Catching Of Stolen Vehicles With Unique Identification Code Using Embedded Systems

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Abstract— The main purpose of this concept is to catch the stolen vehicles by a latest technology. This research work is developing a smart logic to identify the stolen vehicle on check post or Toll base. Still there is no technique to identify the vehicle on check posts by any mean. To employ this technology in use, we issue one unique identification code to every vehicle. This unique number is stored in the silicon chip and the chip is installed in the vehicle. No one can change this number because this UID chip is installed in the engine of the vehicle. This vehicle number is not available in the market. Now the vehicle is equipped with the UID code. This code is also stored in the Data base of check post or Toll base. Now when any vehicle passed through the check post/Toll then at the check post/Toll RF passive vehicle reader generates a 125 kHz frequency for decoding RF tag which has been installed in the vehicle. If the data base does not find the stolen UID code then security gate gets OPEN and if the stolen UID code is matched with the data base then security gate remains closed and alarm becomes ON automatically and finally the stolen vehicle is caught.

Keywords- RFID principles, advantages, limitations, applications.

I. INTRODUCTION

The modernization of transport has become one of the essential signs for the urban modernization level, the increase in the number of cars leads to serious problems concerning transport system. With the development of the technology of computer, communication, electron, information and intelligence has become important factors in achieving convenient and efficient transport system. According to these circumstances, the Intelligent Transport System (ITS) came into existence [1]. Collection of transportation information systems based on conventional detection techniques such as loop detectors, video image processing, and Dedicated Short Range Communication (DSRC) leads to high installation and maintenance costs, the high costs prevented the proliferation of these detection techniques [2]. Radio Frequency Identification (RFID) technology is one of the most rapidly growing segments of today's Automatic Identification Data Collection (AIDC) industry [3]. Using "RFID tags" on objects or assets, and "RFID readers" to gather the tag information, RFID represents an improvement over bar codes in terms of non-optical proximity communication, information density, and two-way communication ability. It can automatically identify target and obtain relevant data without contacting with the target. It has many advantages such as high precision, easy adapting ability and quickly operation and so on. Moreover, it is able to work under harsh environment and reads from long distance [4]. Automatic Vehicles Identification (AVI) system based on RFID is design for all legally registered vehicles; these vehicles must hold RFID tags. When these vehicles travel along a road or intersection which is installed AVI system(RFID reader), the information of vehicle tag is read and sent immediately to Center Computer System (CCS) for achieving the purpose of real-time monitoring and management for vehicle movement conditions. The CCS receives the information and position of the vehicle from traffic intersection and then analyzies and filters to store it in database [5].

II. RFID TECHNOLOGY AND APPLICATIONS

RFID technology is currently being used in numerous applications throughout the world [3]. RFID is not a new technology, for example, the principles of RFID has been employed by the British in World War II to identify their aircraft using the IFF system (Identity: Friend or Foe) and it is still being used today for the same purposes. RFID uses tags to transmit data upon RFID reader queries. RFID tag responds to a reader query with its fixed unique serial number (tag ID). This fixed tag ID enables tracking of tags and the bearers. In addition to the unique serial number, some tags carry information about the objects they are attached to RFID is used for a wide variety of applications ranging from the familiar building access control proximity cards to supply chain tracking, toll collection, vehicle parking access control, retail stock management, tracking library books, theft prevention, etc.

A. RFID System Components

RFID is a generic term for technologies that use radio waves to automatically identify people or objects. There are several methods of identification, the most common of which is to associate the RFID tag unique identifier with an object or person. RFID system (as shown in Fig1) will typically comprise the following [4]:

- RFID tag.
- RFID reader with an antenna and transceiver.
A host system or connection to an enterprise system.

Figure 1. Components of RFID system

B. RFID Tags

The tag, also known as the transponder (derived from the terms transmitter and responder), holds the data that is transmitted to the reader when the tag is interrogated by the reader. The most common tags today consist of an Integrated Circuit (IC) with memory, essentially a microprocessor chip, see Fig.2.

Figure 2. Typical design of passive tag

The implementation of a passive UHF RFID tag is shown in Fig.3, a block diagram of RFID tag using backscatter modulation. The tag consists of tag antenna and tag chip. The tag chip contains a RF-analog front end (voltage rectifier, clock generator, modulator and demodulator), a digital control block, and a non-volatile memory.

Figure 3. Passive UHF RFID tag block diagram

Other tags are chip less and have no onboard IC. Chip less tags are most effective in applications where simpler range of functions is required; although they can help achieve more accuracy and better detection range, at potentially lower cost than their IC-based counterparts. When a tag is interrogated, the data from its memory is retrieved and transmitted. A tag can perform basic tasks (read/write from/to memory) or a tag can perform basic tasks (read/write from/to memory) or manipulate the data in its memory in other ways. RFID tags can interfere with each other. When multiple tags are present in a reader’s field, the reader may be unable to decipher the signals from the tags. For many applications, such as raising the gate in a parking lot, this is not a problem. The systems are optimized so that only one tag is within range at a time.

C. RFID Reader

Reader, as a scanning device, detects the tags that attached to or embedded in the selected items. It varies in size, weight and may be stationary or mobile. Reader communicates with the tag through the reader antenna, which broadcasting radio waves and receiving the tags response signals within its reading area. After the signals from tags are detected, reader decodes them and passes the information to middleware. The reader for a read/write tag is often called an interrogator. Unlike the reader for a read-only tag, the interrogator uses command pulses to communicate with a tag for reading and writing data [3]. RFID reader sends a pulse of radio energy to the tag and listens for the tag’s response. The tag detects this energy and sends back a response that contains the tag’s serial number and possibly other information as well. Historically, RFID readers were designed to read only a particular kind of tag, but so-called multimode readers that can read many different kinds of tags are becoming increasingly popular. Like the tags themselves, RFID readers come in many sizes. The largest readers might consist of a desktop personal computer with a special card and multiple antennas connected to the card through shielded cable. Such a reader would typically have a network connection as well so that it could report tags that it reads to other computers. The smallest readers are the size of a postage stamp and are designed to be embedded in mobile telephones.

D. RFID Antenna

The reader antenna establishes a connection between the reader electronics and the electromagnetic wave in the space. In the HF range, the reader antenna is a coil (like the tag antenna), designed to produce as strong a coupling as possible with the tag antenna. In the UHF range, reader antennas (like tag antennas) come in a variety of designs. Highly directional, high-gain antennas are used for long read distances [3]. Antenna design and placement plays a significant factor in determining the coverage zone, range and accuracy of communication. Physical interdependencies mean that the antenna gain is linked to the antenna size.

E. RFID Middleware

A middleware, as the name suggests, is a piece of software that lies between a lower layer processing device or software and an upper layer server or software, usually at the application level. Therefore, data from RFID readers are sent to a middleware platform that acts as a bridge between RFID readers and host application software. Typically, RFID middleware platform performs aggregation of data across
different readers, filtering of unwanted or noisy RFID data, forwarding of relevant data to subscriber servers or application-level systems, and persistent storage for context aware and other added value services. However, RFID middleware is often given the task of managing, monitoring and configuring the different readers and interrogators. The middleware performs monitoring task on RFID readers to check operational status of the readers. This is a very important function, especially when readers are located in distributed manner, and manual monitoring is impractical.

F. Automatic Vehicles Identification (AVI) based on RFID

AVI system based on RFID is a design that covers every vehicle legally registered which carries RFID tag. When these vehicles travel along a road in which AVI system is installed, all kinds of vehicles information of car tag is read and transmitted in real-time to data processing controlling unit realizing the purpose of real-time monitor and management for vehicle operating conditions [5]. The main components of the AVI system based on RFID include: (i) hardware, i.e. passive RFID tags and readers for generation of traffic information; (ii) RFID middleware and database structure, and application software consisting of real-time process; and (iii) network architecture to deploy AVI system nationwide.

III. ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

A. Advantages

Though RFID is not likely to entirely replace commonly used barcodes in the near future, the following advantages suggest to additionally applying RFID for added value of identification:

- Tag detection not requiring human intervention reduces employment costs and eliminates human errors from data collection.
- As no line-of-sight is required, tag placement is less constrained,
- RFID tags have a longer read range than, e. g., barcodes.
- Tags can have read/write memory capability, while barcodes do not.
- An RFID tag can store large amounts of data additionally to a unique identifier,
- Unique item identification is easier to implement with RFID than with barcodes,
- Tags are less sensitive to adverse conditions (dust, chemicals, physical damage etc.).
- Many tags can be read simultaneously,
- RFID tags can be combined with sensors,
- Automatic reading at several places reduces time lags and inaccuracies in an inventory,
- Tags can locally store additional information; such distributed data storage may increase fault tolerance of the entire system,
- Reduces inventory control and provisioning costs,
- Reduces warranty claim processing costs.

B. Current issues of concern, limitations

Although many RFID implementation cases have been reported, the widespread diffusion of the technology and the maximum exploitation of its potential still requires technical, process and security issues to be solved ahead of time. Today’s limitations of the technology are foreseen to be overcome and specialists are already working on several of these issues.

1) Standardization

Though the characteristics of the application and the environment of use determine the appropriate tag, the sparse standards still leave much freedom in the choice of communication protocols and the format and amount of information stored in the tag. Companies transcending a closed- loop solution and wishing to share their application with others may encounter conflicts as cooperating partners need to agree in standards concerning communication protocols, signal modulation types, data transmission rates, data encoding and frames, and collision handling algorithms. Currently, two major groups of standards are competing worldwide: one is EPC created by the Auto-ID Center and receiving the support of UCC (Uniform Code Council) and EAN (European Article Numbering), the other is the ISO-specified (International Standards Organization) set of standards.

2) Cost

The cost of tags depends on their type. In the 2003 report ‘RFID Systems in the Manufacturing Supply Chain, ARC Advisory Group predicted the following decrease of tag prices:

<table>
<thead>
<tr>
<th>Tag Type</th>
<th>Price in 2003</th>
<th>Price in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive UHF Tag</td>
<td>57 cents</td>
<td>16 cents</td>
</tr>
<tr>
<td>Passive HF Tag</td>
<td>91 cents</td>
<td>20 cents</td>
</tr>
</tbody>
</table>

This predicted decrease is still deemed insufficient, as economic use of tags—taking the associated 5–35% decrease of labor costs and zero tag information generation costs into account as well—would require a maximum of 25 cents per tag for high-end products, and 5 cents for common item-level tagging.

Prices of active or semi-passive tags (at least $1 per tag) are even more of a hindrance, allowing their economic application only for scanning high- value goods over long ranges.
3) Collision

Attempting to read several tags at a time may result in signal collision and ultimately to data loss. To prevent this, anti-collision algorithms (most of them are patented or patent pending) can be applied at an extra cost. The development of these methods, aimed at reducing overall read time and maximizing the number of tags simultaneously read, still goes on.

4) Frequency

The optimal choice of frequency depends on several factors, such as:

a) Transmission mode. RFID tags basically use two kinds of data transmission, depending on the behavior of electromagnetic fields at the frequency used. In lower frequencies (such as 125–134kHz in the LF band or 13.56MHz in the HF band), inductive coupling is used, while in frequency bands above (UHF with typical frequency ranges of 433MHz, 865–956MHz and 2.45GHz), wave backscattering is the main means of transmission. This also affects the safe reading range, as it is easier to build direction-selective devices with a longer read range in higher frequencies. This may restrict design freedom if either reading range or spatial selectivity is an important issue.

b) Behavior of tagged goods and environment. Properties of some materials may be an obstacle to RFID application at a given frequency, as they may corrupt data transmission either by absorption or by ambient reflection of the signals. Typically, conductive materials such as goods containing water, or metal surfaces may be the source of problems. However, absorption and reflection being frequency-dependent, failure at one frequency does not rule out applicability at other frequencies. Electromagnetic disturbance can also have external sources, which is also a common—though also frequency-dependent—problem in an industrial environment.

c) International standards in frequency allocation. Due to historic reasons, the world is divided into three large regions of frequency allocation for various purposes, region 1 containing Europe, Africa, the Middle East and former SU member states, region 2 with North and South America and the part of the Pacific east of the date line, and region 3 with Asia, Australia and the Pacific west of the date line. The industry exerts pressure towards a uniform frequencies allowed for RFID, yet there still are notable differences between the three regions, forcing companies planning to employ tags in several regions to restricting themselves to bands shared by all regions concerned. A compromise for tags only modulating the reader signal without actively producing a carrier wave on their own may be their ability to work in a wider frequency range than nominally specified, allowing their usage even in regions where RFID bands are ‘close enough’.

5) Faulty manufacture of tags.

Manufacturing of tags is not yet 100% failure-free today; about 20–30% of tags used in early RFID pilots have been defective.

![Figure 4. Common RFID frequency ranges and allocation in Region1](image_url)

IV. CONCLUSION

The rapid spreading of ITS enables the researchers to find new methods or algorithms to use RFID technology in transport systems. The structure of the VLS based on RFID is designed depending upon that every vehicle is attached with RFID tags. When these vehicles travel along a road, all information of vehicle's tag is read and transmitted real-time to CCS unit, to realize the purpose of real-time monitor of vehicles movement.

Therefore, after finishing the research work the following conclusions can be noted:

- During the design of the VLS, Rifidi Platform is used to simulate the connection RFID reader with the system and to testing the receiving, analysis and storage the data. The ability, functionality, efficiency, and further effects were tested by RTIS carefully, before introducing the system in a real-life.

- By the use RTIS, the system successfully synchronously connected with ten RFID readers, those readers are distributed on five intersections.

- VLS analyzed the received data from the distributed RFID readers in traffic intersections. Then, VLS concluded the vehicles locations and stored it in table. Vehicles locations table contained all the useful information about travels of the vehicles in road network.

- The location information of road intersection is preloaded by RFID readers. By tracing individual vehicles' information, VLS evaluated the road status throughout the city. VLS appraised the streets and traffic intersections congestion by depending on the average speed of vehicles in that location.

- The VLS monitored the intersections if a stolen or an illegal vehicle passed through them via checking blacklist in real-time. Also, it tracked vehicles that have a specific color in a traffic intersection during a certain period of time.
REFERENCES


