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Design And Development Of Vehicle Accident Detection System Using Mems Technology

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Abstract

In coming days is to face new challenges. Hence every field prefers automated control systems. Especially in the field of electronics automated systems are doing better performance. Probably the most useful thing to know about the global system for mobile communication is that it is an international standard. If you travel in parts of world, GSM is only type of cellular service available. Instead of analog services, GSM was developed as a digital system using TDMA technology. The goal of the paper is to develop a system, which uses Mobile technology that keeps control of the various units of the automobiles, which executes with respect to the signal sent by the mobile. For utilization of appliances the new concept has been thought to manage them remotely by using GSM MODEM, which enables the user to remotely control switching of domestic appliances. Just by dialing keypad, from where you are calling you can perform ON / OFF operation of the devices. The aim of this paper is, when accident happans the MEMS (micro electro mechanical sensor) gets disturbed and sends output signal to the ARM7 processor ,then to locate the place using GPS and is sent to processor. GSM modem will get information and LCD will glow.

1. Introduction

MEMS is a process technology used to create tiny integrated devices or systems that combine mechanical and electrical components. They are fabricated using integrated circuit (IC) batch processing techniques and can range in size from a few micrometers to millimetres. These devices (or systems) have the ability to sense, control and actuate on the micro scale, and generate effects on the macro scale.

The interdisciplinary nature of MEMS utilizes design, engineering and manufacturing expertise from a wide and diverse range of technical areas including integrated circuit fabrication technology, mechanical engineering, materials science, electrical engineering, chemistry and chemical engineering, as well as fluid engineering, optics, instrumentation and packaging. The complexity of MEMS is also shown in the extensive range of markets and applications that incorporate MEMS devices. MEMS can be found in systems ranging across automotive, medical, electronic, communication and defence applications. Current MEMS devices include accelerometers for airbag sensors, inkjet printer heads, computer disk drive read/write heads, projection display chips, blood pressure sensors, optical switches, micro valves, biosensors and many other products that are all manufactured and shipped in high commercial volumes.

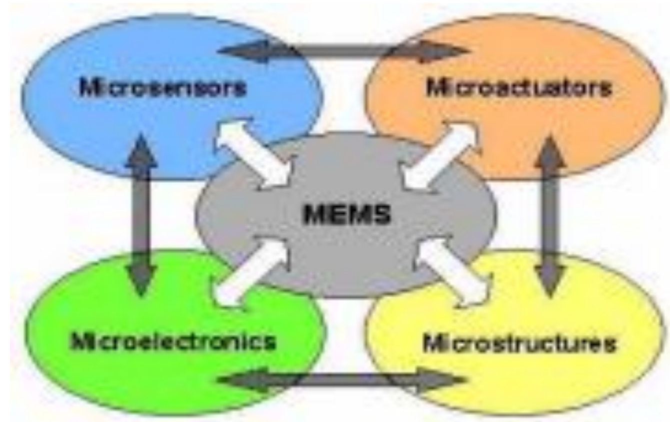

Fig 1. Basic structure of MEMS

MEMS has been identified as one of the most promising technologies for the 21st Century and has the potential to revolutionize both industrial and consumer products by combining silicon based microelectronics with micromachining technology. Its techniques and micro system based devices have the potential to dramatically affect of all of our lives and the way we live. If semiconductor micro fabrication was seen to be the first micro manufacturing revolution, MEMS is the second revolution.

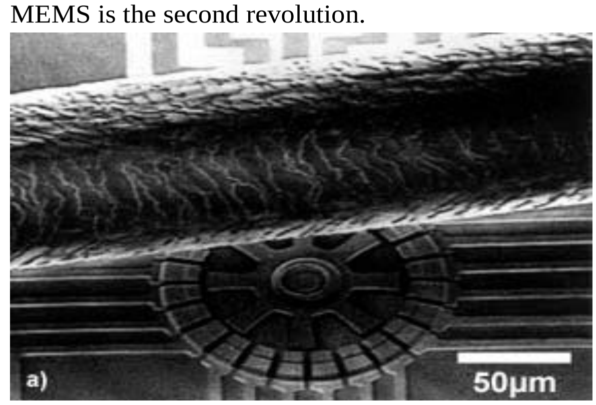

Fig 2. A MEMS silicon motor together with a strand of human hair

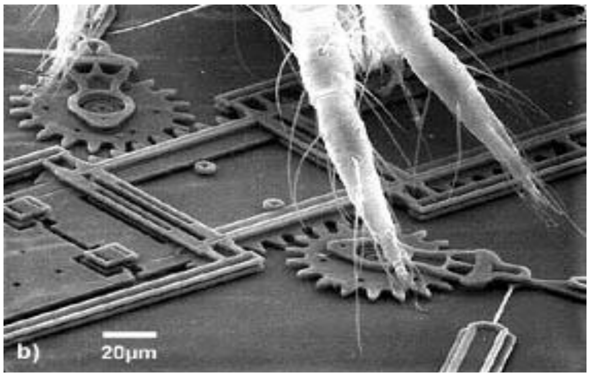

Fig 3. the legs of a spider mite standing on gears from a micro-engine.

2. Hardware components and Fabrication

2.1 8051 Microcontroller :

In 1981, Intel Corporation introduced an 8 bit microcontroller called 8051. This microcontroller had 128 bytes of RAM, 4K bytes of chip ROM, two timers, one serial port, and four ports all on a single chip. At the time it was also referred as "A SYSTEM ON A CHIP" The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory pro-grammar. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt

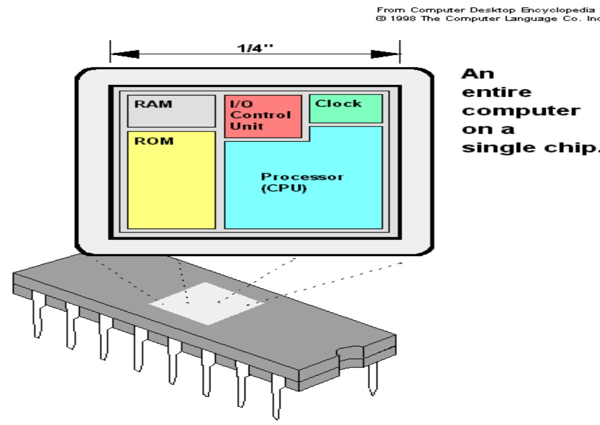

Fig 4. 8051 has 128 bytes of RAM, two timers and 6 interrupts

Features :

Compatible with MCS-51 Products ,8K Bytes of In-System Reprogrammable Flash Memory ,Fully Static Operation: 0 Hz to 33 MHz, Three-level Program Memory Lock, 256 x 8-bit Internal RAM, 32 Programmable I/O Lines, Three 16-bit Timer/Counters Eight Interrupt Sources, Programmable Serial Channel Low-power Idle and Power-down Modes, 4.0V to 5.5V Operating Range, Full Duplex UART Serial Channel Interrupt Recovery from Power-down Mode, Watchdog Timer, Dual Data Pointer, Power-off Flag, Fast Programming Time, Flexible ISP Programming (Byte and Page Mode)

2.2 Pin diagram :

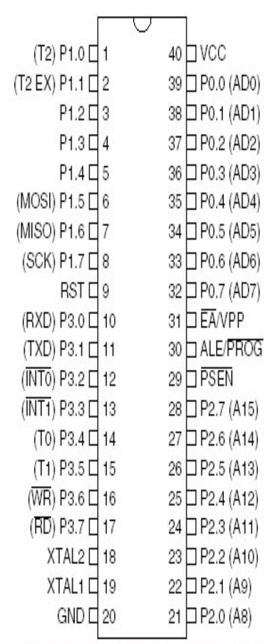

Fig 5. Overview of Pin diagram

Port Pin	Alternate Functions
P1.0	T2 (external count input to Timer/Counter 2), clock-out
P1.1	T2EX (Timer/Counter 2 capture/reload trigger and direction control)
P1.5	MOSI (used for In-System Programming)
P1.6	MISO (used for In-System Programming)
P1.7	SCK (used for In-System Programming)

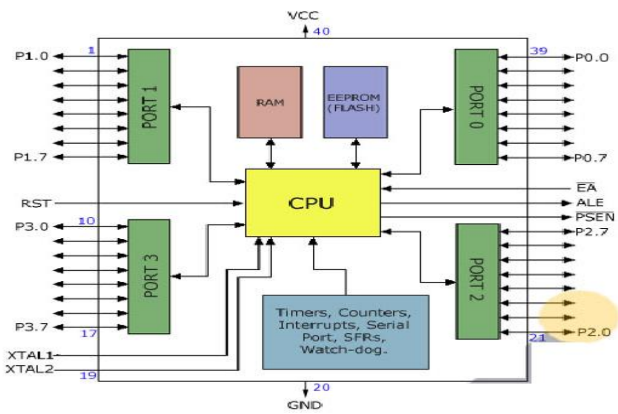

Fig 6. Functional block diagram of micro controller

2.3 GSM modem

The words, "Mobile Station" (MS) or "Mobile Equipment" (ME) are used for mobile terminals Supporting GSM services.A call from a GSM mobile station to the PSTN is called a "mobile originated call" (MOC) or "Outgoing call", and a call from a fixed network to a GSM mobile station is called a "mobile Terminated call" (MTC) or "incoming call".

Fig 7. GSM sample view

BASICS OF WORKING AND SPECIFICATIONS OF GSM

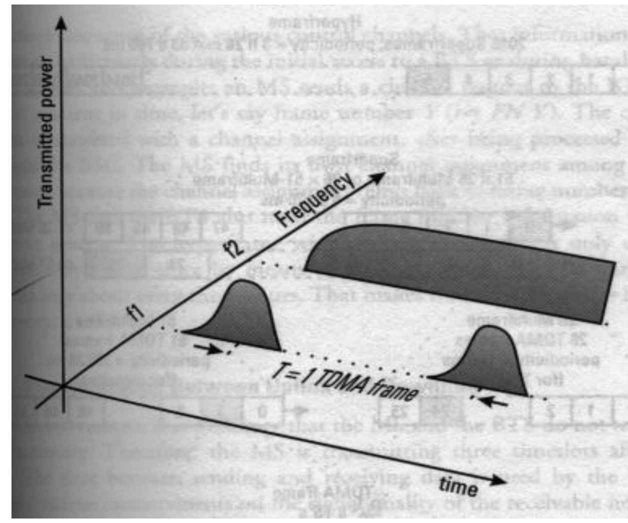

Fig 8. Overview of working

The GSM architecture is nothing but a network of computers. The system has to partition available frequency and assign only that part of the frequency spectrum to any base transreceiver station and also has to reuse the scarce frequency as often as possible.

2.4 GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) is a U.S. space-based radio navigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis -- freely available to all. For anyone with a GPS receiver, the system will provide location and time. GPS provides accurate location and time information for an unlimited number of people in all weather, day and night, anywhere in the world.

The GPS is made up of three parts:

1. Satellites orbiting the Earth
2. Control and monitoring stations on Earth
3. The GPS receivers owned by users.

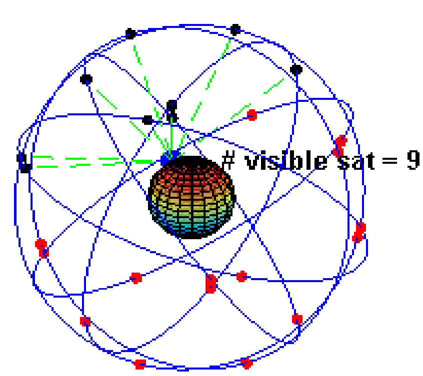

Fig 9. Overview of GPS

The GPS satellite system is the space segment is composed of the orbiting GPS satellites or Space Vehicles (SV) in GPS parlance. The GPS design originally called for 24 SVs, this was modified to six planes with four satellites each. The orbital planes are centered on the Earth, not rotating with respect to the distant stars. The six planes have approximately 55° inclination (tilt relative to Earth's equator) and are separated by 60° right ascension of the ascending node (angle along the equator from a reference point to the orbit's intersection). The orbits are arranged so that at least six satellites are always within line of sight from almost everywhere on Earth's surface.The full constellation of 24 satellites that make up the GPS space segment are orbiting the earth about 20,200 km above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 7,000 miles an hour.

GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

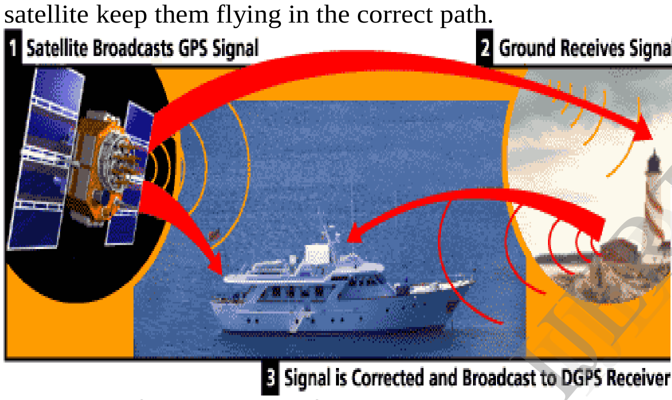

fig 10. Signal transfer using GPS

3.1 MEMS COMPONENTS

Axis orientation/motion detection system

Fig 11. Motion detection sensor

The MMA7660FC is a ±1.5 g 3-Axis Accelerometer with Digital Output(I2C). It is a very low power, low profile capacitive MEMS sensor featuring a low pass filter, compensation for 0g offset and gain errors, and conversion to 6-bit digital values at a user configurable samples per second. The device can be used for sensor data changes, product orientation, and gesture detection through an interrupt pin (INT). The device is housed in a small 3mm x 3mm x 0.9mm DFN package.

Pricipal of operation :

The Free scale Accelerometer consists of a MEMS capacitive sensing g-cell and a signal conditioning ASIC contained in a single package. The sensing element is sealed hermetically at the wafer level using a bulk micro machined cap wafer. The g-cell is a mechanical structure formed from semiconductor materials (polysilicon) using masking and etching processes. The sensor can be modelled as a movable beam that moves between two mechanically fixed beams. Two gaps are formed; one being between the movable beam and the first stationary beam and the second between the movable beam and the second stationary beam. The ASIC uses switched capacitor techniques to measure the g-cell capacitors and extract the acceleration data from the difference between the two capacitors. The ASIC also signal conditions and filters (switched capacitor) the signal, providing a digital output that is proportional to acceleration.

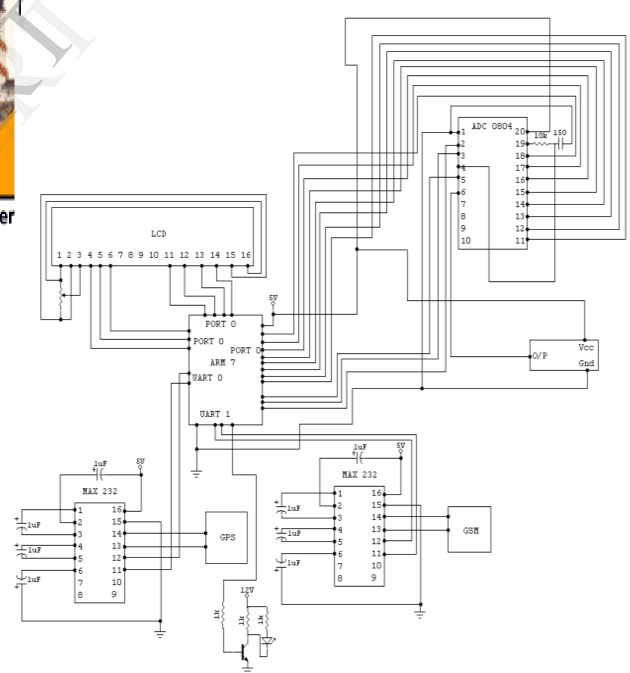

Fig 12. Overview of the circuit

The main aim of the Ppaper is to design an ARM based GSM and GPS accident detection system and release of airbags. In this project LPC2148 processor is used. MEMS is an electro mechanical sensor ,when accident occurs the MEMS gets disturbed and sends output signal to processor, the location is identified using GPS and sends it to processor. The GSM will get the information and

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LED will glow. Thus the accident place is identified and displayed on the LCD screen.

4 Testing and results

1. Firstly we have inserted a sim card of TATADOCOMO network which is in use, into the GSM module correctly and carefully.
2. After inserting Sim card the plug is switched ON, and the LCD will glow and GSM modem will initiate.
3. After initiation the GSM-GPS-MEMS the SIM is registered and is displayed in the LCD. Check that there should be availability of the signal for the registration of SIM.
4. The LCD above shows that the SIM registration is completed and the phone number is to be registered and for that a MISSCALL should be given from the another number, whether the number is known or unknown.
5. The above figure represents giving a MISSCALL to the SIM card registered number, as the SIM card registered number is 8712256430 which is a sample taken by us while performing the operation.
6. After giving a MISSCALL the LCD shows that the call is Disconnected and the message is sending to the number from which the call is done.
7. After giving a MISSCALL from a number which is known, then the message will be sent to that number that the **phone number is registered successfully**. If again MISSCALL is given from another number to SIM card registered number the previous number which is registered is replaced by the new MISSCALL number and the process continues.
8. The figure represents that the message has been sent to the number from which a MISSCALL is given to SIM card registered number.
9. After vibration of MEMS which is placed in the Automobile such as in near engine, inside the vehicle etc., the LCD displays that the accident occurred.
10. Within a fraction of seconds the message will be sent to a registered number that - through which a MISSCALL is given previously to the SIM card registered number that the accident has occurred.

Step 1

Step 2

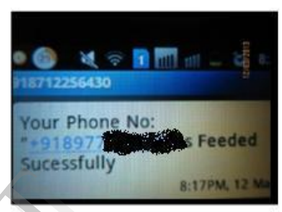
Step 3

Step 4

Step 5

Step 6

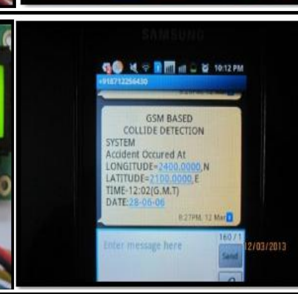
Step 7



Step 8

Step 9

Step 10



5. Conclusion

The project "**ACCIDENT DETECTION USING GSM, GPS &MEMS**" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC‟s and with the help of growing technology the project has been successfully implemented. The MEMS has many applications and the project done may be extended by adding more applications such as airbags, waterproof, by placing MEMS inside the vehicle etc.,

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