Research Article

Novel IoT Device for Enhanced Security

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ABSTRACT

In today's world women are less secure and have many issues regarding their security purpose. They have to undergo among various difficult situations and have to prove themselves every time in all critical conditions. So, for their security and safety purpose government has provided security through rules and regulation to the society. Although there are many existing systems for security purpose need of advanced smart security system is increased. In order to overcome such problems smart security system for women is implemented. This project describes about safe and secured electronic system for women which comprises of an Arduino controller and sensors such as temperature, pulse rate sensor, sound sensor. A buzzer, LCD, GSM and GPS are used in this project. A wire it can be placed to the body of the Victim. So, When the women are in threat, the device senses the body parameters like heartbeat rate, change in temperature, and the voice of the victim is sensed by sound sensor. When the sensor crosses the threshold limit the device gets activated and traces the location of the victim using the GPS module. By using the GSM module, the victim's location is sent to the registered contact number.

Keywords: Auto transfer length extraction; Digital to analog converter; Fast interrupt request; Memory accelerometer module; Serial peripheral interface.

1. Introduction

Safety is the most wanted power for everyone in today's world. Technology is the best way to achieve it. That's the reason to develop this project that can act as a rescue device and protect at the time of danger. The motivation behind this project is an attempt to focus on a security system that is designed merely to serve the purpose of providing security to women so that they never feel helpless while facing such social challenges. An advanced system can be built that can detect the location and health condition of person that will enable us to take action accordingly based on electronic gadgets like GPS receiver, GSM, pulse rate sensor, flex sensor, MEMS accelerometer, body temperature sensor. We can make use of number of sensors to precisely detect the real time situation of the women in critical abusive situations. The heartbeat of a person in such situations is normally higher which helps make decisions to detect the abnormal motion of the women while she is victimized [1]-[16].

An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale [17]-[29].

Personal digital assistants (PDAs) or handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms. This line of definition continues to blur as devices expand. With the introduction of the OQO Model 2 with the Windows XP operating system and ports such as a USB port- both features usually belong to "general purpose computers," the line of nomenclature blurs even more. Embedded systems play major role in electronics varies from portable devices to large stationary installations like digital watches and MP3 players, traffic lights, factory controllers, or the systems controlling nuclear power plants. In terms of complexity embedded systems can range from very simple with a single microcontroller chip, to very complex with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

2. Literature Review

Koss et al. [1] studied the change in the memory pattern of physically abused women. A study was conducted on women working in medical centers and universities, etc. Results proved that after the harassment, the victim memory is affected: "clarity" and "alertness". Authors portrayed that post-harassment, physical symptoms and mental pressure

are high. Mezey [2] published a paper on treating mechanism for harassment victim. Psychological post-harassment effect includes depression, anxiety, and sexual dysfunction. Hence, the aim of the author is to recover the health of the victim to the normal condition. The authors conclude saying that mental health professional can be aware of the history of past physical abuse and chattering. Sudderth's [3] study is based on qualitative analysis of interview with 30 rape survivors, who had been harassed by men. The core of this survey is that the victim people are more feeling negative while discussing their bitter moments that they faced in harassment. They feel hesitant to share their experience with others. Lots of surveys say that a victim person, especially younger victims, does not go and complaint in police station. Even they do not feel good when shares their experience till considerable time. The ultimate purpose of this research is "recovery process". Victimizing survivors avoid exposing inducing emotion connected with harassment. Victim people hesitate to share their experience because of stigma attached to being a harassment victim [30]-[38].

The objective of the research by Shipherd and Gayle Beck [4] is to overcome post-traumatic stress disorder because of harassment. The survey report says that the people become more anxious, depressed, and distressed throughout. They are not able to get rid of harassment related thoughts. This study by Brad Ford (2000) says that people who had experienced child abuse are more depressed alcohol abuse and dating stress. In the survey by Campbell et al. [5], 102 harassment survivors were interviewed about social reaction and family and friends support post-harassment. The support from society and friends are negligible. Instead of giving care and help regarding physically and mentally, they (society and friends) lead them into misery by giving negative complaints and blaming. The survey concludes that the support from society as well as the friend and family did not adequate. The main purpose of Schewe (2002) study is developing co-curricular from Middleware School to high school. Wasco [6] highlighted the limitation of trauma response and applications of post-traumatic stress in people who are harassed. The study by Sochting [7] enforced to provide harassment prevention programs for girls. Most of the North American Universities give priority to change women attitude, by educating them about harassment prevention techniques [39]-[43].

The drawbacks of all these applications are able to intimate their beloved once but are that loved once are able to protect them from that harassment? Probably, they need to ask help from some protecting force like police, etc.; in addition, their functioning is restricted to a particular city or town, so our application is the only solution for this drawback. A woman is a symbol of love, purity, knowledge, sacrifice, etc. peace and prosperity lie in the society where a woman is happy and honoured. Remembering the goddesses you bow down to in the same house where you raise your hand at the actual goddess of Smart Device for Ensuring Women Safety Using Android App 187 your home. The universal truth is that in a house, all the deities are pleased, where women are honoured and no meritorious deed will not yield any result where they are abused. Crime against women is a crime against humanity. One-third of the women may suffer from abuse and violence in her lifetime. Such incidents are more common in recent days, which motivated us to this proposed system. This proposed system will be helpful to all the women's around the globe which will not require any extra efforts for carrying the device.

Personal safety has become an important issue for everyone, but especially for women. The current women safety device in the market has to push the button to send a message. It is difficult to press buttons in critical situation when the keypad is locked. This paper deals with recognizing voice of victim and converting it into text to send email. The email consists of the following details: a. stored details of the victim such as image of the victim, parent/guardian's contact no, and address of the victim, b. surrounding captured images, and c. GPS location information about the victim along with longitude and latitude. The device gets activated once the voice kit is enabled through voice commands. Email can be sent even if the keypad is locked. Many embedded systems have substantially different designs according to their functions and utilities. In this proposed system, structured, modular design concept is adopted, and the system is mainly composed of a single microcontroller (RL78), LCD, Bluetooth, panic switch, voice kit, light source and buzzer, and Android smart device. The microcontroller placed at the center of the unit forms the control unit for the entire device. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided to it. The attack by the victim is indicated through the voice commands, when the voice commands provide through voice kit the unit will get activated, as an instant protection light source is used to give electric shocks to the person who is harassing her and 188 V. Mareeswari and S. S. Patil buzzer is activated to alert surrounding people. A command is sent to Android device through Bluetooth and as it receives the command, the app is activated and captures the victims face and surrounding image, GPS location, and stored details which are fetched from the SQLite database and are sent as email to police and SMS to parent/guardians. If the system fails to recognize the voice command, then an alternative way to activate the system by pressing the panic switch

through which the police and their guardians are altered.

3. Proposed Model
3.1 Block Diagram
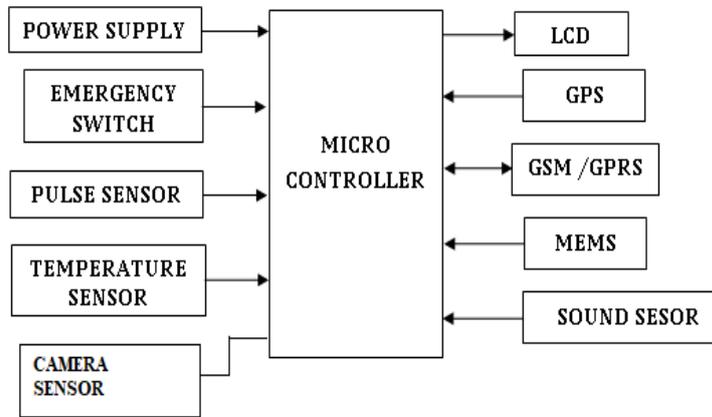
Fig. 1. System Architecture.

The detailed construction and description of the block diagram has given as follows:

A. Power Supply: This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

B. Microcontroller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

C. LCD: This section is basically meant to show up the status of the project. This project makes use of Liquid Crystal Display to display / prompt for necessary information.

D. GPS: A GPS modem is used to get the signals and receive the signals from the satellites. In this project, GPS modem get the signals from the satellites and those are given to the microcontroller. The signals may be in the form of the coordinates; these are represented in form of the latitudes, longitudes and altitudes.

E. GSM Modem: This section consists of a GSM modem. The modem will communicate with microcontroller using serial communication. The modem is interfaced to microcontroller using MAX 232, a serial driver. The Global System for Mobile Communications is a TDMA based digital wireless network technology that is used for communication between the cellular devices. GSM phones make use of a SIM card to identify the user's account.

F. MEMS: MEMS is used to identifying the attacking conditions on the women.

G. Pulse sensor: The pulse sensor is used to calculate the pulse rate of the women.

H. Sound sensor: The sound sensor is used to detecting the shouting conditions of the women

I. Temperature sensor: Temperature sensor is used to checking the women body temperature.

J. Emergency switch: An emergency switch is used to sending the location to the parents when an emergency is need to the women

K. Camera sensor: Camera sensor is used for capturing images near victim position
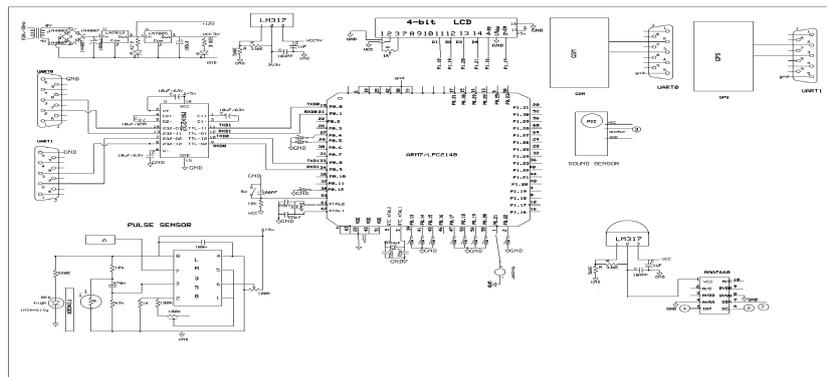
3.2 Schematic Diagram

Fig. 2. Schematic Diagram

In this paper we required operating voltage for ARM controller board is 12V. Hence, the 12V DC. power supply is needed for the ARM board. This regulated 12V is generated by stepping down the voltage from 230V to 18V now the step downed AC voltage is being rectified by the Bridge Rectifier using 1N4007 diodes. The rectified AC voltage is now filtered using a 'C' filter. Now the rectified, filtered DC voltage is fed to the Voltage Regulator. This voltage regulator provides/allows us to have a Regulated constant Voltage which is of +12V. The rectified; filtered and regulated voltage is again filtered for ripples using an electrolytic capacitor 100μF. Now the output from this section is fed to microcontroller board to supply operating voltage.

LCD pins are connected to P1.16, 17, 18, 19, 20 and 21. Switch is connected to pin no P0.20. Sound sensor is connected to P0.16. Pulse sensor is connected to P0.7. MEMS SCL is connected to P0.2. MEMS SDA is connected to P0.3. MEMS INT is connected to P0.4. GPS is connected to UART 1. GSM is connected to UART 0. PC is connected to UART 0.

4. Hardware Components
4.1. Microcontroller (LPC 2148)
ARM stands for Advanced RISC Machines. It is a 32-bit processor core, used for high end application. It is widely used in Advanced Robotic Applications.
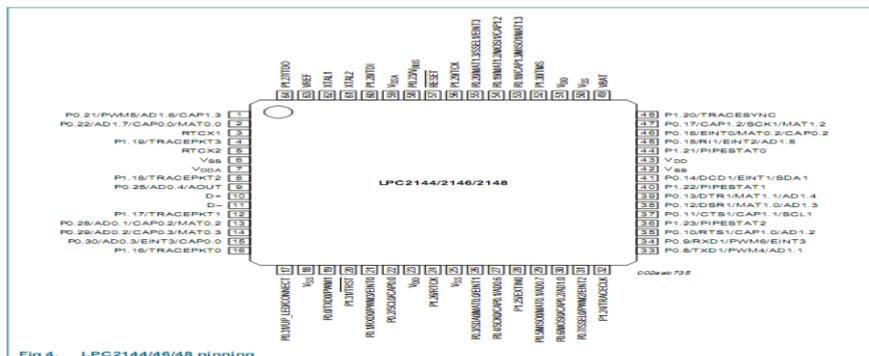

Fig. 3. Pin diagram of the LPC2148

A. Key features:
• 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
• 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.
• 128-bit wide interface/accelerator enables high-speed 60 MHz operation.
• In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.

• Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.

4.2. Universal asynchronous receiver/transmitter 1
A. Features:
• UART1 is identical to UART0, with the addition of a modem interface.
• 16 byte Receive and Transmit FIFOs
• Register locations conform to '550 industry standard
• Receiver FIFO trigger points at 1, 4, 8, and 14 bytes

• Built-in fractional baud rate generator with auto bauding capabilities.
• Mechanism that enables software and hardware flow control implementation
• Standard modem interface signals included with flow control (auto-CTS/RTS) fully supported in hardware (LPC2144/6/8 only).

4.3. Analog-to-digital converter (ADC)

Basic clocking for the A/D converters is provided by the VPB clock. A programmable divider is included in each converter, to scale this clock to the 4.5 MHz (max) clock needed by the successive approximation process. A fully accurate conversion requires 11of these clocks.
A. Features:
- 10 bit successive approximation analog to digital converter (one in LPC2141/2 and two in LPC2144/6/8).
- Input multiplexing among 6 or 8 pins (ADC0 and ADC1).
- Power-down mode.
- Burst conversion mode for single or multiple inputs.
- Optional conversion on transition on input pin or Timer Match signal.
- Global Start command for both converters (LPC2144/6/8 only).

4.4. Real time clock

On, and optionally when it is off. It uses little power in Power-down mode. On the LPC2141/2/4/6/8, the RTC can be clocked by a separate 32.768 KHz oscillator, or by a programmable pre-scale divider based on the VPB clock. Also, the RTC is powered by it's, which can be connected to a battery or to the same 3.3 V supply used by the rest of the device.
A. Features:
• Measures the passage of time to maintain a calendar and clock.
• Ultra Low Power design to support battery powered systems
• Provides Seconds, Minutes, Hours, Day of Month, Month, Year, Day of Week, and Day of Year
• Dedicated 32 kHz oscillator or programmable pre-scalar from VPB clock.
• Dedicated power supply pin can be connected to a battery or to the main 3.3 V

4.5. Liquid crystal display

Liquid crystal displays (LCDs) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. One each polarizers are pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction.

When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarisers, which would result in activating/ highlighting the desired characters. The LCD's are lightweight with only a few milli-meters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations. The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customers friendly.

The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications. This section describes the operation modes of LCD's then describe how to program and interface an LCD to 8051 using Assembly and C.
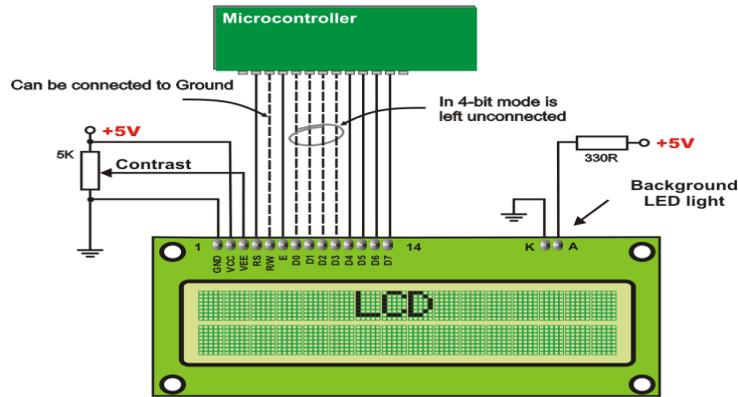
Fig. 4. Interfacing of LCD to a micro controller

4.6. Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave ovens, & game shows. The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.

The "Piezoelectric sound components" introduced herein operate on an innovative principle utilizing natural oscillation of piezoelectric ceramics. These buzzers are offered in lightweight compact sizes from the smallest diameter of 12mm to large Piezo electric sounders. Today, piezoelectric sound components are used in many ways such as home appliances, OA equipment, audio equipment telephones, etc. And they are applied widely, for example, in alarms, speakers, telephone ringers, receivers, transmitters, beep sounds, etc.
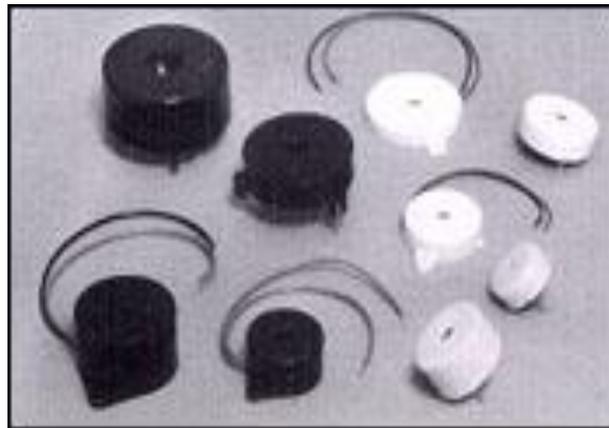

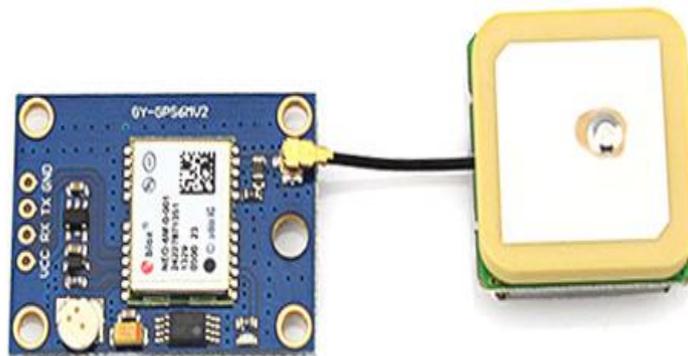**Fig. 5. Types of Buzzers.**

4.7. NEO-6MV2 GPS

Fig. 6. NEO-6MV2 GPS

The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position. It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost-effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. The compact architecture, power and memory options make NEO-6 modules ideal for battery operated mobile devices with extremely strict cost and space constraints. Its Innovative design gives NEO-6MV2 excellent navigation performance even in the most challenging environments.

4.8. GSM/GPRS Modem

Fig. 7. SIM800L GSM/GPRS modem

SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. Low cost and small footprint and quad band frequency support make this module perfect solution for any project that require long range connectivity. After connecting power module boots up, searches for cellular network and login automatically. On board LED displays connection state (no network coverage - fast blinking, logged in - slow blinking).

4.9. Ultrasonic sensor

Ultrasonic sensors work on a principle like sonar which evaluates distance of a target by interpreting the echoes from ultrasonic sound waves. This ultrasonic module measures the distance accurately which provides 0cm - 400cm with a gross error of 3cm. Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping. The module can easily be interfaced to micro controllers where the triggering and measurement can be done using two pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated. Features non-contact measurement with blinding from 0-1cm*. With the sensor oriented as shown alongside, locate Pin-1 as the 1st pin (refer figure 1) on the left hand side.

Fig. 8. Ultrasonic sensor

4.10. Pulse sensor

An alternate name of this sensor is heartbeat sensor or heart rate sensor. The working of this sensor can be done by connecting it from the fingertip or human ear to Arduino board. So that heart rate can be easily calculated.

The pulse sensor includes a 24 inches color code cable, ear clip, Velcro Dots-2, transparent stickers-3, etc. A color code cable is connected to header connectors. So this sensor is easily connected to an Arduino into the project without soldering. An ear clip size is the same as a heart rate sensor and it can be connected using hot glue at the backside of the sensor to wear on the earlobe. Two Velcro dots are completely sized toward the sensor at the hook side. These are extremely useful while making a Velcro strap to cover approximately a fingertip. This is used to cover the Sensor around the finger. Transparent strikers are protection layers used to protect the sensor from sweaty earlobes and fingers. This sensor includes three holes in the region of the external edge so that one can easily connect anything to it.
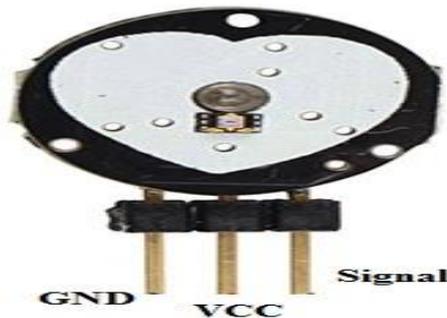
Fig. 9. Pulse sensor

5. software tools used in modeling

5.1. KEIL µVision using Embedded C programming

It is possible to create the source files in a text editor such as Notepad, run the Compiler on each C source file, specifying a list of controls, run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX Converter to convert the Linker output file to an Intel Hex File. Once that has been completed the Hex File can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source files; automatically compile, link and covert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tolls on the command line, the choice is clear. KEIL Greatly simplifies the process of creating and testing an embedded application.

A. Projects:

The user of KEIL centers on "projects". A project is a list of all the source files required to build a single application, all the tool options which specify exactly how to build the application, and – if required – how the application should be simulated. A project contains enough information to take a set of source files and generate exactly the binary code required for the application. Because of the high degree of flexibility required from the tools, there are many options that can be set to configure the tools to operate in a specific manner. It would be tedious to have to set these options up every time the application is being built; therefore, they are stored in a project file. Loading the project file into KEIL informs KEIL which source files are required, where they are, and how to configure the tools in the correct way. KEIL can then execute each tool with the correct options. It is also possible to create new projects in KEIL. Source files are added to the project and the tool options are set as required. The project can then be saved to preserve the settings. The project is reloaded, and the simulator or debugger started, all the desired windows are opened. KEIL project files have the extension

B. Simulator/Debugger:

The simulator/ debugger in KEIL can perform an incredibly detailed simulation of a micro controller along with external signals. It is possible to view the precise execution time of a single assembly instruction, or a single line of C code, all the way up to the entire application, simply by entering the crystal frequency. A window can be opened for each peripheral on the device, showing the state of the peripheral. This enables quick trouble shooting of mis-configured peripherals. Breakpoints may be set on either assembly instructions or lines of C code, and execution may be stepped through one instruction or C line at a time. The contents of all the memory areas may be viewed along with ability to find specific variables. In addition, the registers may be viewed allowing a detailed view of what the microcontroller is doing at any point in time.

5.2. Flash magic

Flash Magic is a PC tool for programming flash-based microcontrollers from NXP using a serial or Ethernet protocol while in the target hardware. The figures

below show how the baud rate is selected for the microcontroller, how are the registers erased before the device is programmed.
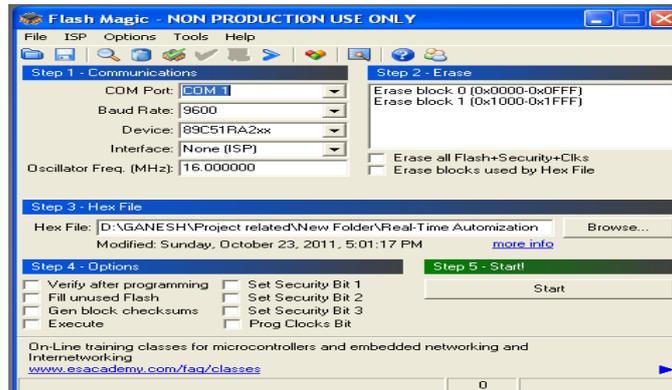

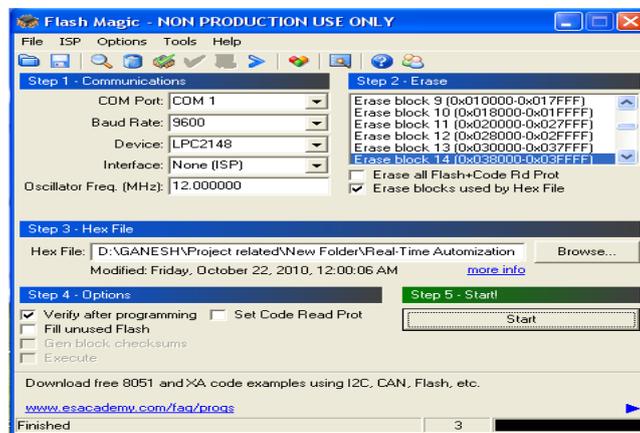**Fig. 10. Dumping of the code into Microcontroller**

Fig. 11. Dump process finished

6. Conclusion

The paper titled emergency alert for women safety with location tracking and capturing photography 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.

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