GPS TECHNOLOGY IN COMMUNITY SERVICES

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Abstract

The paper demonstrated the role of GPS technology in law enforcement and public safety application areas. It presents the design, implementation, testing and verification of a simple, cheap, full proof energy source, user friendly and portable GPS-technology based safety system. The system, called "CARE system" was based on the open data sources and very cheap electronic chips available off the shelf at affordable prices. This proposed system is capable of providing a push button emergency help from different bodies assumed responsible for responding simultaneously by sending an SMS message containing the full information of the emergency location. Typical contents of this message are, the emergency geographic location, the system number, time and the link for displaying the location on an internet interactive map. The system can be fixed on the wall or a fixed stand or table near a patient or disable person. It will be portable to provide service to the moving system user. This is useful for emergencies in general and abduction for ransom and abuse emergencies in particular and demonstrates the system excellent role in law enforcement and public safety areas. The global positioning unit (GPS) integrated in the system provides the location of the user in the form of geographic coordinates, with exact UTC time. All the information delivered to the contacted bodies will be automatically updated whenever the user presses the master button or the contacted body dials the system number. This is facilitated by the GPS unit which receives the coordinates from the satellites for each and every second with time and date. This also, facilitates the moving victim tracking. The system is an excellent contribution to the quality of life improvement for humans in general and old men, women and children in particular.

Key words

Emergency; community service; GPS; button; safety system; patient; disable; old men; women; children; abduction; robbery and location.

1. Introduction.

The bad consequences resulting from the day to day accidents such as fires, illnesses attacks, robbery, abduction for ransom or abuse are mainly due to the time delay in contacting the bodies assumed responsible for responding to these emergencies and the lack of affordable safety systems in general and portable ones in particular. Technology and system improvements have great contributions to safety [1]. However, most of the safety systems designed, implemented and made available for community services are the products, services and risk reduction for both residential and commercial application areas.

Also, most of these available safety systems are for indoors use only and depend on the personal contact of the affected person using fixed and mobile phones. However, these communication facilities are subject to failure for different reasons. Typical examples of these reasons are the battery, account recharge and overloading, availability or weakness, of the communication network. Also, the location of the emergency is usually submitted to the contacted body in the form of a voice message which may not be enough to locate the emergency in a short period of time as this depends on the affected person ability to express himself and describe his location and his knowledge of the geographic area and the surroundings of his location. The proposed safety system is provided with electric, solar and battery energy sources working all together and making it a full proof energy source system.

Accordingly, the proposed system mainly addresses the problems of time delay in contacting the bodies responsible for responding to the emergency, the safety system portability and the form of delivered information. System portability is very essential for all outdoors emergencies in general and the abduction for ransom and abuse emergencies in particular.

2. Research objectives.

The main objectives of the research may be summarized by the following:

a) To design, test, implement and verify a user friendly, simple, cheap and portable GPS-technology based safety system that minimizes the time required to contact the bodies assumed responsible for responding for emergencies.

b) To assure that the system is a full proof energy source and portable in order to provide service to the moving system user.

c) To assure the possibility that the system is capable of contacting and providing the required information for all the bodies simultaneously and providing a multi-dimensional information message that contains the user geographic coordinates, an internet interactive map location and system number.

d) To assure that the delivered information can be easily updated by both the user and the contacted body.

3. Research methodology.

The CARE system comprises hardware and software components and the methodology adopted in designing and implementing the system may be summarized by the following:

a) All the system hardware components were assembled in the system board and tested for functionality.

b) An open data source software, ARDUINO programming software (ARDUINO IDE) was downloaded from the internet and used for coding the proposed system.

c) The code was compiled, debugged and uploaded into the system.

d) Finally, the system was tested and verified using real world data.

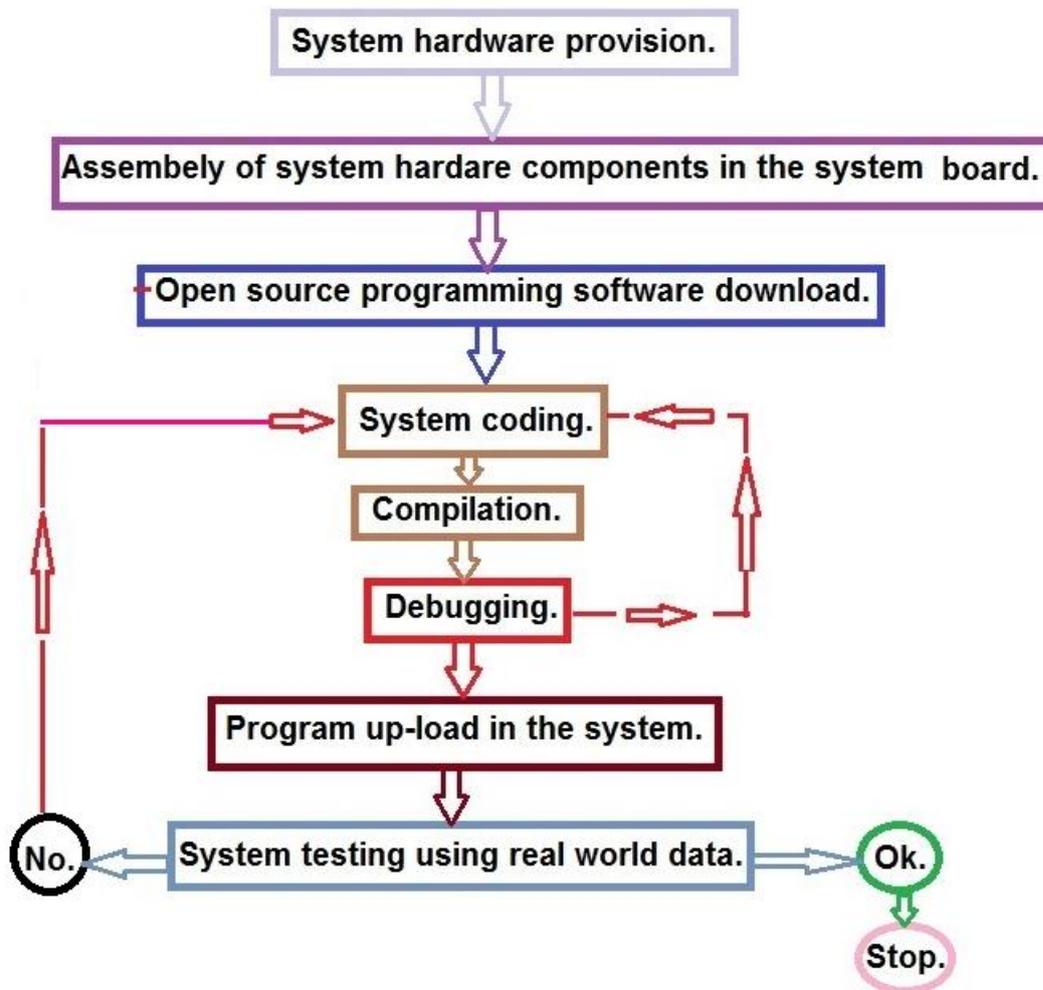Figure 1, summarizes the methodology adopted in implementing the CARE system.

Figure 1, A flow chart summarizing the methodology adopted in implementing the CARE system.

4. System design.

The design of the system is based on the ARDUINO UNO hardware and software. ARDUINO is an open source hardware and software company, project and user community that designs and manufactures simple-board microcontrollers and microcontroller kids for building digital devices and interactive objects that can sense and control objects in the physical world [2]. The proposed safety system main components are briefly described in the following paragraphs:

a)   The ARDUINO UNO.

This is the central processing unit of the CARE system and it receives input from the system user and the global positioning system integrated in the CARE system. Typical example of the user input is the government body to be contacted and is entered by pressing the system master push button. Typical GPS input is the location of the system user and is given as geographic coordinates (latitude and longitude) with the link for displaying the exact location on an internet interactive map. This unit also, commands the GSM unit to send SMS message with the user location details (GPS input) to the intended destination.

Figure 2, ARDUINO UNO unit of the CARE system

b)   The GSM module.

This unit is commanded by the ARDUINO UNO Unit to send SMS message to an intended destination with the user location details whenever the user presses the push button.

Figure 3, The GSM unit of the system.

c)   The GPS UNIT.

This the main component in the CARE system and collects continuously the system user coordinates from the GPS satellites orbiting the earth and sends it to the ARDUINO unit (CARE system CPU). It provides the system user coordinates at any time and on land and sea (the Latitude and Longitude of any location on the Earth, with exact UTC time). This device receives the coordinates from the satellite for each and every second, with time and date.
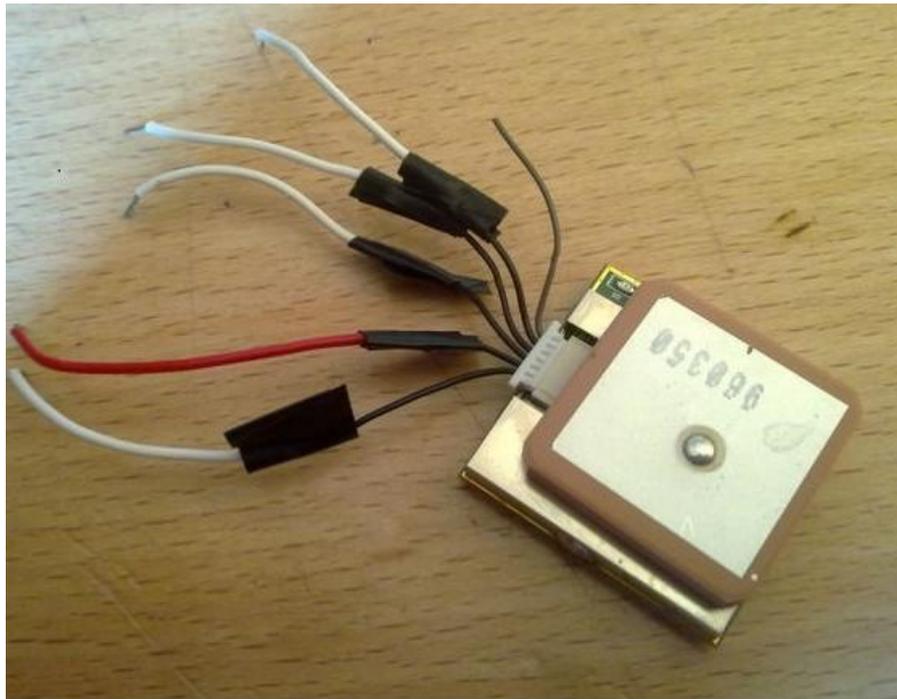
Figure 4, The GPS unit of the CARE system.

Figure 5, The GPS unit connected to ARDUINO board.

g)   The ARDUINO IDE.

This unit represents the software used for coding the CARE system. ARDUINO IDE is an open project written, debugged and supported by ARDUINO.CC and the ARDUINO community worldwide. IDE is an acronym for Integrated Development Environment [3]. The ARDUINO language is merely a set of c/c++ functions that can be called by the code.

5. Discussion.

ARDUINO hardware components required for the design of the project were obtained from the market as they are available off the shelf with quite affordable prices. All the hardware components were assembled in ARDUINO UNO board and tested for functionality. A program (sketch) was written to control all CARE system operations, using ARDUINO software IDE. A sketch is the name that ARDUINO uses for a program. It is the unit of code that is uploaded to and run on ARDUINO board [4].

Though the system can be programmed to deal with many number of emergency responding bodies simultaneously, but for testing and verification it was community services tailed and comprises the police, the ambulance, fire station, the owner and all the mentioned bodies together simultaneously. The owner button is assigned as required, to the house owner in case of fires, patients and robbery, user relative in case of abduction etc. Accordingly, the system is provided with five buttons beside the master button which is used to reset the system and stop the alarm as required. Figures 6 and 7 show the assembled CARE system with the programmed buttons and the system functions sequence respectively.

Figure 6, The assembled CARE system with the programmed buttons

Although was programmed to serve residential areas and moving people by pressing only one push button once, but it can also, be programmed to serve a variety of different bodies to name but a few, hospitals, schools, pharmacies, factories, universities etc. Also, the portability of the system is very useful in application areas such as transportation systems and particularly for trucks carrying oil and other flammable materials. Portability also, adds a great advantage to the system, particularly in the abduction for ransom and abuse emergencies, that represent a nightmare to old people, women and children. There is no doubt that the system will be a fantastic safety tool for Saudi women if they are going to derive cars outside the residential areas and share the long highways with men and may be involved in different types of accidents.

All the information delivered to the contacted body can be updated whenever the system user presses the system button or the contacted body redials the system number. This is particularly useful for emergency cases when the victim is moving. Also, the system is provided with a sounder for indoors use that makes an alarm with very loud whistle to help the contacted bodies in identifying the emergency location and alert the residents and neighbors to provide the possible help and make the necessary safety measures for themselves. This is particularly useful in cases of fire and robbery emergencies.
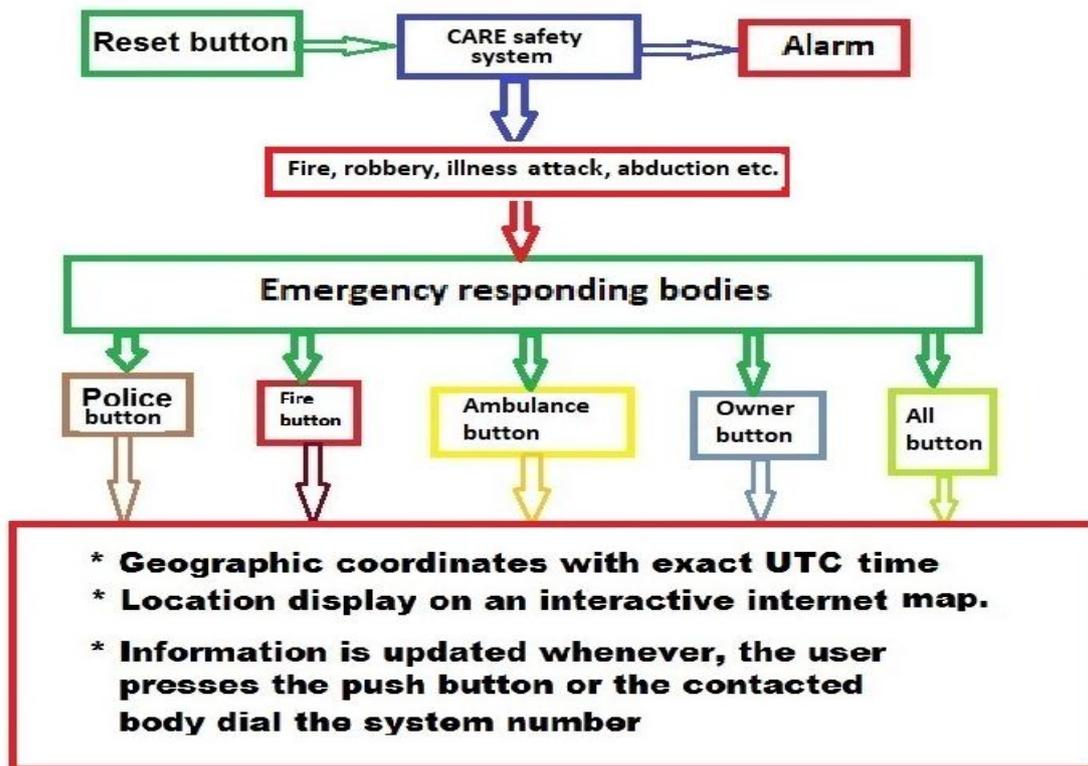
Figure 7, A flow chart showing the system functions sequence.

Table 1 and figure 8 show real world data test typical examples of the SMS message containing the geographic coordinates, time and system number and the emergency location shown in an internet interactive map respectively. Needless to mention that the contacted body uses the delivered information to navigate to the emergency location.

Table 1, A typical real world data test example of an SMS message sent by CARE system.
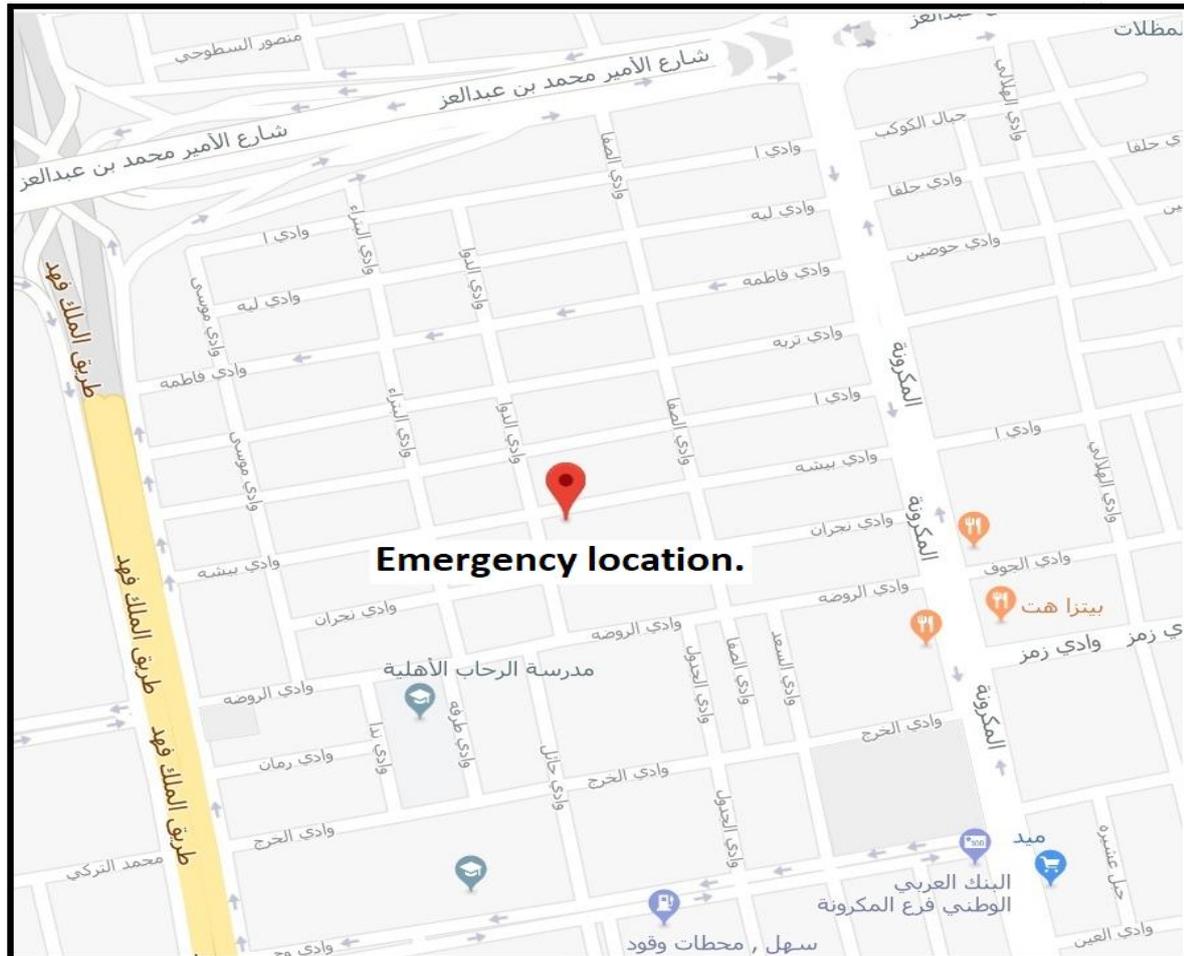
Figure 8, A typical real world data test example of an emergency location sent by CARE system (red mark).

6. Conclusions.

The GPS is successfully integrated with the digital devices and interactive objects using ARDUINO UNO open source hardware and software and smart public safety system is designed, implemented, tested and verified using real world data. This system is very simple, user friendly, portable and quite affordable by the average community member. It is a push button system that can be used by patients, disables, old people and children.

The portability characteristic adds an important dimension to the system and makes it a fantastic safety tool for moving people. This is particularly useful for old people, children and women who are frequently involved in abduction for ransom and abuse emergencies. The emergency location is delivered to the contacted bodies as geographic coordinates which can be displayed and clearly marked in an internet interactive map. All the information delivered can be updated whenever the user presses the master button or the contacted body dials the system number. The effort made in the paper clearly revealed the role of integrating the GPS unit with the digital devices and interactive objects in law enforcement and public safety application areas.

7. References.

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[2] https://en.wikipedia.org/wiki/Arduino

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