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DESIGN AND DEVELOPMENT OF VEHICULAR MONITORING AND TRACKING SYSTEM BASED ON ARM

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Abstract: Today Vehicular monitoring and tracking is one of the important area where in European countries doing research work to track and monitoring effective vehicle. This is complete package of vehicular tracking, monitoring by using GPS and GSM on GUI in base station also provide security, traffic information, accident prevention, identity. This system can deal with both pace and security. The Vehicle Monitoring and tracking System is a GPS based vehicle tracking system which is communicating through GSM module with the central server system. Server showing speed, direction and location of vehicle on screen and store requires data into server. The system is useful in much application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat.

Keywords: Embedded Linux ,C++, Qtopia ,Qt Creator ,Linux Drivers for USB CAM ,ADC Device Drivers, UART Protocol for Data transmission & Receive for GPS and GSM Module, ARM Mini2440 Board, S3c2440 ARM 9 Processor, GPS , GSM , Temperature sensor ,USB Camera, DC Motor.

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INTRODUCTION

In this modern, fast moving and insecure world, it is become a basic necessity to be aware of one's safety and security. The number of vehicles also increases on roads and highways. This result in more accident that interns leads to the traffic jams and public get help instantaneously. Maximum risks occur in situations. This system helps in such conditions to passengers and provides relief. It's the intelligent vehicle control for critical remote location application. This system can deal with both pace and security. The Vehicle Monitoring and Security System is a GPS based vehicle tracking system that is used for security applications as well. The information given to monitoring station is in continuous manner and when the accident occurs. The project uses two main underlying concepts. These are GPS (Global Positioning System) and GSM (Global System for Mobile Communication) and server which can store required data which is send by vehicle. The main application of this system in this context is tracking the vehicle to which the GPS is connected, giving the information about its position whenever required and store required information on both sides i.e vehicle and server. Global Position System (GPS) is a space-based satellite navigation that provides location and time information in all weather conditions, anywhere on or near the Earth. GPS Receiver MT3318 Module is used that have a active patch antenna from Cirocomm .This is done with the help of the GPS satellite and the GSM module attached to the vehicle which needs to be tracked. The GPS antenna present in the GPS module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and thus it reveals the position information. This information got from the GPS antenna has to be sent to the Base station wherein it is decoded. For this we use GSM module which has an antenna too. The module is mounted on the PCB along with the 3.3V low drop voltage regulator, transmit, receive and power indication LEDs, Schmitt trigger based buffer for 5V to 3.3V logic level conversion .Thus we have at the Base station; the complete data about the vehicle. For real time monitoring an automatic monitoring system can be established with GSM, in this vehicle automatically identify and upload critical data about the vehicle and operating conditions. The monitoring device can send modified control parameters and guidelines to the vehicle driver. These parameters are temperature, ultrasonic distance, IR.

II. RELATED WORK

In today's world as the population increases day by day the numbers of vehicles also increases on the roads and highways. This result in more accident that interns lead to the traffic jams and public get help instantaneously. Many researchers have proposed the use of cutting edge technologies to serve the target of vehicle tracking. These technologies include Communication,

GPS, and GIS, Remote Control, server systems and others. To improve the level of supervision and management for cargo transport vehicles, especially trucks carrying coal it is important to develop transport vehicles remote monitoring module [The proposed tracking system in this paper is designed to track and monitor automobiles' status that is used by certain party for particular purposes, this system is an integration of several modern embedded and communication technologies. To provide location and time information anywhere on earth, Global Positioning System (GPS) is commonly used as a space-based global navigation satellite system [2]. The location information provided by GPS systems can be visualized using Google Earth [3]. In wireless data transporting, Global System of Mobile (GSM) and Short Message Service (SMS) technology is a common feature with all mobile network service providers [4]. Utilization of SMS technology has become popular because it is an inexpensive, convenient and accessible way of transferring and receiving data with high reliability [6]. In current system there is different module for security and car monitoring tracking, and traffic information accident prevention system. Here this system explains new Design and implementation of complete package for vehicle on single ARM -9 boards. The development of vehicular design brings public many convenience in life but also brings many problems at the same time, for example, traffic congestion, difficulty in monitoring dispersive vehicle, theft and other series of problems. In current system it is sensory to provide tracking and monitoring system which is connected to base station and through base station require vehicle continuously tack and monitor for safety of goods in logistic, cargo vehicle transportation. For this system developed to security, tracking, monitoring and traffic information with accident prevention. The implemented tracking system can be used to monitor various parameters related to safety; emergency services and engine stall [1]. The paper shows an implementation of several modern technologies to achieve a desirable goal of fleet monitoring and management.

III. HARDWARE DESIGN

Figure1. show Vehicular system blocks hardware. ARM board with different components mounted on it. The system work with different modules as shown in fig and it is the heart of system receiving information from different module and sends it to GSM module for server.



Figure 1: vehicular system Hardware

A. GSM Module:

It is the almost popular wireless standard for mobile phones in the world. GSM module allows transmission of Short message service (SMS) in TEXT mode and PDU mode. Global System for Mobile communications (GSM) is the wireless standard for wireless communication used to send information to the control station. It Support instructions of AT commands. SIM300 can be integrated with a wide range of applications. SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz SIM300 provides GPRS multi-slot class 10 capabilities and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

B. ARM Mini2440:

Fig 2.shows ARM ARM Mini 2440 Board and connected components to it. The LCD is connected to ARM board shown in Fig. Friendly ARM Mini2440 Board is equipped with SAMSUNG's S3C2440A 16/32-bit RISC microprocessor, it is is designed to provide hand-held devices and general applications with low-power, and high-performance micro- controller solution in small die size.

ARM is a unit in the system which is receives data, computed ti and sends to base unit.The S3C2440A is developed with ARM920T core, 0.13um CMOS standard cells and a memory complier. Its low- power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA).



Figure 2: ARM Mini 2440Board

C. GPS Receiver:

Global Position System (GPS) is satellite navigation that provides location, and time information in all weather conditions, anywhere on or near the Earth GPS Receiver MT3318 Module is used to receive data in in standard National marine electronics association (NMEA) format. The

PS module has -157dBm tracking sensitivity with 9600 baud

GPS modules are popularly used for navigation, positioning, time and other purposes. GPS antenna receives the location values from the satellites. GPS gives information about Message transmission time Position at that time and send to the server for GUI (Graphical User Interface) and store into server. GPS is interface with ARM processor. ARM processor using UART1 protocol interface with GPS receiver. Which contains information about Vehicle position (longitude, latitude) and speed GPS Sentences beginning with the following specifications: \$GPGGA, \$GPGSA, \$GPGSV, \$GPRMC, and \$GPVTG. And sentences also begins with \$GPMSS, \$GPZDA.

C .On Board Data Storage:

To store data on board SD card is used in the system. All required data is stored in SD card so as system can be used as black box. The SD card is interface with ARM by using SPI protocol in board. All vehicles related data which is transmitted to system is store into SD card.

D. Microphone:

The driver can record his voice over the microphone in any case of emergency the same data will be stored over the SD card to retrieve. This system acts as Black box for vehicle to store emergency voice.

E. Accelerometer

Accelerometer sensor is used to measure static (earth Gravity) or dynamic acceleration in all three axes; forward/backward, left/right .It gives output in voltage 1.65V to 3.3V in positive direction and in negative direction the voltage drop from 1.65V to 0V.

F. Camera:

In order to view the scenario over the vehicle we use the USB camera which will driven through Video for Linux drivers of the board, for demonstration scenario we will shown it over the intranet network over the web .

G. Accident Detection:

To detect the accident will use the IR sensor, if in this case, the system acquire the information, will alert surrounding through buzzer and send the GPS data to the sever indicating the accident also send emergency massage for help to emergency services.

H. Accident Privation:

Will calculate the distance of the adjacent vehicles and updates the microcontroller on same, if any any vehicle is neared then the predefined value then the system will alert the driver using the buzzer. Driver can take action according to situation.

I. Base unit:

Base Unit Contain all the peripheral to be monitored in our Project connected to the ARM 9 Board, as the user starts his vehicle, the system will collect all the information from the sensors and the information is transmitted to Tracking server using GSM/GPRS modem on GSM network by using SMS. Tracking server also has GSM/GPRS modem that receives vehicle location information via GSM network and stores this information in database. This information is available to authorized users of the system. The base station is continuously communicated with the vehicle.

J. Emergency Button:

Here we are using switches to detect any accident. As soon as any of the switches are pressed the latitude and the longitude of that place are recorded (with the help of GPS), also we are recording various vehicle parameters such as engine temperature, fuel level, speed etc. These parameters are then sent to the base unit and emergency services via the GSM modem.

K. Temperature Sensor:

It continuously monitors the temperature of engine as well as cabin & sends its value to microcontroller. If temperature of engine or cabin exceeds desire value then system alerts to driver.

L. Traffic information:

On Server Side we will equip a GSM Modem to communicate to the Vehicle data received by the server modem will be shown the Visual Studio Window to know the exact location and status of the Vehicle. After gating data traffic density neared by vehicle module send information to server.

M. Fingerprint Detection System:

We will implement a Fingerprint Detection System. This system tries to find the identity of a given Fingerprint according to their memory (Training Set). We are designing our own vehicle unit which consists of 2 DC motor based wheels. These wheels are operated using 12v DC motor. The system works at 5v and the DC motors operate at 12V, so to match the voltages we are interfacing a DC motor driver circuit L293D which will in turn drive the DC motors. Fingerprint Scanner scans the finger print of driver and authentication it if the identity of driver is matched he can start vehicle and GSM module message to base station with his identify.

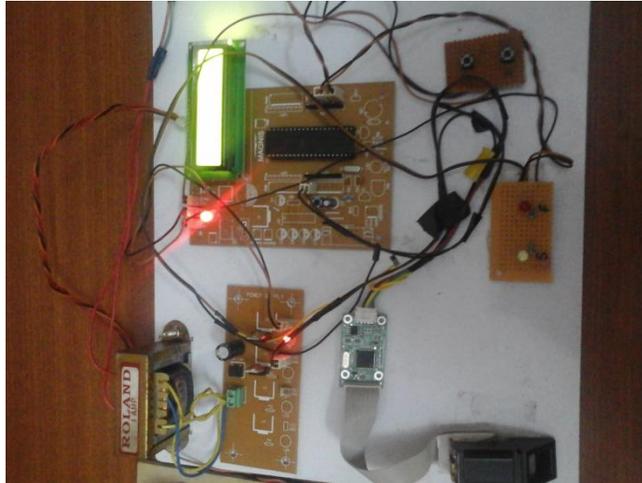


Figure 3: Fingerprint module

Here, we want to find the identity of a person where an image of fingerprint of that person (test image) is given to the system.

IV. SOFTWARE DESIGN

A. Server:

Server is base station in this system which is monitoring and tracking vehicle using GUI application. The Visual studio is used to develop GUI application. Server receive require information through GSM module display and store. Base station continuously monitoring vehicle and it can send required information to vehicle. Figure shows vehicle poison on Google map

B. ARM Linux Operating System:

In this project, we are using Linux2.6.3 kernel cross compiled for ARM architecture, RM Linux is a port of the successful Linux Kernel to ARM processor based machines.

C.GUI: QTOPIA GUI Library:

Qt is a cross-platform application framework that is widely used for developing application software with a graphical user interface (GUI), and also used for developing non-GUI programs such as command-line tools and consoles for servers. Qt uses standard C++ but makes extensive use of a special code generator together with several macros to enrich the language. To

develop the Programs, we use Qt Creator IDE (Interface Development Environment) to write and debug the source codes.

V. Work flow of the system

The flow chart of system showed in figure 4 which indicating complete working of system. ARM is the heart of system where all data from different module is received processed and sends to Base station through GSM module. As system start driver has to authenticate his finger on finger print detection module if authentication fail driver can not start vehicle .If authentication success engine will start vehicle identity number and driver identity number will send to the server this information with time will store in server.

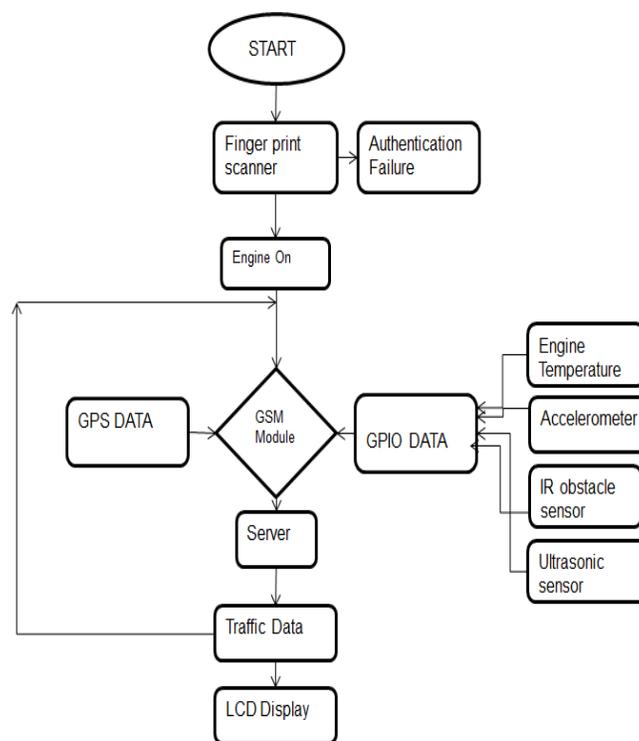


Figure 4: Flow diagram of system

The GPS module continuously receiving data from satellite in formats of NMEA Messages calculate position, speed of vehicle send to GSM module with temperature of vehicle server receive this data. The transmitted GPS data is processed by a Visual Basic program using a Kalman filter to correct the current position. The resulted data of corrected position and automobile parameters is sorted in an Excel sheet. The Excel file is exported to a KML file that is compatible with Google Earth program. Hence, Google Earth will view the location and status of

the automobile on the map by reading the KML file. The KML file, developed for Google Earth, is used to save geographic data that includes navigation maps and other driving instructions. After starting engine on IR obstacle sensors and ultrasonic sensor continuously sensing obstacle if obstacle coming near to the vehicle i.e crosses the predefined distance buzzer will on and driver should take action. Accelerometer is used to detect accident if detected the emergency message transmitted to the server and emergency services such as police or hospital. Server store all required data.

VI. APPLICATIONS

The system is useful in application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat. In security application it is used in vehicles' carrying industrial goods this system helps to on time delivery. It is also used in boats to track and monitor the position of boat in water. This module can use in any normal venial to protect from accident to get security, identity.

VII. RESULTS

This system used in vehicle to track and monitor affected vehicle. In the result we can see on the server screen the current position and direction of the vehicle with speed, temperature and driver identification through GSM this information store in SD card and in server. The fingerprint module identify driver and then start engine also send this information to server. This system is capable to avoid accident by using visual indication to driver to indicate back side vehicle. This system also provides Traffic information to server. We can see live streaming on server which will show current situation in vehicle.

VIII. CONCLUSION

Design and Development of Vehicular Monitoring and Tracking System based on ARM is the complete package of vehicular monitoring, tracking, identity, security, traffic information accident prevention, with emergency services provide at any time and any place. This system continuously communicates with base station over GSM module and store requires data into server. The system is useful in much application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat. This system has wide area of Application to save lives of people and to improve the service.

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