Fingerprint based authentication and security system using GSM and GPS technology

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Abstract: *Fingerprint sensor captures the fingerprint images, matches the uniqueness of each print read by the sensor and compares it to the one stored in its module or local system database. A vehicle tracking system that works using GPS and GSM technology, which would be the cheapest source of vehicle tracking and it would work as anti-theft system. It is an embedded system which is used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM).It will continuously monitor a moving vehicle. This system contains single board embedded system that is equipped with GPS and GSM modems along with ARM processor which is installed in the vehicle. After pressing the emergency key in case of trouble, SMS is sent to the server via SMS using AT command.*
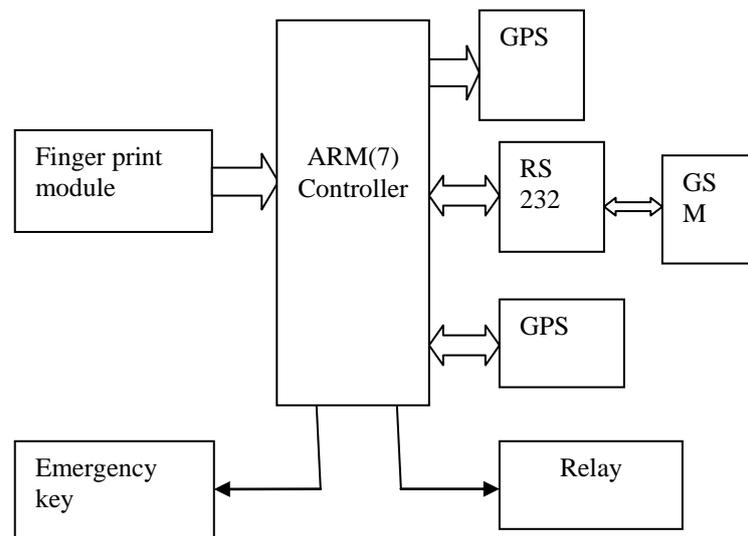
Key Words: *GPS, GSM, Fingerprint sensor, ARM processor, tracking*

I. Introduction

In today's world employee security has become a major concern. Especially employee's that are working in call centres who have to do a night shifts and return home at late night hours For such employees their safety is a major worry for all companies. We read many attacks on such call centre cabs in recent times, moreover there is no efficient way to inform the company or the police so that any immediate action can be taken to resolve above mentioned problems we have come up with the solution of finger print recognition and GPS based employee tracking and security Here we are tracking the employee cab as well as the employee's, also we have an arrangement for emergency button so whenever any employee finds him/her self in any kind of trouble an SMS can be sent to the nearest police station and the company so that immediate action can be taken by the concerned authorities.

II. SYSTEM ARCHITECTURE

Figure shows the basic block diagram. Finger print module is used for identification of valid employee's.
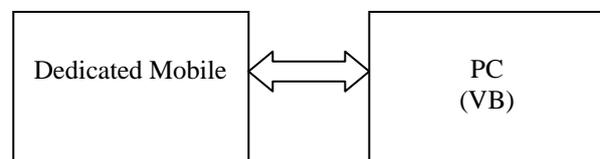

Receiver Unit:

Fig 1: System block diagram

III. HARDWARE DESIGN
Finger Print Module

First the user has to confirm its identification before entering. For user identification finger print sensor is used. The finger print sensor is attached to arm processor. The role of arm processor will be to access the finger print sensor by using its commands. There is Serial Communication between Finger Print Module and PC. The user will first put her/his thumb on sensor. Matching will be done from sensor data base. If match found then access will be granted, detail of member will be SMS to base station. If user is invalid then also SMS will be sent to base station & access will not be granted. Biometric identification from a print made by an impression of the ridges in the skin of a finger is often used as evidence in criminal investigations. This is an optical biometric fingerprint reader/sensor (R305) module with TTL UART interface for direct connections to a microcontroller UART. The user

can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person. This module can directly interface with any 3.3V or 5V microcontrollers, but a suitable level converter/serial adapter is required for interfacing with the serial port of a PC.

GPS Unit

The GPS receiver provides high position, velocity and time accuracy performances as well a high sensitivity and tracking capabilities. A GPS tracker essentially contains GPS module to receive the GPS signal and calculate the coordinates. For data loggers it contains large memory to store the coordinates, data pushers additionally contains the GSM/GPRS modem to transmit this information to a central computer either via SMS or via GPRS in form of IP packets.

GSM Module

The AT commands are given to the GSM modem with the help of PC or controller. The GSM Modem is serially interfaced with the controller with the help of MAX 232.GSM module is used to send message to base station. Interfacing is serial with ARM processor at 9600 baud rate. AT commands are used to access GSM modem.

ARM7TDMI-S processor

The LPC2138 microcontrollers are based on a 16/32 bit ARM7TDMI-SCPU with real-time emulation and embedded trace support that combines the microcontroller with embedded high speed. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. With a wide range of serial communications interfaces and on-chip SRAM options of 8/16/32 kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large Buffer size and high processing power. Various 32-bit timers, single or dual 10-bit8 channel ADC(s), 10-bit DAC, PWM channels and 47 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously.

R305 interface with controller

In today's secure world biometric safety is on the top. Unlike other techniques which make use of passwords and numbers, that are needed to be remembered, biometric techniques make use of human body parts like fingerprints or even iris of our eyes and as we know that these things are unique to all thus it makes biometric systems the most effective over others. In this project I have interfaced a very popular fingerprint scanner R305 with LPC2138 controller. This module communicates over UART protocol with controller i.e. it makes use of Rx and Tx pin of microcontroller to interact with it. Now talking about this module, it comes preloaded with scanner as well as detection section and we are left with 4 pins for connections. These 4 pins are: VCC, GND, Rx and Tx. It works over 3.3 to 5V supply and its Rx and Tx pin is connected to Tx and Rx pin of the controller respectively.

At power on, it takes about half a second for initialization, during this period the module can't accept commands. The system sets aside a 512-bytes memory (16 pages X 32 bytes) for user's notepad, where data requiring power-off protection can be stored. There is an image buffer and two 512-byte-character-file buffers within the RAM space of the module. This buffer serves for image storage and the image format is 256*288 pixels. Two character file buffers can be used to store both character file and template file. System sets aside a certain space within Flash for fingerprint template storage, that's fingerprint library. It is non volatile in nature.

Data Interface

UART1 provides mechanism that enables implementation of either software or hardware flow control. The UART1 receiver block, U1RX, monitors the serial input line, RXD1, for valid input. The UART1 RX Shift Register (U1RSR) accepts valid characters via RXD1. After a valid character is assembled in the U1RSR, it is passed to the UART1 RX Buffer Register FIFO to await access by the CPU or host via the generic host interface. The UART1 transmitter block, U1TX, accepts data written by the CPU or host and buffers the data in the UART1 TX Holding Register FIFO (U1THR). The UART1 TX Shift Register (U1TSR) reads the data stored in the U1THR an assembles the data to transmit via the serial output pin, TXD1. The UART1 Baud Rate Generator block, U1BRG, generates the timing enables used by the UART1 TX block. The U1BRG clock input source is the VPB clock (PCLK). The main clock is divided down per the divisor specified in the U1DLL and U1DLM registers. This divided down clock is a 16x oversample clock.

IV.   SOFTWARE

One of the important parts in making an embedded system is loading the software/program we develop

into the microcontroller. Usually it is called "burning software" into the controller. Before "burning a program" into a controller, we must do certain prerequisite operations with the program. This includes writing the program in assembly language or C language in a text editor like notepad, compiling the program in a compiler and finally generating the hex code from the compiled program. Earlier people used different software applications for all these 3 tasks. Writing was done in a text editor like notepad/WordPad, compiling was done using separate software (probably a dedicated compiler for a particular controller like LPC2138), converting the assembly code to hex code was done using another software etc. It takes lot of time and work to do all these separately, especially when the task involves lots of error debugging and reworking on the source code. Keil MicroVision is free software which solves many of the pain points for an embedded program developer. This software is an integrated development environment (IDE), which integrated a text editor to write programs, a compiler and it will convert your source code to hex files too.

V. RESULTS

The implementation of realization of "Advanced Authentication & Security system for call centre Employee's with live GPS tracking" is done successfully. The communication is properly done without any interference between different modules in the design.
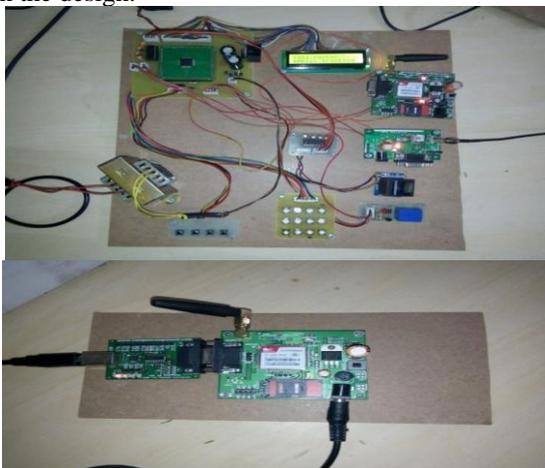

Fig 2: ARM 7 Board (LPC2138) and Receiver unit

Fig 3: Registration using thumb

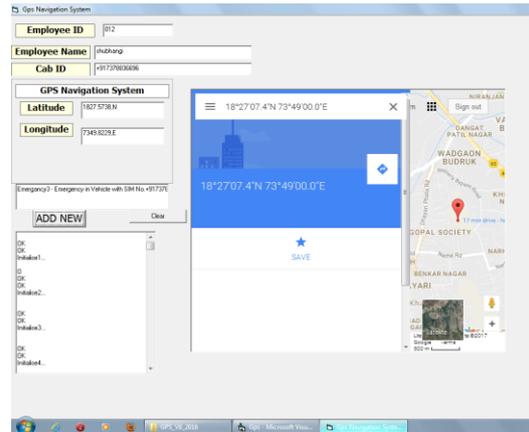In the receiver side by using VB software it shows location and details of employees.

Fig 4: displaying the location and the Employee's Information

VI. CONCLUSION AND FUTURE SCOPE

After Successful completion of this research, the following benefits are realized : (1) Effective Communication with administrators. (2) Quick response to accident. (3) Quick alert to police and other security services. Hence, A Vehicle tracking system is becoming increasingly important in rural and urban areas and it is more secured than other systems. It is more interactive by adding a display to show basic information about the vehicle and provides alert system for reporting any kind of trouble occurrences.

The system could be modified into a web based system.

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