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Design and Deployment of Embedded Wireless Vehicle Monitoring System Using GPRS

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ABSTRACT: Synthesizing the embedded system, the GPRS (General Packet Radio Service) networking and the car license recognition technology, this paper designs and realizes ATMEL ARM (Advanced RISC Machines) processor based embedded wireless vehicle management system. The transmission network is constructed through the way that the GPRS wireless network and Internet integrates and it has substituted the traditional wire transmission network. The main feature of the system is [2] short engineering construction cycle, redundant reliability, high transmission speed, timeliness strong, extendibility, and so on. The Testing carried out on character recognition, aptness in displaying the results, displaying the picture with high quality proved to be best and hence could be used in the parking lot, at the junctions, vehicle surveillance, at intersections and so on.

KEYWORDS: GPRS, ARM Processor, compressed encoding, Frame Grabber, Kernel, Boot Loader, Character Recognition.

I.INTRODUCTION

As a result of the high performance, the low power loss, the low price and the expansion network function of the embedded processor, using embedded system in the long-distance complex monitoring management system has become the trend.[4]Integrating the embedded system, the GPRS networking and the car license recognition technology, this paper represents deployment and development of a kind of embedded wireless vehicle management system which uses the ATMEL ARM9 microprocessor from the hardware and the supporting application developed using C Programming language.

This is a Linux operating system based application. Technological intelligence [2] is a highly sought after commodity even in traffic-based systems. These intelligent systems do not only help in traffic monitoring but also in commuter safety, law enforcement and commercial applications.

This system has realized communication between the computer and the long-distance ATMEL ARM processor through the GPRS network. The overall system is mainly composed of

- Vehicle monitoring system,
- The wireless communication link and
- Long-distance administrative center

The long-distance administrative centre is composed by the

- Web server,
- The database server and.
- The client side

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II.STATEMENT OF THE PROBLEM

The project aims at implementing the following functions for effective building of Vehicle Monitoring System:

- Building cross-compilation tool chain
- Kernel cross compilation
- Building root-file system
- Burning the Images on to the target board using minicom.
- Building Image capture application
- Cross-compiling the Image capture application
- Transferring the Executable file and executing the application on the target
- Establishing the GPRS connection on the target board
- Transferring the Licensing information from the remote place.
- Receiving the Licensing information in to the host
- Comparing with the existing database and giving acknowledgement

III.OBJECTIVE OF THE PROJECT

A. To establish a wireless communication between the applications, that is, the ARM 9 Atmel Board, which captures the Image of a vehicle's License Plate and Sends it across the administrative center, for which the application has to be written in Embedded C.

B. The captured Image (Vehicle's License Plate) has to be converted to the text format using Optical Character Recognition (OCR) algorithm.

C. The Converted Text information has to be sent across the administrative server through GPRS connectivity, where a database has to be maintained for cross verification of Licensed or not Licensed Vehicle plate.

D. An acknowledgement should be posted if it is a Licensed Vehicle.

E. In case, if the vehicle is a new entry, a provision has to be made for the registration of that vehicle's License plate.

F. In case, if the vehicle is not a registered entry, then an alarm should be beeped on the spot where the Vehicle is been recognized and immediately a complaint has to be registered in the concerned RTO Department.

G. Since it involves web server for wireless communication, html pages has to be developed in order to achieve the above mentioned objectives.

IV. DESIGN METHODOLOGY

The Embedded Vehicle monitoring system involves Waterfall Model in which development is seen as flowing steadily downwards through the phases of requirements analysis, design, implementation, testing (validation), integration, and maintenance.

This Vehicle Monitoring system involves distance communication and hence GPRS connectivity has to be established. Block diagram of the System structure is as shown in the Fig 1.

In order to Grab the Images, a webcam & the associated application as developed in Embedded C is required which continuously takes pictures of the vehicles in the parking lot or cross roads etc.

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Since Linux operating system has been ported on the target board, the application developed along with the driver should be cross compiled and thus the Atmel ARM 9 board will be able to take pictures continuously.

A modem should be connected with the target board in order to activate the GPRS connectivity, and hence the images taken, will get converted in to the text format so that, the information of Vehicle license plate will get transferred to the Server side.

The database on the server side identifies whether the information sent across is a Registered Vehicles License or not as an acknowledgement to the target board.

In case of not registered vehicle, an alarm signal will be sent across the target board indicating the Vehicle should not be allowed inside the parking lot etc, and immediate information will reach the concerned RTO office for further enquiry regarding stolen vehicles or so.

A. Design Overview

After power-on reset of the system, it moves Boot loader to start Linux OS, and then loads all kinds of connection and the camera drivers, to complete the initialization. It uses AT instruction to realize the GPRS module's operation, and it connects with the long-distance video frequency monitoring centre through moving PPP dialling program which linking GPRS network and completes the registration of the terminal. The camera starts to carry on the real-time monitoring, and after the compression, it will pass the obtained monitor image to the long-distance administrative centre for display.

The system uses the dynamic difference background images law [2] to judge the monitoring image, and when there are movement vehicles conforming to the rule, it takes a snapshot. Then it will hand the vehicles picture over the car license recognition software module of the embedded Linux system to recognize the car-license and transmit the car-license information to the long-distance administrative centre through the GPRS network.

The long-distance administrative centre completes vehicles' automatic charge or pass by inquiring car-license information in the database, and when there are exception occurs, the system will alarm.

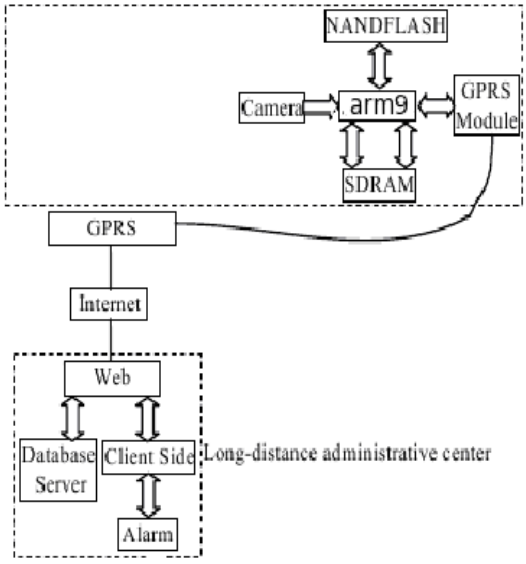

Fig. 1. Vehicle Monitoring System Block Diagram

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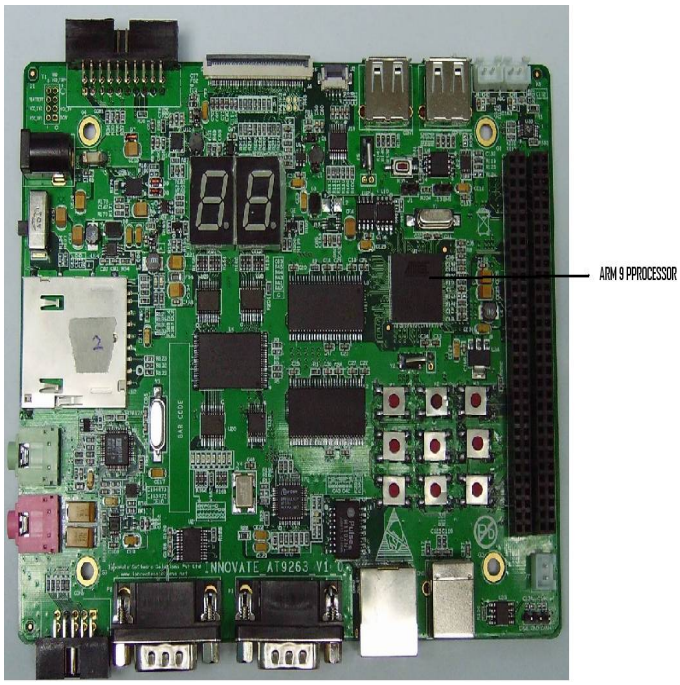

Fig. 2. Hardware Feature Block Diagram

B. Execution and Results.

The entire set up with the ATMEL ARM board, with the camera module is as shown in the Fig.3. Once the connections are established with the board, peripheral devices and long distance administrative system, the following step by step procedure must be followed.

Fig.3. At91sam9263 Embedded board with Zippys camera.

Step 1: A board is designed according to the specification required by the project as shown in the Fig.2. As a first procedure, enabling all the drivers and necessary programs, a cross-compilation tool chain has to be built on the

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designed board.

Step 2: Setting the Kernel cross compilation.

Step 3: Building root-file system on the board.

Step 4: Inserting camera module in kernel using insmod.

Step 5: Burning the Images on to the target board using minicom.

Step 6: Building Image capture application

Step 7: Executing application which is having capturing image and reading characters from image and sending this number. Here many cases have been tried which includes taking the picture of the license plate from an angle, at a distance more than the design specification, taking a blurred image. The clear picture by which characters are recognised is exhibited here.

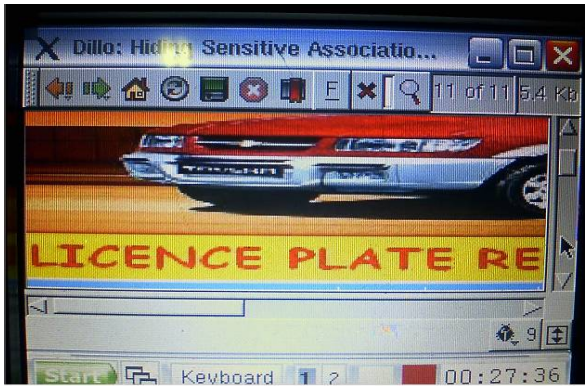

Fig.5. Web Page

Step 8: Fig.5. Shows executing web page present in a server in our host taking car number as an input. This is web page.

Step 9: If car number is valid then it will print with respective owner image as in Fig.6. Now it is showing owner image.

Fig.6. Car Owner's Image

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Step 10: If the number is registered, it will display information regarding vehicle like Car no,engine no, model, owner name, address, contact no fetching the information from the long distance administrative centre's database, as shown in Fig.7.

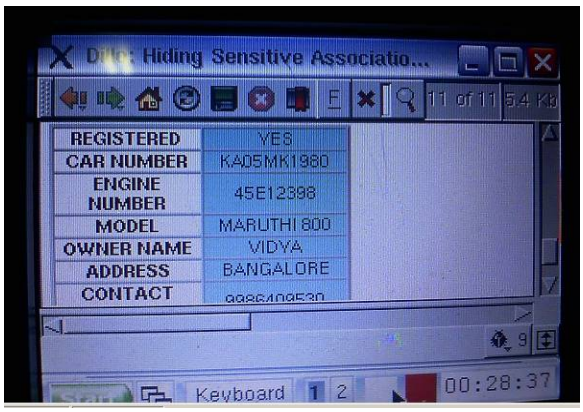

Fig.7. Registered Car Information

Step 11:Fig.8.shows if the vehicle is not registered then these information will popup saying as NULL.

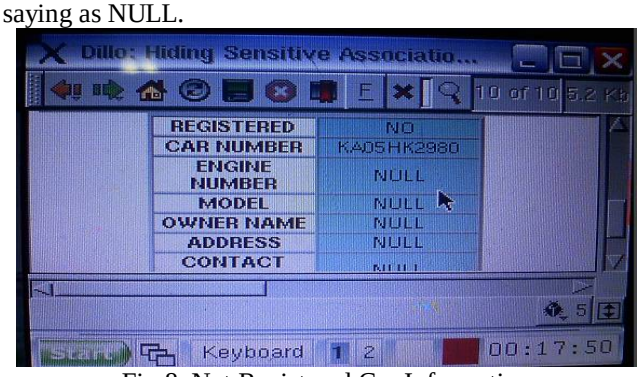

Fig.8. Not Registered Car Information

V. CONCLUSION

As a result of the high performance, the low power loss, the low price and the expansion network function of the embedded processor, using embedded system in the complex long-distance monitoring management system has become the trend. Presently, image monitoring management system unifying the wireless communication technology, the embedded system technology and the Internet technology has become a new develop hot-spot in the monitoring domain.

This project proposes one kind of embedded wireless vehicle management system basing on the GPRS network and the ARM microprocessor. Through the real-time gather to the image from the scene's monitor and the car license recognition to the appeared vehicles, the system transmits the real-time information to the supervisory system server through the GPRS network, meanwhile the system may monitor image through the Internet long distance on-looking administrative centre.

VI. FUTURE WORK

- In this project, the vehicle monitoring system in which a camera focused to grab frames of the vehicles License plate has a limitation in long distance, angle of view, illumination conditions.
- It can be altered further to identify all types of fonts written on the License Plate with different backgrounds.
- The resolution of the camera used can also be improved.

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- In statistical character recognition the aim is to make supervised or unsupervised classification. Various methods and applications have been suggested for the future work such as Hidden Markov Model. The sequential pattern recognition, which can be seen as a special case of statistical character recognition, is currently mostly approached by the use of the Hidden Markov Model (HMM). As a matter of fact, current state-of-the-art speech recognizer systems are based on HMMs. The HMMs originally emerged in the domain of speech recognition; other interesting fields have shown an interest for the use of these stochastic models, such as handwriting recognition, biological sequence analysis face recognition, etc.
- In future we can go for video input decoding chip TVP5150, and the compressed encoding chip MPG440.
- Work still remains to be done in order to improve the neural network's recognition performance and overcome as much as possible common misclassification errors (I –1 and O-0) that still occurred when the segmented plates were introduced to a commercial OCR system.

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