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Research of new technology in IoV platform for BEV based on charging stations

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Abstract

In this paper, we proposed an IoV (Internet of Vehicle) platform, aimed to support the development of BEV (Battery Electric Vehicles). With the help of charging station, there are three main functions of this platform. First, due to network interface deployed on the charging station, BEV will contact backend server with high speed cable network. Second, the charging station will deploy WIFI APs, so that cars and other mobile equipments around the station can connect to internet conveniently. Third, the backend server will offer commercialized multimedia information service, statistical data from BEV, customized vehicle service, etc.

Keywords: charger, communication, commercial

1 Introduction

1.1 Standards for Internet of Vehicles

In the present era, network technology is rapidly developed. With its specific advantages, network technology is refreshing traditional industry. For instance, with the development of 2G, 3G, even 4G wireless networks, the function of mobile phone goes far beyond messaging and phone call, which makes mobile phone into a wireless network terminal. Lots of mobile phone manufacturer combined their products with this new technology.

Vehicle industry, the key industry in a country, is influenced by network technology as well. Many researchers in Vehicle industry have been trying to combine vehicle with networks. This integrated technology is called Internet of Vehicle in China. However, researchers have not given an accurate definition of this technology. According to the results from different papers, Chinese researchers always accept a definition like: IoV is the internet of things for vehicles. With the help of sensing device on vehicles, mobile communication technology, navigation system, intelligent terminal device and information platform, IoV can offer communications between vehicles and road, vehicles and vehicles, vehicles and human, vehicles and city, and provide effective monitoring and scheduling on vehicles, people, things, road, location, etc.[1] But, IoV can be treated as an application of IoT in Intelligent Transportation System, some researchers proposed that IoV do not have to give a strict definition, for IoV's specific definition is same as IoT, and its technical framework, standard should be same with IoT. [2] If we talk about IoV in western countries, we will find that this system has different name and definition. For example, foreign researchers describe Telematics like: Telematics, a fusion of telecommunication and information technology, is a complex system of integrated services and technologies. The Telematics system architecture consists of a vehicle-mounted hardware (VMH) wirelessly communicating with remote backend systems. These systems include the application servers with appropriate content integration such as maps, and the database servers which collect and publish information exchanged between the VMH and the backend systems. [3] According to these descriptions, Telematics has the same aim as IoV, however, their definition is totally different. So we need an accurate definition of this integrated technology, so that researchers in different countries can have effective cooperation in this technology.

In this paper, we prefer to research how to apply IoV in the specific application platform of BEV, rather than discuss the definition of IoV. Therefore, in this paper IoV means that with the help of sensing device on vehicles, mobile communication technology, intelligent terminal device and information platform, IoV can provide high speed information communication between vehicles and information platform, effective monitoring on vehicle running conditions, custom service and multimedia service.

1.2 Development status of charging facilities for BEV

Currently, America, Japan, France, England, etc, have constructed their own charging facilities for BEV. Most of these facilities are charging spots. [4]

In America, due to independence of different states, every state has different plan for their own charging facilities. California and Virginia have constructed their own charging facilities. One company in California cooperates with San Francisco, Auckland and San Jose, aiming to deploy charging spots in residential area, commercial building, parking lots and government buildings in these cities. These charging stations can provide 240V, 70A quick charging service, and can full charge BEV in 3.5 hours.

In Japan, there are more than 100 charging stations in 2009. 60% of these charging stations are deployed near Tokyo area. Japan government claimed that there would be thousands of charging stations in several years in Japan. Tokyo Electric Power will lead the construction of these infrastructures. In 2013, there may be more than 1000 charging stations in Tokyo.

In England, there have been 60 free charging spots in London. If you are drivers of BEV, you can have countless charging and parking service on these free charging spots. And you only have to pay 75 pounds fees annually.

In France, there are 10 thousands BEVs, 200 charging stations, in 2008. However, these BEVs set an example in government, buses, electricity department.

In China, most of these charging stations service electric buses and special vehicles in some companies. China has not constructed charging station, which aims to serve ordinary customers. However, there are several projects of these charging stations. In 2009, the first charging station-Shanghai caoxi charging station, satisfied all kinds of BEVs, had come into use; In the end of 2009, 2 charging stations,134 charging spots had been constructed in Shenzhen. Charging capacity reached 2480 KVA. [5]

Consider about the plan of charging facilities, the development of infrastructures for BEVs had burst. State Grid Corporation of China, China Southern Power Grid, Petro China, Sinopec, China National Offshore Oil Corporation had published their plan to construct charging facilities for BEVs. [4]

1.3 Main contents

Shanghai Jiao Tong University is based on the construction of new energy automotive network centres, and research background of earlier investigations. The main contents of this paper include the following two parts:

1, you can design a campus in the current Shanghai Jiao Tong University vehicle test environment to achieve messaging storage solutions.

2, combined with research findings, propose technical solutions on the platform of the future development of scalable functionality.

In the first section, the main contents are stored in vehicle messaging program design. The program envisages a have a wireless WLAN connection charge pile area, the pure electric vehicles have been able to record a good server to send back the vehicle information. Therefore, in this design, including a vehicle CAN signals collection procedures, non-vehicle CAN signals collection procedure has been collected signal processing, the signal processing is complete and an SD memory card is an SD card sends the contents of the program content. Among non-vehicle CAN signal collection and processing of GPS signal as an example (transmission mode for the serial communication), vehicle CAN signals to battery status information collection and processing example (transmission mode for the CAN communication).

In the second part, the paper attempts to summarize the first part of the transceiver storage solutions, and envisages the program in the future of car use may need to be resolved.

1.4 Significance of research

There are two ways for China to produce its own BEV. The first one is that we should wait for the maturity of battery technology of BEV, before we industrialize BEV. The second is that we build a new business model for BEV, industrialize it, after that, we should develop technology for BEV. [6] In this paper, we support the second view. In that model, we can promote our BEV industry as quick as possible.

Hence, this paper provides a technological idea to combine IoV with BEV. Through the media of charging facilities, we proposed a low cost, innovative IoV platform for BEV. With the help of abundant application in IoV technology, we can advance the competence of BEV's facilities, so that we can promote the technology of IoV platform and BEV. The schemes provided in this paper are supplements for the project "Green car data service centre" (temporary). And these schemes may be tested by this project.

2 Technical framework outlined

2.1 Electric car network platform component overview

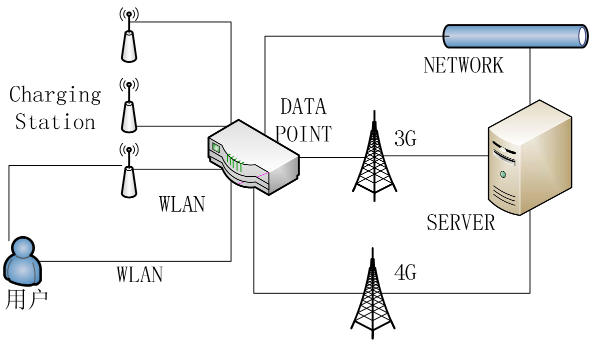

Figure1: electric car network platform schematic diagram of the overall system

Figure 2 Charging pile integrated cabinet

Electric vehicle data communications network platform frame shown in Figure 1. Pure electric cars and charging network access points will pile charging piles arranged in the vicinity, which is placed in the charging piles integrated cabinet (Figure 2) in. Integrated charging piles around the cabinet will be available through the vehicle charging piles internal wireless routers get connected to the wireless network, the router will also share their Internet connection to the vehicle users, and charge pile. Here, the router to get Internet connection, there are three main ways, one through a wired network (fiber-optic network, ordinary broadband networks, dedicated networks, etc.) to obtain Internet network connection, the second is to get Internet via 3G cellular networks network connection, three by 4G cellular network of Internet network connection. Pure electric car charging pile and can be obtained through these networks link the ability to connect with a remote server, allowing the recorded data itself is sent to the remote server database. Based on these data the remote server, you can think that pure electric car manufacturers to provide various customized data services.

2.2 Electrical Vehicle car network platform part of the technical analysis

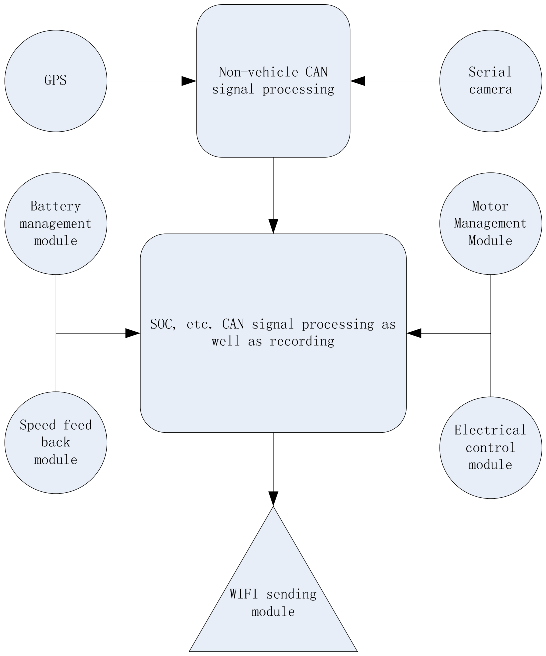

Figure 3 Flowchart vehicle signal acquisition

According to Figure 3, we can network platform for car parts in automotive systems technology needed to conduct a preliminary analysis of critical communications and presentation.

In the picture at the top of non-vehicle CAN signal processing section, the paper focuses on serial communication signals, so it comes to a serial port communication mode of communication and CAN communication. Among them, the thesis GPS module, for example, discusses the GPS module serial communication with CAN communication signal conversion. Therefore, in the processing of the GPS signal, the serial signal acquisition will involve, serial signal and conversion of the CAN signal, CAN signal transmission of these three major problems.

In the picture below the SOC and other CAN signal processing portion that relates to the communication mode is CAN communication, SPI communication, WIFI signal is sent. CAN communication which is the most important part, because of the need to capture the signal SOC signals and other vehicles are CAN frame format. SPI communication is mainly responsible for collecting the signal to write to the SD card still in storage, enabling data to local backup vehicle. In this paper, WIFI signal transmission using a relatively simple approach. Because there are a lot of commercial WIFI chip modules, and these modules have the TCP / IP protocol integrated into the hardware circuit, only need a good start to configure the hardware circuit, we can achieve TCP / IP packets sent. Together, these WIFI module and microcontroller is SCI serial communication interface, so the subsequent test experiment, a test article for the transmission frame directly on the SCI-based serial and did not go to spend the extra funds to build a WLAN network.

2.3 Car parts electric car network platform debugging platform

Development board core chip is MC9S12XEP100MAL, the core chip has a wealth of functional modules, S12 series is the more powerful of a microcontroller. And with matching this development board has a wealth of external resources, and can basically meet the general basis based on S12 MCU development capabilities. This thesis is based on the technical feasibility validation scheme is applied to the development board module with RS232 serial port module, CAN bus module, SD card module three main modules, the circuit diagram as shown in the following figure.

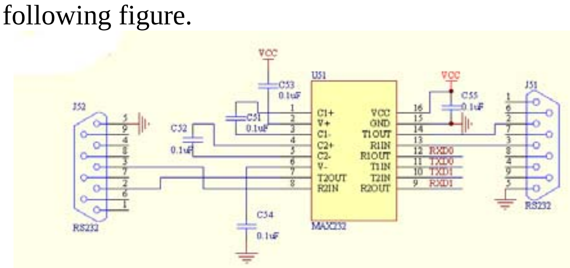

Figure 4 Serial partial circuit diagram

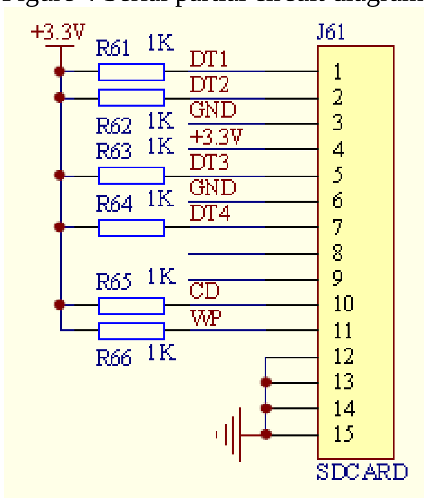

Figure 5 SD card is part of the circuit diagram

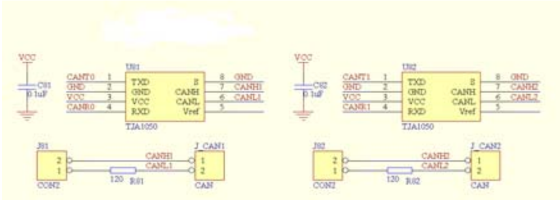

Figure 6 CAN bus section circuit diagram

3 Non-networked car charging pile car CAN signal acquisition program

In-car non-CAN signal acquisition, the papers selected signal as a serial GPS module program examples. The main reasons are, first, based on the GPS signal can be calculated from the vehicle. Second, based on the GPS signal can be calculated vehicle speed, the information in the future studies of pure electric vehicles is also very valuable.

Taking into account the technical solutions currently plans to centralize all of the vehicle information sent over the network via WLAN charging piles to the backend server, therefore, GPS position signal loses its timeliness. Then, the process is not in the transmit GPS signals to send all data collection, but directly to the mileage after calculated from information transmitted to the data service centre. In this paper, based on GPS signals mileage calculation scheme, you can also expand out more GPS signal processing scheme, for example, can be timed to calculate the mileage accumulated value for the vehicle velocity distribution.

In addition, according to the GPS serial signal processing methods, other serial signals can also be carried out in accordance with the same underlying code serial signal receiving and sending CAN messages, some just need to change the data format conversion and processing section, the current proposal in the serial signal transduction CAN signal processing has better applicability.

3.1 GPS signal standard format

GPS signal acquisition and other on-board signal different from its other processor platforms with the communication protocol is a serial communication protocol, so you must pass a separate acquisition program to achieve this signal acquisition. In the GPS signal acquisition, the most crucial point is how the GPS fixed data output statement GPGGA format of the GPS signal is converted into a numerical signal microcontroller operation.

GPS collection procedures in the formal presentation and testing are required before the GPS signal common GPGGA format signal with a brief description of [22]. GPGGA format signal is the most widely used GPS positioning data. The following examples will be used to introduce GPGGA format signal.

Example: $ GPGGA, 050201,03101.5592998, N, 12126.5894002, E, 1, 05,1.6,79.2, M, -7.0, M, * hh

The standard format is: $ GPGGA, (1), (2), (3), (4), (5), (6), (7), (8), (9), M, (10), M, (11), (12) * hh (CR) (LF)

The meaning of each part corresponding to:

(A) Positioning UTC time: 05 hours 02 minutes 01 seconds

(2) Latitude (format ddmm.mmmmmmm: namely 0dd degrees, mm.mmmmmmm points)

(3) N / S (latitude or south latitude): 31 degrees north latitude 01.5592998 points

(4) Longitude (format dddmm.mmmmmmm: namely ddd degrees, mm.mmmmmmm points)

(5) E / W (N or W): 121 degrees east longitude 26.5894002 points

(6) quality factor (0 = no position, 1 = real time GPS, 2 = Differential GPS): 1 = real-time GPS

(7) the number of satellites available (0-8): You can use the number of satellites = 05

(8) horizontal accuracy factor (1.0 to 99.9): Horizontal Accuracy factor = 1.6;

(9) antenna elevation (sea level, -9999.9 ~ 99999.9, unit: m): Antenna height = 79. 2m

(10) earth ellipsoid relative sea level (-999 9 ~ 9999.9, unit: m):-7.0m

(11) age of differential GPS data, real-time GPS None: None

(12) Differential reference station number (0000 to 1023), real-time GPS None: None

* Sum check Domain: hh sum check digit

(CR) (LF) carriage return, line feed.

Since there are more GPGGA format redundant data, as a technical solution principle test experiment, the procedure herein PC program just by Matlab simulation data sent latitude and longitude data. Future in the actual application process, you only need to imitate the current latitude, longitude receiving process, a few more data receiving array can complete the GPGGA format data frames received completely.

In this trial, the article presents a MC9S12XEP100 MCU coordinates collection and calculation programs. And through the matlab simulation to verify the accuracy of the calculation scheme to ensure that vehicle platform calculated VMT effective and accurate.

3.2 Test Methods

Given GPS coordinates collection platform to build real inconvenience and costly, the paper through the computer serial port analog transmission has been collected good GPS signal to the next crew S12. Because the real application platform and simulation platforms are the serial communication mode of the test there was no difference with the real environment. Experimental procedure as described below:

1, Matlab PC program through the computer serial port to send meet GPGGA standard GPS coordinate data.

2, the next crew S12 after receiving the GPS coordinates to begin serial port to send the coordinates stored in ASCII code.

3, the next bit machine transitions to receive serial ASCII code coordinates.

4, the next-bit machine even twice received latitude and longitude coordinates represent the distance difference.

5, the cumulative distance difference, the interval of the CAN frame to the signal recording chip.

3.3 Coordinate acquisition and processing procedures

GPS data sent through the serial port and can not be directly on the operation, requiring only after the conversion of certain operations, mainly because the serial port to send only send eight or nine data, and therefore send GPS coordinates when the serial port is 12 in each of the coordinate values are converted into an ASCII code, and then sent through the serial port an a. So, the next bit machine operation, you must convert these data processing, or is unable to complete the mileage calculation.

Therefore, this program together with the coordinate acquisition program also coordinates the implementation of the process, the following will make a detailed description of these procedures.

Collection serial port to send the ASCII code is very simple, involving only two underlying register, SCI0 status register 1 (SCI0SR1) and Data Low Register (SCI0DRL). SCI0 status register which relate to the operating position is RDRF, the operation after completion of data reception bit will be set. Then, in the program implementation process, only need to query SCI0SR1_RDRF bit is set to 1, if the data is set to a low of 8-bit data register can be read out. This process is completed the data from the serial port to read a basic operation.

The next step is how to handle these scattered GPS data. This procedure uses a query way to collect serial data, the main program continuously check SCI0SR1 status register, when it is set to 1 will read out the data, stored in a cache array. In order to better distinguish between longitude and latitude data, the program buffer array respectively latitude and longitude of the buffer array. When Latitude buffer array becomes full, the cache flag latitude, longitude data into the next buffer array, when the array is stored longitude cache is full, longitude cache flag, began to enter the array data processing program, which began The separated ASCII code data consisting of computable long integer value.

Wherein the array data handler ASCII high four cut away, to obtain the value of the lower 4 bits of data. Because ASCII coding, the lower four data corresponds to a decimal value from 0 to 9, so this can be converted into ASCII code values calculated, and then through binary arithmetic, you can get the GPS coordinates of a long integer value .

3.4 Mileage sending program

Since GPS coordinates signal is a serial signal, and the vast majority of different vehicle CAN signal, if done with a chip serial signal reception and in-vehicle CAN signal receiver receiving process is likely to cause a conflict. Therefore, a separate article planned to achieve a chip GPS signal reception, processing, calculation and mileage data, the CAN signal conversion. In the previous section, the article has been completed on the GPS signal reception, processing and handling calculation, in this section, the article focuses on the GPS signal into accumulated mileage of the CAN make a presentation.

Section 2.2.2 in the article has the basic format of the CAN frame to make a brief introduction, then, in this section directly on the MCU CAN signal transmission will be described. As a mere mileage data signal, so here this normal intended use of the CAN data frame to transmit this signal, that is, the mileage of the CAN frame only 11 bit ID number. In Section 2.2.2, CAN data frame with a detailed description of the specific format, which includes seven sections, namely the frame start (which means that the beginning of a data frame), the arbitration field (indicating the priority of the frame section), the control section (the number of bytes of data indicates a reserved bit), the data segment (contents data can be sent from 0 to 8 bytes of data), CRC section (check frame transmission error), ACK segment (to confirm received normally), end of frame (data frame indicates the end of the segment). If you need MC9S12XEP100 CAN signals to achieve the basic transceiver operation, and there is no need for all of the control segment to operate. Given unlike CAN signal is sent as serial signal transmission is simple, so this time sending the CAN signals, creating a basic configuration of a signal to be transmitted to the structure of the CAN signal.

CAN message structure:

```
struct can_msg / / send packets
{
   unsigned int id; / / ID number of packets
   Bool RTR; / / RTR detection bit
   unsigned char data [8]; / / 8 bit data segment
   unsigned char len; / / data length
   unsigned char prty; / / data local priority
};
```

Before sending the CAN signals the need for packet ID, RTR detection bit (control segment), the data segment, data length, and data local priority configuration.

In this test a GPS set in the packet transmission ID is 0x7ef (ID temporarily in the test ID, so in accordance with section 2.2.2 of the arbitration priority introduction section, this is not particularly critical for the vehicle control signal as a priority the minimum signal to send, but not able to take into account all the high 7 all set to hidden, so setting this value 0x7ef. If in the future need to apply the specific vehicle function, you need to change based on the actual situation of the CAN address).

Because the frame is a data frame transmission, so RTR RC frame detection bit is set to 0.

According to section 2.2.2 of CAN data frame structure for the introduction of each frame of data can be sent in 64, then the microcontroller these data are stored in the eight 8-bit data register (Data Segment Registers) in. Here, the paper currently encoded using the ASCII code directly mileage information, that is, each data register stores only the number of miles an ASCII value. As the CAN data frame can send up to eight ASCII code, so, if in accordance with the meter level accuracy send mileage information, charging interval during which the two, mileage cumulative maximum theoretical value can reach 99,999 km. From the current pure electric vehicles once fully charged can travel mileage point of view, the theoretical value far exceeds its mileage number. Therefore, in order to record more precise information on the number of miles, this program uses a centimetre-level accuracy (accuracy only, instead of the actual measurement accuracy, but to get the actual measurement accuracy of GPS data has reached the centimetre-level) to send the mileage , then the mileage accumulated maximum theoretical value can reach 999 kilometres, the total theoretical value of pure electric vehicle car enough to achieve effective data recording module without overflow.

Data length is assigned to eight, because here the process of transferring data using the 8-bit CAN frame data.

Data local priority, given the module sends the time did not compete more data, so that the position 0, without extra configuration.

4 Charging pile vehicle CAN signal acquisition vehicle networking storage solutions

In the Bosch company in February 1986 of the SAE Conference proposed CAN (Automotive Serial Controller Area Net work) after the communication, CAN communication achieved great development and application. Currently, the vehicle ECU applications are becoming more common, according to the 2002 survey data, the number of luxury cars ECU has reached as much as an average of 105, and these means of communication between the ECU are mostly based on CAN communication . Therefore, one can imagine, CAN signal is quite nerve inside the vehicle control signal. In pure electric cars such a platform, naturally, no less a shadow of a CAN message.

Therefore, this article in the CAN signal processing battery status information is selected as an example for the following reasons. First, the pure electric vehicle battery technology has not yet fully developed, thus, during operation of the battery status information is crucial for further development. Second, taking into account the safety performance of vehicles, pure electric vehicle battery energy source as a vehicle, its status is essential, must always testing and inspection, once problems are required to notify the owner.

In addition, depending on the battery status information is handled, other CAN signals can also follow the same underlying code CAN messages received and stored, the part just need to change the data format conversion and processing section, the current proposal in the serial signals to CAN signal processing has good applicability.

4.1 Test Methods

Taking into account the real car debugging requires a sound program base, and now, access to experimental resources, this article only through the PC terminal Kvaser CAN development board debugging tools in MC9S12XEP100 confirmatory technical program debugging. Among them, the core chip CAN signals collected mileage GPS signal, pure electric vehicle battery SOC signal and battery temperature signal.

CAN signal reception storage process:

1, Kvaser simulate real situations crew sent down GPS Mileage CAN frames, as well as information and the battery SOC, battery temperature signal related to the CAN frame.

2, the next crew received CAN frame, the CAN frame for resolution.

3, the key messages from the CAN frame data format into a human readable ASCII code into the development board SD card.

CAN transmit signal reading process:

1, the next bit machine in a continuous battery charge state signal received more than 1 minute after the vehicle has been determined in the charged state of charge pile.

2, the next crew begins the sending process, vehicle ID code is sent first, followed by waiting for the remote server to send back a reply character.

3, acknowledgment character, the next bit machine into the information transmitted processes, read the SD card to store information sent to the host computer, the information encoded in the 4.4.2 section will explain in detail.

4, the next crew to complete information transmission process, send termination symbol, the PC recognizes termination, the next bit machine empty SD card storage space, CAN signal reception starts normal storage processes.

The above content is preliminary technical feasibility authentication.

4.2 CAN signal acquisition program

4.2.1 Acquisition Signal Descriptions

According to section 4.1 a basic introduction to the test method, the program will collect GPS Mileage CAN frame signal, and battery status information. In the third chapter has given the GPS Mileage CAN frame signal with a detailed description, in this section will not repeat them, but in Table 1 will put the frame signal with a brief description.

Table 1 GPS signal content frame

Contents	details
ID	0x001
length	8
Byte 1	Mileage signal one hundred thousand (ASCII coding)
Byte 2	Mileage signal ten thousand (ASCII coding)
Byte 3	Mileage signal thousand (ASCII coding)
Byte 4	Mileage signal hundred (ASCII coding)
Byte 5	Mileage signal ten (ASCII coding)
Byte 6	Mileage signal bits (ASCII coding)
Byte 7	Mileage signal ten decile (ASCII coding)
Byte 8	Mileage signal ten percentile (ASCII coding)
frame type	Normal data frame

From the data frame structure, can be seen clearer in the frame of the program needs to read the entire contents of the first byte of the first three bytes of the first eight, the first 6 bytes of the entire contents.

Table 2 Battery Status frame data format

Byte	Parameter content	English shorthand	description
1	SOC	SOC	0-100%, 0,1% offset / digital
2	Battery bus current (low byte)	Battery_ Current	0-3000A, offset 0,0.1 A / bit
3	1-7 bit cell bus current (high byte)		
	8 battery charge and discharge status	Battery_ State	0:Discharge, 1: Charging
4	battery bus voltage (low byte)	Battery_ Voltage	0-3000V, offset 0,0.05 V / bit
5	Battery bus voltage (high byte)		
6	cell temperature	Battery_ Temperature	-40 ~ 210 ℃, offset -40,1℃ / bit

7	1-2 Bit power on / off requests	Battery_Request	01: Power-on request 10: down request
	3-4 Reserved	Battery_Reserved	1
	5-6 Battery fault level	Battery_ErrorRank	divided into three grades
	7-8 Reserved		
8	1-4 digital lifecycle	CAN_Cycle	0-15
	5-8 Reserved	Battery_Reserved	2
Address	0x002		
Length	8		

4.2.2 CAN signal acquisition procedures

Before performing CAN signal acquisition, the program still need to initialize the base module, but considering most modules in this program similar to the third chapter, it is no longer, its initialization procedures and 3.3 lower machine initialization procedure is the same.

In program design, in order to make the next bit machine to send and receive CAN frame consistent operation of the CAN frame, therefore, in the acquisition process is also applied to the same procedure as in sending CAN frame structure whose contents are as follows.

CAN message structure:

```
struct can_msg / / send packets
{
    unsigned int id; / / ID number of packets
    Bool RTR; / / RTR detection bit
    unsigned char data [8]; / / 8 bit data segment
    unsigned char len; / / data length
    unsigned char prty; / / data local priority
};
```

The CAN frame reception subroutine, program flow with the CAN signal transmission process is very similar, just the flow of information changed.

In view of all of the received CAN frame is a data frame, so the contents of the data segment portion of real and effective. Then the data processing and conversion paragraph CAN signal acquisition has become an important part of the program. In the process, the received data are stored in the named msg_get the can_msg struct.

For GPS data, since the CAN frame transmission process has each one is in ASCII format for transmission, so only need a GPS GPS data is stored in an array, and then through the underlying file system operations to the SD Cards can be formed static record. In the GPS data records, each record will occupy 10 bytes of storage space

For SOC data processing may be slightly more complicated. In section 4.2.1, the article illustrates the use of this test battery status frame format in which the data to be collected with a battery state of charge SOC data (CAN frames the entire contents of a byte), the battery charge and discharge status (CAN frame of the first 3 bytes of 8 bits), the battery temperature (CAN frame the entire contents of the sixth byte), these three important data values. Wherein the battery charging and discharging status bit is a status bit judgment, this is not need to be recorded, therefore not detailed processing, the contents of the other two bytes is required to extract it. MCU when the reception of each byte of the CAN frame is stored in a separate specific registers (DSR0 ~ 7), so the process of reading the subprogram each bit of data has been stored in the array individually. Then you only need to read msg_get structure of a data segment 0 and 5 data you can get the value of the battery state of charge and temperature. But the point to note here, in the CAN frame agreement, the battery temperature values are from -40 ~ 210 ℃, while the CAN frame data bytes may be set from 0 to 255. So there needs to do the first five bits minus 40, to obtain the true temperature data.

Given the need to write to the SD card, write the corresponding ASCII code to facilitate people to read, so the data needed for further processing.

SOC data is a data value of 0 to 100, the rounding operation by the microcontroller division modulus can be obtained for each bit of the data value, plus 30H, 0 to 9 can be obtained in ASCII code, stored in SOC record array, followed by the file system operation, to write to the SD card.

Temperature data is a data value of -40 to 210, in order to make the SD card data easier to read, it will be handled slightly more complicated. First need to determine whether a negative temperature value, if it is positive, the SOC can be used to obtain the same operating temperature of an array of records. If it is negative (i.e. msg_get.data [5] <40), then with 40 less msg_get.data [5], to obtain a positive data value after rounding modulus divider for each data access value plus 30H. But in

the first array is written needs to write "-" sign to indicate a negative temperature. Recording status information of the battery in each record will occupy 10 bytes of storage space.
Thus, CAN signal acquisition and processing of the basic procedures have been completed.

4.3 Signaling processes

Before sending the signal process begins, you first need to determine whether the vehicle is charging pile charging status. Taking into account pure electric cars have regenerative braking capability, so not all of the charge states are in charge pile charging. In order to distinguish between two charging modes, this flag is considered a cumulative manner.
Taking into account the information about the state of the battery on the bus every 50ms broadcast time, if the battery charge and discharge continuously received status bit (described in detail in Section 4.2.1) in respect of that vehicle 1200 has a charge time of 1 minute, given the general charging time of regenerative braking of about 30s, it can be determined that the vehicle is already in the charged state of the pile instead of the regenerative braking charge state of charge. And, as long as the 1200 flag cumulative process, there is a charge and discharge status position 0 (ie, discharge status), the flag will be cleared and re-start charging flag cumulative.
Complete vehicle charging pile charge state determination, we can confirm that the vehicle has been in charge pile network coverage. ECU will enter the next signal recording signal transmission mode, it will transmit the unique ID of the module to the background data centers, data centers feedback after receiving confirmation received frame ID. If the ECU has not received confirmation of the feedback received frame background, will continue to send out the inherent ID50 times after the connection, indicating that the second charge was not successful data transmission. When the ECU to confirm the connection is successful, will first transmit frame start character (6 0xff) and send the number of failures, then the data will be transmitted in accordance with optimized SOC frame to transmit data pointer, GPS coordinate data, as well as SOC, battery temperature, etc. state data, the specific format and content as shown in Table 3.

Table 4-3 WIFI data transmission frame

SOC data pointer				SOC data	temperature data	GPS data (sent to the meter level accuracy)			BREAK	
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0xff	0xff
0~4294967296				0~100	0~250	0~999999				

5 Car charging pile networking analysis and application development

5.1 Application Analysis of technical solutions

Currently, the network platform for electric vehicle research or technical solution state solution is in the laboratory validation study. According to the current data Jiaotong new energy automotive service center construction, automotive parts technology solutions through wireless WIFI considering ways to send this pure electric cars collected signal sent from the original form of the timing of changes sent via 2G/3G networks into the vehicle when charging through the charging piles surrounding wireless network centralized send the collected data.
In the context of this thesis, the main focus in the use and development boards MC9S12XEP100 core chip simulation debugging car GPS signal acquisition, car battery status signal acquisition, the data obtained will be collected simultaneously recorded on the SD card static storage device, through the formulation WIFI data transmission frame and sending process is completed vehicle information transfer. These technical program content has been able to send a CAN signal computer simulation cases successfully completed.
In the next step of the research process real car, the need for further refinement of the development board analogy content, and should create a separate circuit motherboard to lower the cost and ease of installation. Among them, the main work needs to be done as follows.
1, the reference development board making GPS signal acquisition module and CAN module motherboard records are sent.
2, the survey experiments vehicle internal CAN signal communication protocol developed GPS frame address.

3, to determine the basic parameters of WLAN charging pile, such as whether to support DHCP, remote server address.
4, currently under development support crew signaling protocol server system.

5.2 Expand the application of technical solutions

Papers currently proposed technical solutions is just the pure electric car charging pile signal based networking platform car transport an idea of the basic functions, but also based on the idea to expand this program a very many applications.

5.2.1 Technical solutions and technologies merging VANET

The proposed technical solutions capable of VANET technology combine to make a VANET network charging piles roadside network access points, all vehicles on the road so as to provide network access services.
Currently, the program is in the transmission of information when pure electric vehicle charging, but this is not the only form of information transfer. Since charging pile layout simplicity, it can be cost-effectively arranged on both sides of the road, then the network connectivity with WLAN charging piles will be able to road vehicles on the road are provided Internet access services. If we take into VANET network technology development in the future applications can be connected with a network capacity roadside charging piles as V2I (Vehicle to Instrument) in the roadside network access facilities. Its connection form shown in Figure 7.

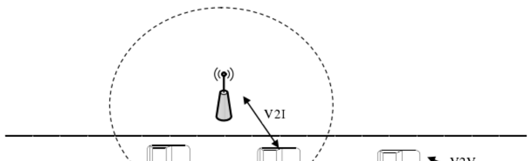

Figure 7 VANET network connection diagram

In this paper, we propose the collection of information transmission scheme is not currently able to support this network of networks based on discontinuous transmission behaviour, if you want to achieve in the transmission of information under VANET technology, the signal transmission process section also requires further study.
In addition, the transmission of information under VANET technology has not confined to the electric car, the fuel vehicles on the road in the process can also be used to build the WLAN network charging pile background data centers to its unique vehicle data transmission. If, VANET next article similar to the transfer of information technology solutions can be achieved, then the idea of such technologies can be achieved not only the reality of VANET technology applications, and for pure electric vehicle development facilities provide new commercial space.

5.2.2 Throwbox of charge pile

The proposed technical solution capable Throwbox technology combine to make the charge pile into a low-power network access points, and more randomly arranged in the city.
If you take into account the rapid development of wireless technology, open WIFI nodes increasingly the case, refer the University of Massachusetts (UMass) The DOME Mobile Tested, Jiao tong new energy vehicle platforms can also try to capacity with WLAN access as DOME Mobile Testbed charging pile under Throwbox. Throwbox basic schematic is as Fig 8.

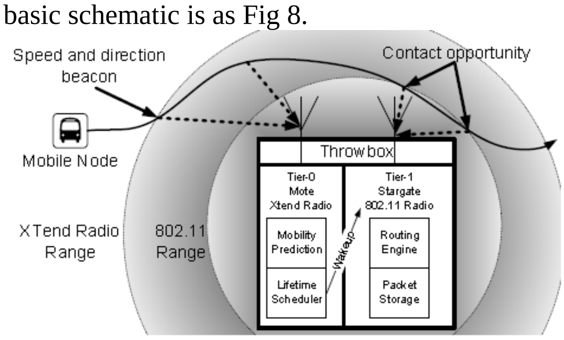

Figure 5-2 Throwbox basic schematic

By charging pile facilities, urban areas will be able to build as much as the 3G network transmission speed of cheap open WIFI network. Meanwhile, the research team also through such a network platform to develop a variety of automotive applications and collection vehicle plant information needed to develop a variety of vehicles.
However, if you need to implement to provide high-quality network services Throwbox group, charging pile facility deployment is still a long way to go. From DOME tested experimental results, they are still yet to be resolved in Amherst town WIFI network environment to provide interactive services to long latency problem, which is delayed up to 0.55 minutes [12]. However, the network platform data transmission if only as a vehicle, there is no problem.
If you can develop technical solutions to achieve a pure electric vehicle charging facilities not only be able to provide fuel car service car networking

nodes, but also for the pure electric vehicle charging facilities for the development of considerable financial support, but also can promote the future of car networking further technological innovation and development.

6 Conclusion

Shanghai Jiao Tong University-based data service center of new energy vehicles development, this paper presents a pure electric car charging pile of new car networking platform technology solutions. The technical program main contents include: on-board non-CAN signal (serial signal) acquisition and conversion of CAN frames, vehicle CAN signal recording and WIFI sent.

In-car non-CAN signal, the program uses a GPS signal as processing examples, completed in the laboratory platform acquisition, processing, CAN frame transformation process and made a valid lower machine process.

In-vehicle CAN signal, the program uses a battery status signal as processing examples, finished on the bench of the collection, processing, storage and transmission process and propose an effective lower machine process.

Article clearly pointed out that the technical solutions only support pure electric car with a network access capability in charge at the pile, static charge, to be able to perform a complete data transfer processes. But this is not the development of programs limit. According to section 5.2 of the discussion about the expansion of the content, the technology program also capable of VANET technology, Throwbox technology combine to make pure electric cars get in discontinuous network environment, the ability to send data. However, to achieve this expansion of applications, but also the need for vehicle transmission processes further study.

In accordance with article analysis, the current paper, based on a pure electric car charging pile of new car networking platform technology program is able to in the future development of pure electric vehicles, vehicle networking technology (Intelligent Transportation Systems), pure electric vehicles ancillary facilities to provide effective assistance beneficial.

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