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VLSI Based Vehicle Security and Accident Information System

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Abstract: *VLSI based vehicle security and accident information system is useful to avoid the accidents and to provide vehicle security against theft. Security of the vehicle is done by password. Theft information is sent to owner's mobile by using GSM module. Accident of the vehicle is detected by using pressure sensor which is connected in the vehicle. The information of accident is sent to the hospital which is nearby for the location point of view. The location of the vehicle is identified with help of most famous technique called GPS technique. So almost this work is based on VLSI. As there are different module which are used for security and accident information. In order to make the combined system that performs the purpose of vehicle security and accident information system can be achieved by interfacing. For this interfacing these modules FPGA will be used.*
Keywords: *Very large scale integration, Global system for mobile communication, Global positioning system and Field programmable gate array.*

I. Introduction:

The present methods of Vehicles security are: Remote starters for vehicle doors, Vehicle with door lock module facility, Using motion sensors, etc. The limitations of these methods are that these cannot provide high degree of security to the Vehicle. So there is only manual information of accident to the hospital. There is no automatic accident information system. So our system fulfils these requirements. Our system uses the FPGA as the basic module to interface with GPS, GSM and RF modules.

Global Positioning System:

The Global Positioning System (GPS) is a system used for finding the location of an object of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles. GPS was developed by the United States Department of Defence for its useful application in military for locating utility. GPS has proved to be a useful tool in non-military mapping applications as well. GPS satellites are orbited high enough to avoid the problems associated with land based systems, yet it can provide accurate positioning 24 hours in a day, anywhere in the world. Uncorrected positions determined from GPS satellite signals produce accuracies in the range of 50 to 100 meters. When using a differential correction technique, the users can get accurate positions within 5 meters or less [1].

Triangulation:

In a short, GPS is based on satellite ranging - calculating the distances between the receiver and the position of 3 or more satellites (4 or more if elevation is desired) and then applying some good old mathematics. Assuming the positions of the satellites are known, the location of the receiver can be calculated by determining the distance from each of the satellites to the receiver. GPS takes these 3 or more known references and measured distances and "triangulates" an additional position [2].

Location Determination by GPS Satellites:

GPS satellites are orbiting the Earth at an altitude of 11,000 miles. The department of defence can predict the paths of the satellites vs. time with great accuracy. Furthermore, the satellites can be adjusted periodically by huge land-based radar systems. Therefore, the orbits and the locations of the satellites are known in advance. Now a day's GPS receivers store this orbit information for all the GPS satellites in an almanac. Consider the almanac as a "bus schedule" advising you about the position of each satellite at a particular time. Each GPS satellite continually broadcasts the almanac. The GPS receiver will automatically collect this information and store it for future reference [3].

Calculation of the Position from the GPS Satellites:

GPS is used to find the distance between a GPS satellite and a GPS receiver by finding the time taken by a radio signal travelling from the satellite to the receiver. Radio waves travels with the speed of light. This is about 186,000 miles per second. If the time taken by the signal to travel from the satellite to the receiver is known, then the distance from the satellite to the receiver (distance = speed x time) can be determined. If the exact times of the transmission and reception of the signal are known, the signal's travel time can be determined.

In order to do this, the satellites and the receivers are acting as accurate clocks which are synchronized to generate the same code exactly at the same time. The code received from the satellite can be compared with the code generated by the receiver. By comparing the codes, the time difference between the satellite generated, and the receiver generated can be determined. This interval is the travel time of the code. Multiplication of this travel time, in seconds, by 186,000 miles per second gives the distance from the receiver position to the satellite position in miles.

Increased Accuracy by Using Differential GPS:

A differential correction technique is a technique which is necessary to get accuracies within 1to 5 meters, or even better, with advanced equipments. This requires a second GPS receiver, which is a base station, collecting data from a stationary position and from a precisely known point (typically it is a surveyed work). Because the physical location of the base station is known, the correction factor can be find out by comparing the known location with the GPS location determined by using the satellites. The differential correction process takes this correction factor and applies it to the GPS data collected by a GPS receiver in the field. Differential correction eliminates most of the errors listed in the GPS Error Budget.

Global System for Mobile Communications:

GSM stands for global system for mobile communication. This is the standard used for mobile phones in the world. GSM service is used by over 2 billion people across more than 212 countries and territories. The important features of the GSM standard makes the international roaming very common between mobile phone operators, enabling subscribers to use their phones in many parts of the world. GSM differs significantly from its predecessors in that both signalling and speech channels are Digital call quality, which means that it is considered a second generation (2G) mobile phone system. For the consumers point of view, the key advantage of GSM systems has been good digital voice quality and low cost alternatives for making calls such as text messaging Like other cellular standards GSM allows network operators to offer roaming services which mean subscribers can use their phones all over the world.

The modulation used in GSM is Gaussian minimum shift keying (GMSK).This is a type of continuous-phase frequency shift keying. In GMSK, the signal to be modulated onto the carrier is first smoothed with a Gaussian low-pass filter prior to being fed to a frequency modulator, which greatly reduces the interference to neighbouring channels (adjacent channel interference).

Radio Frequency Communication:

RF itself has become synonymous with wireless and high-frequency signals, describing anything from AM radio between 535 kHz and 1605 kHz to computer local area networks (LANs) at 2.4 GHz. However, RF has traditionally defined frequencies from a few kHz to 1 GHz. If one assumes as microwave frequencies as RF, this range extends to 300 GHz. A wave or sinusoidal can be completely described by either its frequency or its wavelength. These are inversely proportional to each other and related to the speed of light through a particular medium. As frequency increases, wavelength decreases. For reference, a 1 GHz frequency has a wavelength of roughly 1 foot and a 100 MHz wave has a wavelength of roughly 10 feet.

Operation at Higher Frequencies:

Typically, data is structured and easily represented at low frequencies; how can we represent it or physically translate it to these higher RF frequencies? For example, the human audible frequency range is from 20 Hz to 20 kHz. According to the Nyquist theorem, we can completely represent the human audible range by sampling at 40 kHz or, more precisely, at 44.1 kHz (this is where stereo audio is sampled). Cell phones, however, operate at around 850 MHz.

Field-programmable Gate Array:

A field programmable gate array (FPGA) is an integrated circuit (IC) that includes a two-dimensional array of general-purpose logic circuits, called cells or logic blocks, whose functions are programmable. The cells are linked to one another by programmable buses. A field-programmable gate array comprises any number of logic modules, an interconnected routing architecture and programmable elements that may be programmed to selectively interconnect the logic modules to one another and to define their functions. The basic device architecture of an FPGA consists of an array of configurable logic blocks (CLBs) embedded in a configurable interconnect structure and surrounded by configurable I/O blocks (IOBs). An IOB allows signals to be driven off-chip or optionally brought from the FPGA to interconnect segments. The IOB can typically perform other functions, such as tri-stating outputs and registering incoming or out-going signals. The configurable interconnected structure allows users to implement multi-level logic designs. In addition, FPGAs typically include other specialized blocks, such as block random access memories (BRAMs) and digital signal processors (DSPs). These specialized blocks perform more specific tasks than the CLBs, but can still be configured in accordance with a variety of options to enable flexible operation of the FPGA. Field programmable gate arrays may be classified in one of two categories. One category of FPGA devices is one-time programmable and uses elements such as antifuses for making programmable connections. The other category of FPGA devices is reprogrammable and uses devices such as transistor switches as the programmable elements to make non permanent programmable connections. An FPGA can support hundreds of thousands of gates of logic operating at system speeds of tens of megahertz. To implement a particular circuit function, the circuit is mapped into the array and the appropriate programmable elements are programmed to implement the required wiring connections that form the user circuit. The FPGA is programmed by loading programming data into the memory cells controlling the configurable logic blocks, I/O blocks and interconnect structure.

A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing—hence "field-programmable". The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC) (circuit diagrams were previously used to specify the configuration, as these were for ASICs, but this is increasingly rare). FPGAs can be used to implement any logical function that an ASIC could perform. The ability to update the functionality after shipping and the low non-recurring engineering costs relative to an ASIC design (not withstanding the generally higher unit cost), offer advantages for many applications.

FPGAs contain programmable logic components called "logic blocks" and a hierarchy of reconfigurable interconnects that allow the blocks to be "wired together"—somewhat like a one-chip programmable breadboard. Logic blocks can be configured to perform complex combinational functions, or simple logic gates like AND and XOR. In most FPGAs, the logic blocks also include memory elements, which may be simple flip-flops or more complete blocks of memory. FPGA Comparisons: Historically, FPGAs have been slower, less energy efficient and generally achieved less functionality than their fixed ASIC counterparts. A combination of volume, fabrication improvements, research and development and the I/O capabilities of new supercomputers have largely closed the performance gap between ASICs and FPGAs.

Advantages include a shorter time to market, ability to re-program in the field to fix bugs and lower nonrecurring engineering costs. Vendors can also take a middle road by developing their hardware on ordinary FPGAs, but manufacture their final version so it can no longer be modified after the design has been committed.

Xilinx claims that several market and technology dynamics are changing the ASIC/FPGA paradigm:

IC costs are rising aggressively. ASIC complexity has bolstered development time and costs R&D resources and headcount is decreasing, Revenue losses for slow time-to-market are increasing Financial constraints in a poor economy are driving low-cost technologies.

These trends make FPGAs a better alternative than

ASICs for a growing number of higher-volume applications than they have been historically used for, to which the company attributes the growing number of FPGA design starts Some FPGAs have the capability of partial re-configuration that lets one portion of the device be re-programmed while other portions continue running.

FPGA versus CPLDs:

The primary differences between CPLDs and FPGAs are in their architecture. A CPLD has a somewhat restrictive structure consisting of one or more programmable sum-of-products logic arrays feeding a relatively small number of clocked registers. The result of this is less flexibility, with the advantage of more predictable timing delays and a higher logic-to interconnect ratio. The FPGA architectures, on the other hand, are dominated by interconnection. This makes them far more flexible (in terms of the range of designs that are practical for implementation within them) but also far more complex to design for.

Another notable difference between CPLDs and FPGAs is the presence in most FPGAs of higher-level embedded functions (such as adders and multipliers) and embedded memories, as well as to have logic blocks implemented decoders or mathematical functions.

Security Considerations:

For security point of view, FPGAs have both advantages and disadvantages as compared to ASICs or secure microprocessors. FPGAs' flexibility makes more modifications during fabrication. For many FPGAs, the loaded design is exposed while it is loaded (typically on every power-on). To address this issue, some FPGAs support bit stream encryption.

Applications of FPGAs:

FPGAs have gained rapid acceptance and growth over the past decade because it can be applied to a very wide range of applications. A list of typical applications includes: random logic integrating, multiple SPLDs, device controllers, communication encoding and filtering, small to medium sized systems with SRAM blocks. Other interesting applications of FPGAs are prototyping of designs later to be implemented in gate arrays and also emulation of entire large hardware systems.

Universal asynchronous Receiver/Transmitter:

A universal asynchronous receiver/transmitter (usually abbreviated UART) is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device. UARTs are now commonly included in microcontrollers. A dual UART or DUART combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously; these devices are called USARTs (universal /asynchronous receiver/transmitter).

Transmitting and Receiving Serial Data:

The Universal Asynchronous Receiver/Transmitter (UART) controller is the main component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. In this situation, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. A UART is used to convert the transmitted information between its sequential and parallel form at each end of the link. Each UART contains a shift register which is the fundamental method of conversion between serial and parallel forms. The UART usually does not directly generate or receive the external signals used between different items of equipment. Typically, separate interface devices are used to convert the logic level signals of the UART to and from the external signalling levels. External signals may be of many different forms. Examples of standards for voltage signalling are RS-232, RS-422 and RS-485 from the EIA. The presence or absence of current (in current loops) was used in telegraph circuits. Some signalling schemes do not use electrical wires. Examples of these are optical fiber, In DA (infrared) and (wireless) Bluetooth in its Serial Port Profile (SPP). Some signalling schemes use modulation of a carrier signal (with or without wires). Examples are modulation of audio signals with phone line modems, RF modulation with data radios and the DC-LIN for power line communication. Communication may be "full duplex" (both send and receive at the same time) or "half duplex" (devices take turns transmitting and receiving).

Asynchronous Receiving and Transmitting: In asynchronous transmitting, teletype-style UARTs send a "start" bit, five to eight data bits, least-significant-bit first, an optional "parity" bit and then one, one and a half, or two "stop" bits. The start bit is of opposite polarity of the data-line's idle state. The stop bit is the data-line's idle state and provides a delay before the next character can start. (This is called asynchronous start-stop transmission). In mechanical teletypes, the "stop" bit was often stretched to two bit times to give the mechanism more time to finish in printing a character. A stretched "stop" bit also helps resynchronization. The parity bit can either makes the number of "one" bits between any start/stop pair odd, or even, or it can be omitted. Odd parity is more reliable because it assures that there will always be at least one data transition and this permits many UARTs to resynchronize. Asynchronous transmission allows data to be transmitted without the sender having to send a clock signal to the receiver. Instead, the sender and receiver must agree on timing parameters in advance and special bits are added to each word which is used to synchronize the sending and receiving units. When a word is given to the UART for Asynchronous transmissions, a bit called the "Start Bit" is added to the beginning of each word that is to be transmitted. The Start Bit is used to alert the receiver that a word of data is about to be sent and to force the clock in the receiver into synchronization with the clock in the transmitter. These two clocks must be accurate enough not to have the frequency drift by more than 10% during the transmission of the remaining bits in the word. (This requirement was set in the days of mechanical teleprompters and is easily met by modern electronic equipment).

System Design:
Accident Information and Vehicle Security System
System Functions:

To start the engine of the vehicle, the password should be given. If it is correct, the vehicle will be started normally. Whenever the engine gets started, the alert message is sent to the owner's mobile. Second attempt will be given in case of missing of password. If it is continued in second attempt also, the doors will be locked, buzzer will start to beep and alert message will be sent to the owner's mobile. If the password is given in reverse manner, the theft information will also be sent to nearest police station. The accident is detected by the pressure sensors.GPS receiver sends the data via RF modem to the nearest hospital.

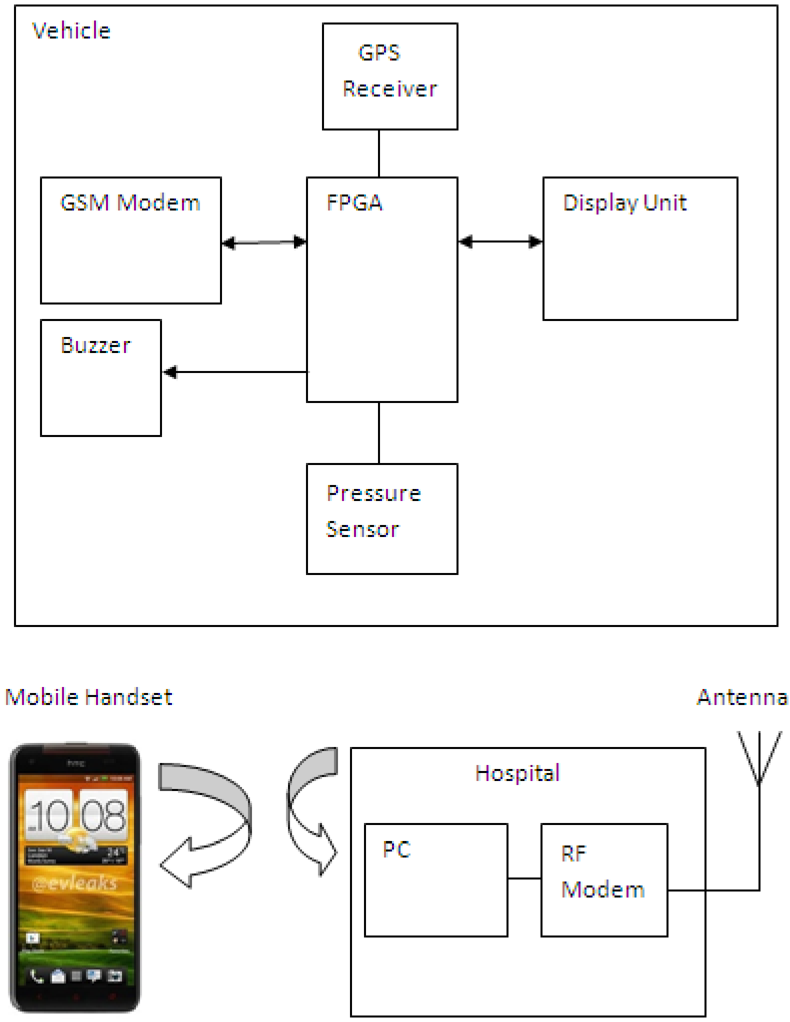

Figure 1. Block diagram for vehicle security and accident information system

Advantages of the System:
(i) With this system it is possible to identify a person who found in the accident and treatment can be given as soon as possible.
(ii) By using this, vehicle theft can be detected and it can be avoided before it happens.
(iii) Vehicle security is maintained properly.

Future Scope of the System:
(i) Automatic information to the traffic police to clear the accident place as soon as possible in the future.
(ii) Avoiding the alert message in the vehicle when no person is present in the vehicle.

II. Conclusion:

Thus the accident location will be detected using GPS and will be communicated to the nearest hospital using RF communication. Theft information is sent to the owners mobile using GSM.

References

[1]. Trimberger, S., 1994. Ed., Field-Programmable Gate the accident spot, as soon as possible. Array Technology, Kluwer, Academic Publishers.
[2]. Oldfield, J. and R. Dorf, 1995. Field Programmable there is none in the car. Gate Arrays, John Wiley & Sons, New York
[3]. Rose, J., A. El Gamal and A. Sangiovanni-Vincentelli, 1993. Architecture of Field-Programmable Gate Arrays, in Proceedings of the IEEE, 81(7): 1013-1029.

[4]. Jan A. Audestad. Network aspects of the GSM system. In EUROCON 88, June 1988.
[5]. D. M. Balston. The pan-European system: GSM. In D. M. Balston and R.C.V. Macario, editors, Cellular Radio Systems. Artech House, Boston, 1993.
[6]. In 1998, United States Vice President Al Gore announced plans to upgrade GPS with two new civilian signals for enhanced user accuracy and reliability, particularly with respect to aviation safety and in 2000 the United States Congress authorized the effort, referring to it as GPS II
[7]. Press Release, "Xilinx Co-Founder Ross Freeman Honored as 2009 National Inventors Hall of Fame Inductee for Invention of FPGA.