ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645
Indian Journal of Science and Technology, *Vol 9(30), DOI: 10.17485/ijst/2016/v9i30/99031, August 2016*

Design of Universal Module for Personal Security

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Abstract

Objectives: The proposed work is an attempt to design a security unit that can send the whereabouts of the user when an urgent situation arises. **Methods/Statistical Analysis:** This is done by using Global Positioning System (GPS) which determines the precise co-ordinates of the user. Microcontroller then extracts the required information and sends this location using Global System for Mobile communication (GSM) modem to a list of pre-assigned numbers when prompted by the user. **Findings**: The setup is portable. User can carry the device in their handbags. The triggering of the process is made wireless using RF transmitter and receiver. The GPS works continuously so that any change in the location of the user is updated constantly. **Applications/Improvements:** It could be used as a valuable tool in case of imperative circumstances.

Keywords: GPS, GSM, Microcontroller, NMEA Protocol, RF Transmitter and Receiver

1. Introduction

In India, crime against women (rape, sexual assault, insult to modesty etc) is getting doubled in last ten years. 2.24 million crimes against women are filed in last decade. 26 crimes against women are reported every hour[1]. In this work we proposed, new technique to indicate the location of the people who is in trouble. We developed, hand held device which has both GPS and GSM module to inform the location of the people to the predefined numbers and corresponding police station. GPS technology is being used everywhere nowadays as this system can be accessed from anywhere on earth and it can provide coordinates of our current location which is helpful in determining where we are staying[2]. The Global System for Mobile Communications, or GSM-is the technology used for the operation of mobile phones across the globe[3,4]. These two technologies can be combined and used for various applications such as vehicle tracking, security systems etc. The combination of GPS and GSM along with a controlling unit like microcontroller provides a consistent and cost effective technique[5].

With the sudden surge in criminal activities, especially against women, we have attempted to design a security system which uses global positioning system to determine the location of the user. This is then sent through GSM module to a list of pre-assigned contact numbers, when triggered by the user. The process can be summarized as follows:

- The GPS modem sends the location to the microcontroller.
- This information is displayed on the LCD screen.
- During urgent situation, the user can switch on the transmitter.
- Location information is sent to a group of contact numbers through GSM modem.

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The overall module containing the microcontroller, GPS and GSM is small and portable. In order for the user to take swift action in case of crisis situations, the triggering of the process is made wireless. This is done by using Radio Frequency (RF) transmitter and receiver. The transmitter and receiver can work within a range of 100 meters. The communication between the microcontroller, GPS receiver and GSM modem follows Universal Asynchronous Receiver Transmitter (UART) communication[6–10].

The proposed system is simple and can be easily implemented to report the location of the user via SMS. This system may find its application for sending the precise location of the user to his friends or family when there is no other means of communication or in cases of emergency.

2. Hardware Design

The hardware framework for the system is shown in Figure 1. The design includes an ATmega16 microcontroller which is used to interface with various hardware peripherals. For this ATmega16 serially communicates with the GSM modem and GPS receiver. Two modes of serial communication are possible- USART and SPI (Serial Peripheral Interface). The microcontroller can be used for operations up to frequency of 16 MHz.

The In-System Programming (ISP) programming method is used to program the microcontroller. It is functionally performed through SPI, plus some twiddling of the Reset line. As long as the SPI pins of the AVR are not connected to anything disruptive, the AVR chip can stay soldered on a PCB while reprogramming. Program has been downloaded onto the board using the software Pony Prog 2000. PonyProg is serial device programming software with a user friendly GUI framework. Its purpose is reading and writing every serial device. Figure 2 shows the programming through serial port.

The microcontroller continuously extracts the location data (i.e., latitude and longitude) from the GPS receiver of the user. It uses a baud rate of 9600 bps. The data is received in NMEA (National Marine Electronics Association) 0183 format and can be obtained from the transmitter pin. Typical format of the data received from

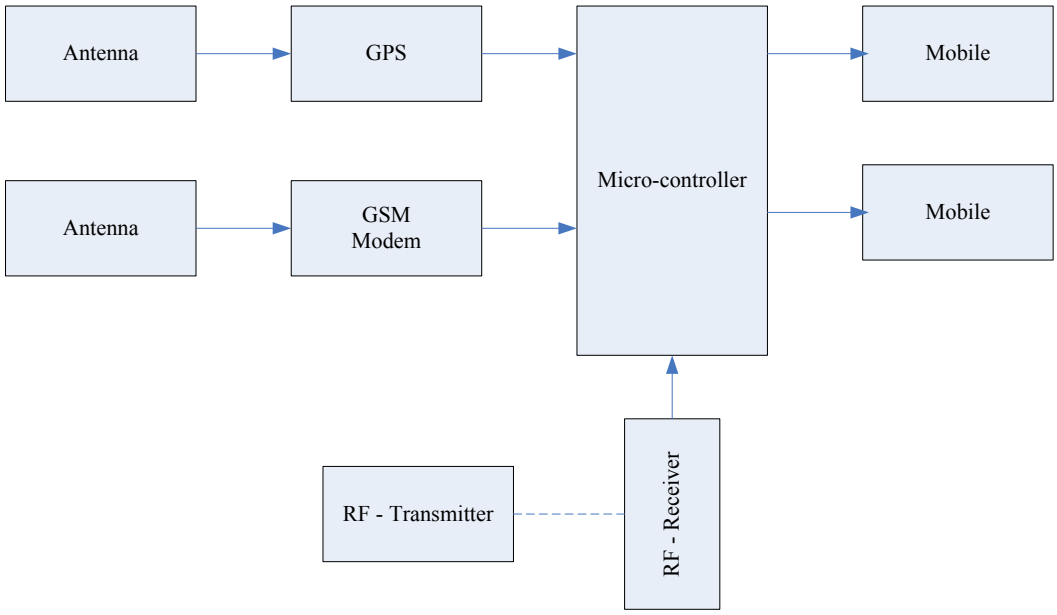

Figure 1. Hardware design.

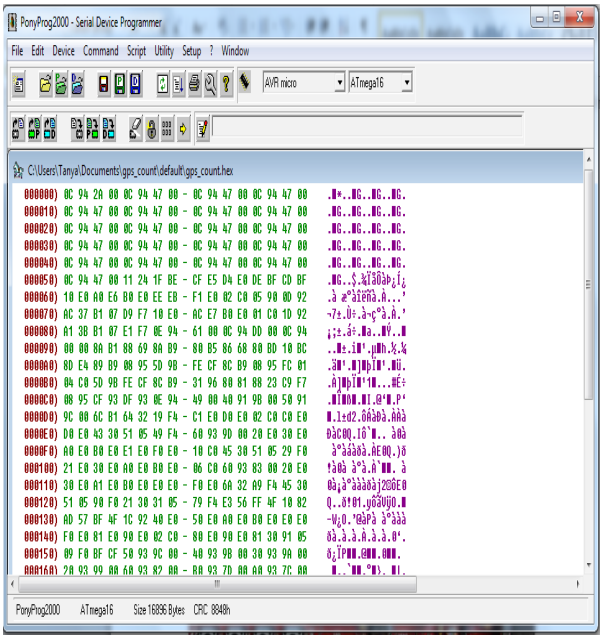

Figure 2. Serial programming.

the GPS module is shown in Figure 3. The location is then displayed on the LCD.

The RF transmitter and receiver are used to provide the triggering signal wirelessly at 433MHz. The range of proper signal transmission is within 100 meters. When triggered, GSM modem sends the location to a list of pre-assigned contact numbers at a baud rate of 9600 bps through AT commands. The design uses RS-232 protocol for serial communication between the modems and the microcontroller.

3. Algorithm

Figure 4 shows the flowchart of the work. Step by step procedure is given below. Initially both GPS and GSM need to be initialized. After that, follow the given steps

- Read data from the GPS and extract the location information from GPRMC header.
- Check the status flag, if 1 then send latitude and longitude information to the given contact numbers else read data from GPS.
- Send the latitude and longitude coordinates to given contact numbers.
- Again check the status flag and continue above methods.

$GPRMC,130303.0,A,4717.115,N,00833.912,E,000.03,043.4,200601,01.3,W*7D<CR><LF>

$GPZDA,130304.2,20,06,2001,,*56<CR><LF>

$GPGGA,130304.0,4717.115,N,00833.912,E,1,08,0.94,00499,M,047,M,,*59<CR><LF>

$GPGLL,4717.115,N,00833.912,E,130304.0,A*33<CR><LF>

$GPVTG,205.5,T,206.8,M,000.04,N,000.08,K*4C<CR><LF>

$GPGSA,A,3,13,20,11,29,01,25,07,04,,,,,1.63,0.94,1.33*04<CR><LF>

$GPGSV,2,1,8,13,15,208,36,20,80,358,39,11,52,139,43,29,13,044,36*42<CR><LF>

Figure 3. Data from GPS receiver.

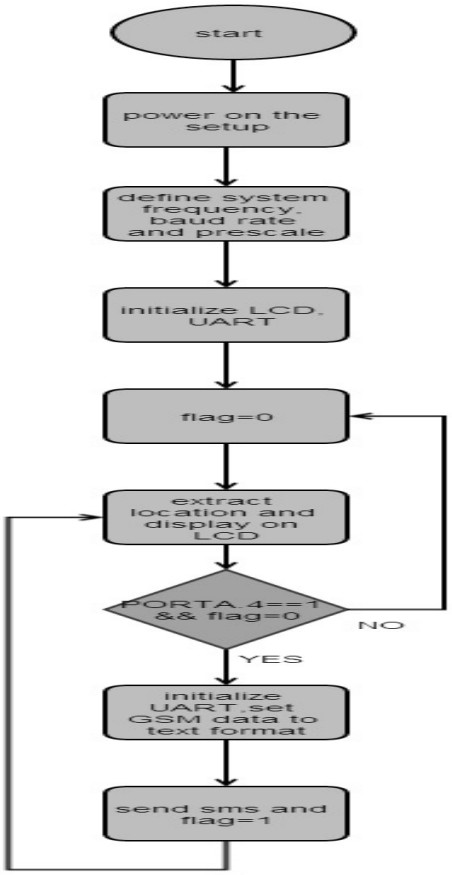

Figure 4. Flowchart of the work.

4. Result

In this work, we have used following main components.

- Microcontroller.
- GSM.
- GPS.
- RF transmitter – receiver.

Microcontroller is connected with GSM modem, GPS receiver and RF transmitter-receiver. RF transmitter – receiver is used to send the pulse to the microcontroller. At Mega 16 is the controller is used in this work. The location from the GPS receiver is displayed on the LCD and on the phone to which the SMS is sent. Various visualizing software's can be used to translate these coordinates to

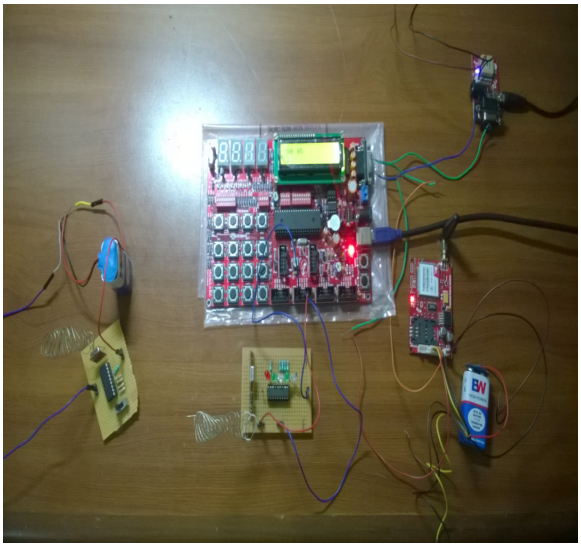

Figure 5. Hardware setup.

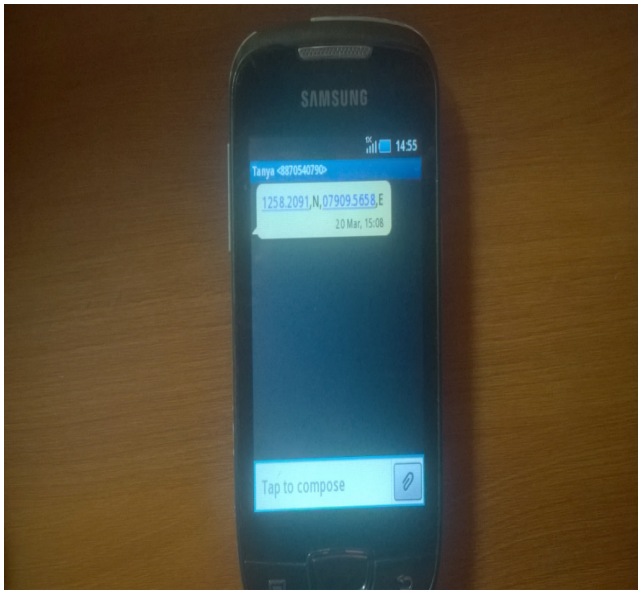

Figure 6. Message received.

find out the exact location of the user. The complete setup is shown in Figure 5. We have tested the entire setup in our university laboratory.

The above setup can be kept in any convenient place. This can be hand held device. RF communication is used to trigger the interrupt to the microcontroller. When emergency occurs, user can use RF module. When controller gets interrupt, it sends location to the pre defined mobile numbers. The message received is shown in Figure 6.

Latitude and longitude information of the location will be received via SMS. The received information has to be converted into degree-minutes-seconds format.

When you enter the information in any real time map applications, it will give the exact location of the user. Figure 7 shows the exact location of the user.

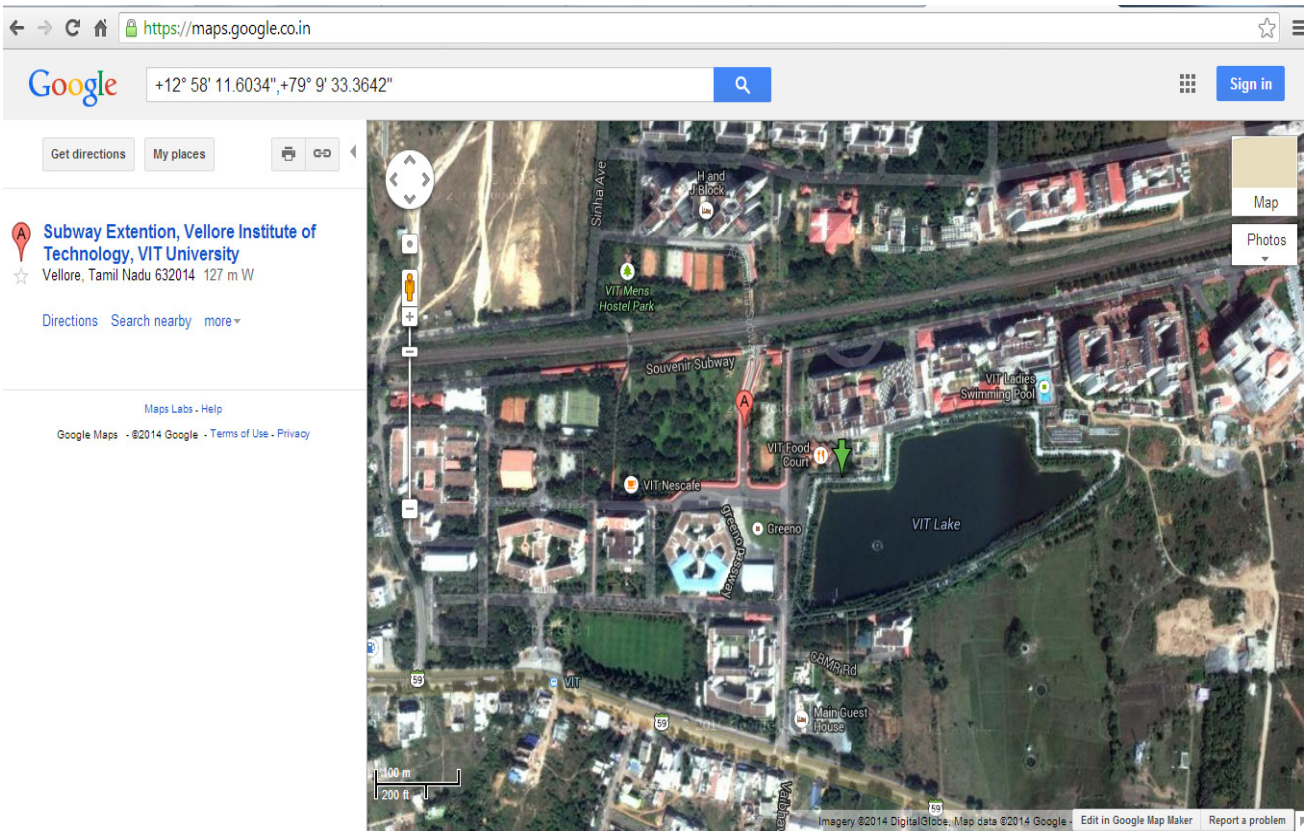

Figure 7. Indicated location.

5. Conclusion

The present day scenario makes it extremely important to prioritize the safety of humans. Our work is an attempt to provide such a tool. It is an integrated system and it is possible to locate anyone anywhere. This system is advantageous in many ways. It provides a real time solution, is effective and accurate. It has low cost of operation and has wide area range capability. It can be switched on wirelessly from a distance of maximum 100 meters. The module may also be finding its application in intimating the location of the user to friends or family when no other means of communication is available.

6. References

1. Violence against women in India. Available from: https://en.wikipedia.org/wiki
2. Khan A, Mishra R. GPS–GSM based tracking system. International Journal of Engineering Trends and Technology. 2012; 3(2):161–4.
3. Farooq U, Haq TU, Amar M, Asad MU, Iqbal A. GPS-GSM integration for enhancing public transportation management services. 2nd International Conference on Computer Engineering, ICCEA; Bali. 2010. p. 142–7.
4. Thattai K, Manikanta K\B, Chhawchharia S, Marimuthu R. ZigBee and Atmega 32 based wireless digital control and monitoring system for LED lighting. International conference on Information Communication and Embedded Systems (ICICES); Chennai, India. 2013. p. 878–81.
5. Zogg J-M. GPS basics-introduction to the system. 1st ed. Switzerland: u-blox Publication; 2002.
6. Le-Tien T, Phung-The V. Routing and tracking system for mobile vehicles in large area. 5th IEEE International Symposium on Electronic Design, Test and Applications (DELTA'10); Ho Chi Minh City. 2010. p. 297–300.
7. Muruganandham, Mukesh PR. Real time web based vehicle tracking using GPS. World Academy of Science, Engineering and Technology. 2010; 61(1):91–9.
8. Thong STS, Han CT, Rahman TA. Intelligent fleet management system with concurrent GPS and GSM real-time positioning technology. 7th International Conference on ITS Telecommunications, ITS'07; Sophia Antipolis. 2007. p. 1–6.
9. Biswal A, Marimuthu R, Balamurugan S, Ravi S. Design of senor network for real time data acquisition of water level in the agricultural field. ARPN Journal of Engineering and Applied Sciences. 2015; 10(8):3391–6.
10. Arvind RV, Raj RR, Raj RR, Prakash NK. Industrial automation using wireless sensor networks. Indian Journal of Science and Technology. 2016; 9(11):1–8.