this object is lost and this object is found in the other user's zone he/she can retrieve the owner's information from the database and can return the object to the owner.

If also the user finds that the object is not within his reader's range ,then the user can send the request to all other users who are accessing this app.Thus if the object is found the other person can return the object by retrieving the owner information from the database.

IX. ALARMING DEVICE

The object is fixed with the tiny alarming device which in turn is fixed with a tiny button. Once the object is lost and if in case the user cannot find the object in their zone they can even use the alarming device to locate the objects.

If the object is lost then the user can press the alarm key in the "Intelligent tracker" app. Once the key is pressed, the list of objects which are stored in the database of the "Intelligent tracker" is displayed and the user can select the required object from the list of objects.

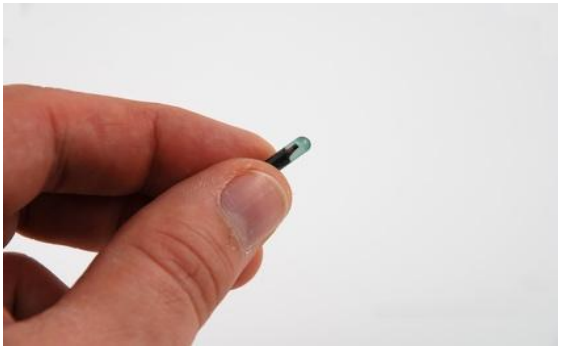


Figure 8: tiny alarming device

Once the object is selected the device starts to ring until the object is found and the alarming device is turned off. This is an effective way to find the lost objects. The another advantage of this "Intelligent tracker" is that if the person loses his/her mobile and the person could not be able to identify it then he can use the alarming device in any of the objects and once the button in the object is pressed the mobile starts to ring. Thus the "Intelligent tracker" can be used as a "Two-way finder" (i.e.) a device to identify object and vice versa. To find the mobile in turn and if the mobile is switched off and the object needs to find the mobile, the button in the object is pressed then the mobile is tracked using the Global Positioning System (GPS) and the exact location of the object is tracked using the GPS and the location is sent to the registered user's mail id.

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