

Android based Vehicle Anti-theft Alarm and Tracking System in Hand-held Communication Terminal

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ABSTRACT

With the rapid development of China's automobile industry, the number of cars is increasing rapidly. Automobile has developed into an important means of transportation for people. However, while people are enjoying the convenience and speed brought by the vehicle travel, the theft of vehicles is causing more and more concern. Owing to the importance of vehicles safety, how to prevent vehicles from being stolen is becoming a hot topic in the field of artificial intelligence. In this paper, a vehicle anti-theft alarm and tracking system based on Android operating system in hand-held communication terminal is designed and developed. By using the built-in sensors of the terminal based on Android Operating System (OS), such as a smart phone, the abnormal information of a vehicle will be sent to the owner's smart phone through communication network. In this way, the long-distance remote alarm can be realized. In addition, the usage of the positioning function of GPS or communication base station makes vehicle location tracking into possible. Finally, a demo system is performed and it can effectively perform vehicle anti-theft alarm and tracking.

I. INTRODUCTION

In recent years, the number of cars in China has increased by tens of millions each year, and the increasing number of vehicles has brought the anti-theft of vehicles some challenges. For the traditional alarm, in the event of car theft, the alarm installed in the car will make alarming sound immediately. However, since the parking locations of the cars are usually far away from the owners, the owner cannot hear the alarm. Even if the owner can hear, he cannot accurately judge whether the alarm comes from his car or not. Moreover, if the vehicle is stolen and driven away, the owner cannot track it in time. Therefore, it is an exigent need to design a new kind of alarming system. There are some radio-based alarms, which can emit radio for several hundred of meters. It is obvious that it cannot meet the requirements of distance well [1].

Nowadays, the development of communication network and artificial intelligence technologies is exerting tremendous influence on people's life and working styles. There is no doubt that these two technologies will bring a new idea for designing an anti-theft vehicle alarm system. Motivated by this, a vehicle anti-theft alarm and tracking system is designed and developed based on Android OS in the hand-held communication terminal [2]. In view of its openness and convenience, Android OS has gradually become the most dominant mobile operating system in the world market. Moreover, the smart mobile terminal is cheaper and easier to use [3]. Hence, the newly developed system based on Android

OS brings convenience to the owners of cars and it will have a bright application future.

II. SYSTEM DESIGN

Sensors built-in a smart phone are very rich, such as acceleration sensor, direction sensor, magnetic sensor and so on. When the mobile phone has any movement, the relevant data of the sensors in the smart phone will change, and the abnormal state can be sensed. Our system writes an APP that calls Android operating system's built-in accelerometer to get the corresponding sensor data. When the mobile terminal is put in the car, any movement of the car will be detected by the built-in sensor. And thus the sensory data will be analyzed by the program to detect any abnormal situation of the car.

For a built-in acceleration sensor with three-axis, its working principle is to calculate acceleration according to the capacitive voltage value changed by inertia force. When APP calls for the accelerometer, it will return the acceleration values of three axes x, y, z with unit m/s^2 . The values of x, y and z are affected by the gravity acceleration. The mobility of the smart phone will result in the changes of their values. The abnormal information of the car, also low power information of the smart phone, if any, will be sent to the mobile phone carried with the owner of the car via communication network and Internet. In this way, the function of anti-theft alarm can be realized. In addition, the vehicle's position identified by its latitude and longitude can be tracked by using positioning function of GPS or communication base station easily. In many actual tests, all alarms could be realized effectively.

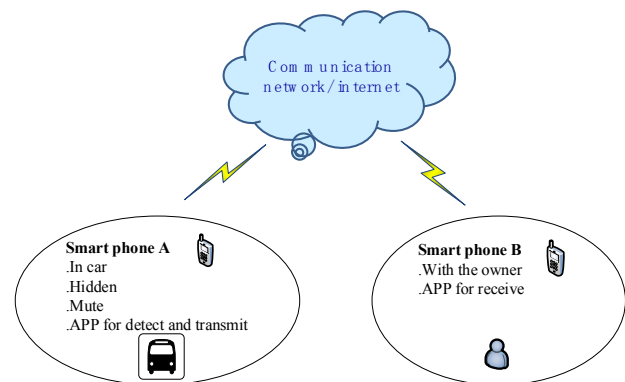


Fig. 1. Architecture of a vehicle anti-theft alarm and tracking system

Fig.1 illustrates the architecture of a vehicle anti-theft alarm and tracking system. Specifically, Smart phone A with a detection and alarm APP can be put in a hidden place in the

car and be set to silent mode. Smart phone B with the abnormal information receiving APP is carried by a car owner. The communication between Smart phone A and B can be realized via Internet (e.g. data stream) and mobile communication network (e.g. short messages) simultaneously in case the owner's data connection is switched off. If Smart phone A moves, its APP detects the abnormal situation, and immediately emits its latitude and longitude to the owner's Smart phone B. Fig2 shows the login interface of Smart phone A, and the receiving interface of Smart phone B.

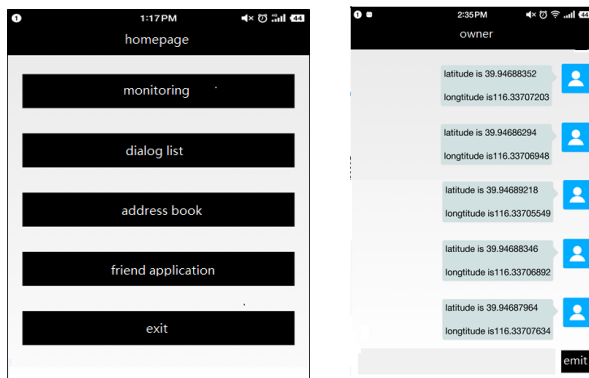


Fig. 2 Interfaces of Smart phone A and B

III. FEATURES OF ANDROID BASED APP

Android OS is rich in control elements, which can be used by APP developers and provide a good user interface experience. In general, Android based APP has four components:

- (a) Activity: is used for application realization, user interaction, and data exchange.
- (b) Service: is hidden and provides the corresponding service for the event.
- (c) Broadcast: is the information transfer between applications. A broadcast receiver receives, identifies, and analyzes broadcast. Applications can broadcast and receive broadcasts.
- (d) Content provider: is an interface for data exchange with the third-party applications since direct data transfer cannot be allowed between applications.

Furthermore, Android OS comes with a SQLite database, which is very convenient to use.

IV. INSTANT COMMUNICATION CLOUD

The proposed vehicle anti-theft alarm and tracking system uses the existing communication network and Internet through a kind of instant communication software called Huanxin Instant Messaging Cloud. So, the abnormal information of vehicle perceived by the smart phone in the car can be sent to the smart phone of the car owner. Then, the owner can take corresponding measures according to the situation.

Instant communication software is web-based. Currently, Huanxin Instant Messaging Cloud becomes the largest instant messaging cloud Platform as a service (PaaS) in the world.

Users can add their own APPs to Huanxin cloud and realize real-time communication via Internet. The new protocol for the message synchronization can provide stable and efficient traffic even in the unstable network environment. Thus, the reliable, ordered and real-time message delivery can be ensured and security level is much higher. Also, cloud provides better scalability and supports more docking and device synchronization scenarios. The interface is simple and the structure is clear.

V. CHARACTERISTICS OF ALARM AND TRACKING SYSTEM

To sum up, the proposed system has some distinct characteristics [5].

- (a) Good real-time performance: the reaction period of the system from detection to alarm is very short.
- (b) High practicability: since smart phones with Android OS are widely used, which are cheap and easy to use.
- (c) High accuracy: the performance of system is stable and false alarm can be effectively prevented.
- (d) Good extendibility: the built-in sensors in smart phone is diverse, they can collect different kinds of data besides acceleration for different applications [6].

VI. CONCLUSIONS

To guarantee the vehicle safety, this paper designs and develops a novel vehicle anti-theft alarm and tracking system based on Android OS in hand-held communication terminal. In addition, a demo system is realized to perform the function of vehicle anti-theft alarm and tracking effectively. If the latitudes and longitudes of the car received by the owner's phone are combined with a Google map or a Baidu map, the location could be displayed on the map to track more easily.

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REFERENCES

- [1] C. S. Song, L. Xie, "Remote wireless anti-theft alarm system for vehicles", *China Patent*: CN03109823.1, 2004.
- [2] H. H. Tan, F. He, W. P. Wang, "Design and Implement of Remote Monitor and Control System Based on Android", *Modular Machine Tool & Automatic Manufacturing Technique*, 2015, Issue 7, pp:61-63.
- [3] Ajay Kumar Jha, Woo Jin Lee, "An empirical study of collaborative model and its security risk in Android ", *Journal of Systems and Software*, Volume 137, March 2018, pp.550-562.
- [4] Wen-hui Dong, Li Wang, Guang-zhi Yu, Zhi-bin Mei, "Design of Wireless Automatic Fire Alarm System", *Procedia Engineering*, Volume 135, 2016, pp. 413-417.
- [5] Vibha Lohan, Rishi Pal Singh, "Research challenges for Internet of Things: A review", *International Conference on Computing and Communication Technologies for Smart Nation (IC3TSN)*, 2017, pp.109-117.
- [6] Syed Maruful Huq, M. Ashikur Rahman, Sabbir M. Saleh, "Application for integrating microcontrollers to Internet of Things", *20th International Conference of Computer and Information Technology (ICCIIT)*, 2017, pp.1-4.