A Covert Kidnapping Alert and Location Identifier (CKALI)

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Abstract- **Kidnapping is the taking away or transportation of a person against that person's will, usually to hold the person in false imprisonment and confinement without legal authority. This paper reports a complete research work in kidnapping emergency alert situations. The authors were able to program a microcontroller incorporating a trigger activated GSM/GPS module to report via the GSM communication network (using SMS messaging) to a monitoring center, giving the exact position of the point where the kidnapping took place, and the route taken by the kidnappers and the victim. All the components are miniaturized using advanced very large scale integration techniques, and embedded in a belt which can be worn as a regular clothing accessory. This device (CKALI) will allow fast response and rescue of kidnapped victims; thereby saving lives and money. The paper reports its experimental results, and gives appropriate conclusions and recommendations.**

Keywords - Emergency, GPS/GSM, Kidnapping Alert, microcontroller, SMS, CKALI.

I INTRODUCTION

Kidnapping is a global menace, which is more prevalent in countries like Mexico, Brazil, Colombia, Russia and most recently Nigeria. Findings revealed that kidnappers rake in billions of dollars yearly in Brazil. In Mexico too, it is a serious business as gangs encourage their young members to practice on pets and domestic animals so as to master the game before going for human beings [1]. The rate of kidnapping in Nigeria has risen considerably in the last decade, with Nigeria now accounting for 25% of global kidnappings. Kidnapping in Nigeria has become very prominent and according to a 1999 statistics, Nigeria was fifth in ranking to Columbia, Russia, Mexico and Brazil for ransom kidnappings and was tagged the "global capital of kidnapping" in a statement at the African Reinsurance Forum [2]. When a kidnap occurs, the reaction of security agencies now becomes a battle between life and death. Today, innovations in wireless communications have tilted the odds in favour of success than failure. Before, security agencies had nothing to rely on other than raw courage. Now the world of wireless communication has led to an entirely new way of minimizing the death rate due to kidnapping.

GPS tracking systems are used to track anyone and anything these days [3], [4], [5]. Technology has rapidly advanced in the past few years and it has become very easy for the average person to use a tracking system [4]. If you have a vehicle, then you may want to place a GPS tracking system in your car, this way if your car ever gets stolen, it can easily be located at the shortest possible time.

Kidnapping Alert System is quite a novel research area. A good example of a kidnapping alert system is the KINGXIN watch tracker made in China; it uses a GPS+GSM+GPRS wireless communication network positioning system to communicate real time location information of a kidnap victim. Most GPS trackers today are worn in hidden clothing, pockets, necklaces, armbands, or watches, where they can easily be found. One inventor has already patented an ingestible GPS tracking device [6]. Additionally, a company in Mexico, XEGA, produces implantable tracking devices to help combat kidnappings [7]. But these devices are RFID tags and would become useless if separated from an external GPS tracker [8].

The approach adopted for our research work on the belt tracking device (CKALI) is based on the provision and proper translation of location information in terms of latitude and longitude using the GPS/GPRS module connected with a microcontroller and a battery, embedded in the belt, and having the ability to effectively communicate with the Google Earth Software installed on a computer system via the GSM network, where the location information in latitude and longitude terms is decoded into actual places on the map. Another feature is that an SMS can be triggered by pressing the miniature panic button located on the belt. We adopted the use of SMS messaging because in the third world (Nigeria in particular), the attention being paid to emergency calls is

grossly inadequate and this has wrecked a lot of havoc on lives and properties [9].

The Real-time GPS/GPRS/SMS belt tracker (CKALI) which is a novel device, can be worn at all times, just as a normal clothing accessory and would serve as a means of protection against kidnapping, and a kidnap victim can be located in the shortest possible time.

II   MATERIALS AND METHODS

In this research work, we made use of Machine to Machine (M2M) technologies and GSM/GPS module which is a device that operates mostly under M2M platform. This is a devices that can operate over a network without human interference [9]. The system has two main parts. The first part is the tracking device which is attached to the belt. It comprises of a GPS module, a microcontroller and a GSM module. The second part of the system consists of a receiver device which we built; it receives the GPRMC messages and sends it to the monitoring workstation PC connected to the internet and running Google Earth software and Franson GpsGate client software. Franson GpsGate Software is an important tool utilized in the design of this system. It is a web-based GPS tracking software with real time view, advanced system alerts and reporting. Some of its

functions include using JavaScript to gather GPS position; normalizing the GPS connection; GPS simulation and logging; sharing one GPS to several applications using virtual communication ports; connecting a GPS to Google Earth; sending GPS data over HTTP to a personal server; multiplexing and splitting NMEA streams. The version used in this research work is Franson GpsGate v2.6.0.402. This software installed on the monitoring system acquires the GPS coordinates reaching the GPS module interfaced with the receiver, logs it continually and connects dynamically with Google Earth to provide a trace of the path of the tracked kidnap victim. The core tracking functionality of the system is done by the Google Earth software. Google Earth is a virtual globe, map and geographical information program that maps the earth by the superimposition of images obtained from the satellite imagery, and is able to show all kinds of images overlaid on the surface of the earth, and is also a Web Map Service Client.

A.   Belt Tracker Architecture and Signal Flow
The circuit diagram of CKALI and the receiver device used to receive the GPS coordinates on the monitoring system is as shown in fig.1. If an individual is kidnapped and he/she presses the trigger on the belt, the information flow is as shown in fig. 2.
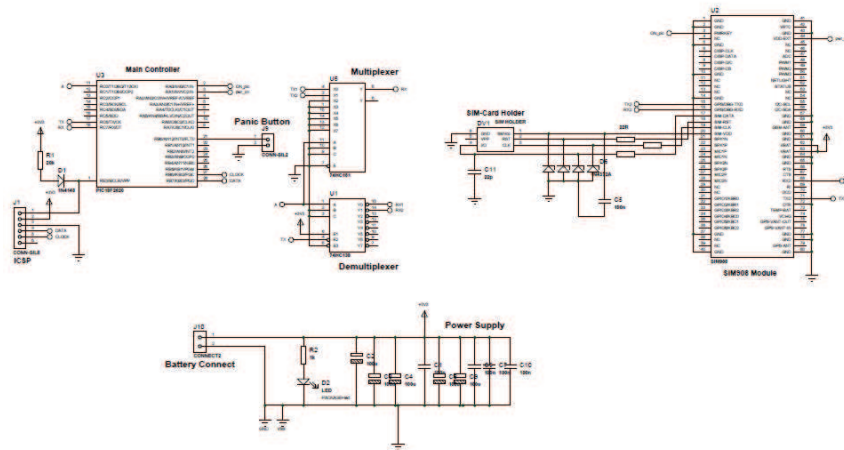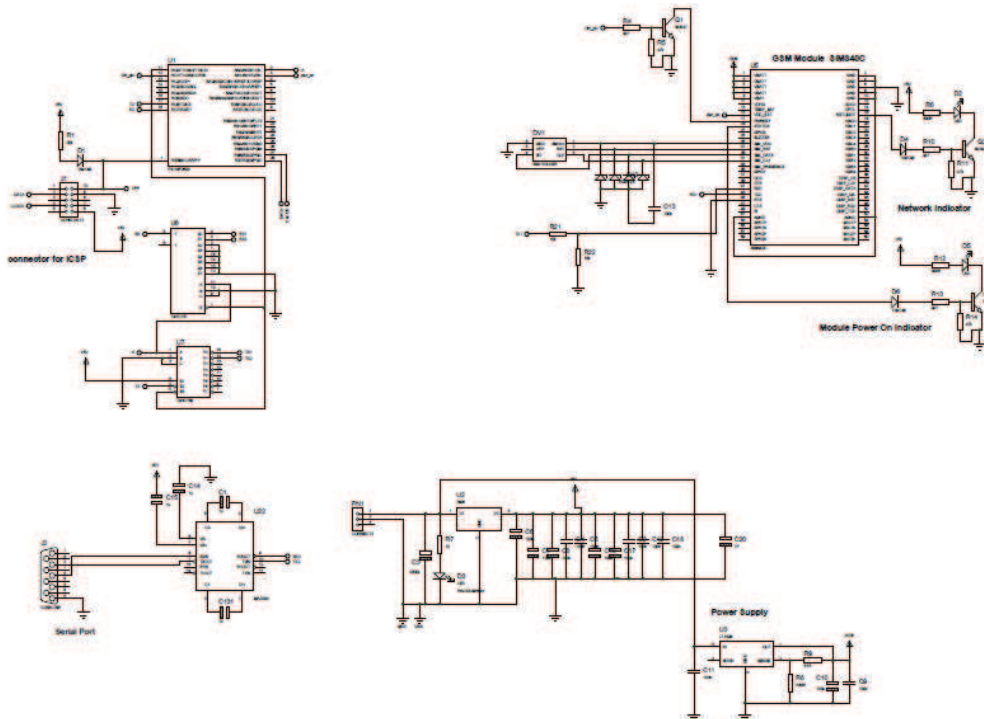

Fig. 1 (a) CKALI Circuit Design Layout

Fig. 1 (b) GPS coordinates Receiver Circuit Design Layout

The GPS/GSM module works with an installed trigger on the belt. This module is constantly being tracked by a constellation of satellites located in six orbital planes at a height of 20,200km and circle the earth every 12 hours, each plane is inclined at 55 degrees to the earth's equator and contains 4 satellites each [4]. These satellites enable the GPS receivers embedded in the belt tracker when activated by the trigger, to pinpoint the exact location, in terms of longitude and latitude, of the kidnapped victim.

In case of a kidnapping, the victim presses the trigger at the bottom of the leather enclosure of the belt, this trigger sends an activating signal to the GPS/GSM module, and the GPS module retrieves the location information in real time from the satellites in the form of longitude and latitude readings. The microcontroller processes the GPS information and extracts the desired values, this information is then sent to the monitoring computer using the GSM module (modem) by SMS which changes every 40 seconds. The pre-configured phone which is supposed to alert the security personnel for tracking is sent an SMS message "Help! I have been abducted, please start tracking". On the internet; connected monitoring computer running the Google Earth software the SMS is translated into GPS location information and real-time tracking is done, and as the kidnap victim moves, the route travelled is displayed. The Franson GpsGate Client software running in the monitoring computer acquires the GPS coordinates reaching the GSM module interfaced with the receiver, logs it continually and connects dynamically with Google Earth to provide a trace of the route of the tracked kidnapped victim. This information can then be used by security operatives to safely rescue the kidnapped victim.
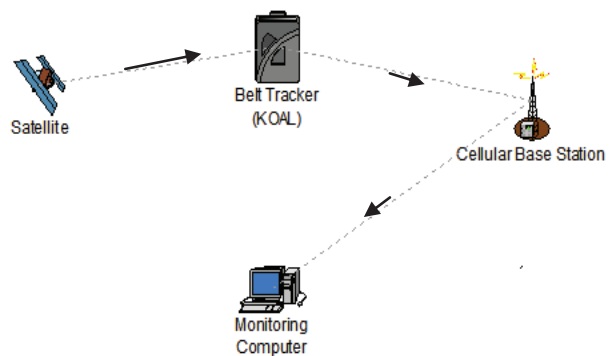

Fig.2. CKALI Signal Flow

B.   CKALI Experimental Setup

CKALI was tested by setting up a system to simulate a kidnapping scenario. In order to do this, a kidnapping scenario was aranged, the belt tracker was worn at each instant by different persons scattered across a geographical area (around Ogun State in Nigeria). Each person was told to press the trigger on the belt and then to drive around with the device for twelve minutes, while we did the monitoring of the persons location and route from the monitoring computer system.

III   RESULT

For each individual that wore the belt in the various locations, when the trigger on the belt was pressed, the GPS module retrieved the location information from satellites in the form of longitude and latitude real time readings. This GPS information was then processed and sent by the microcontroller as an SMS through the GSM network using the GSM module to our alert pre-configured phone and the GSM modem of our monitoring system. We were alerted by the SMS reaching the phone, the SMS message was as follows:

"HELP!, I HAVE BEEN ABDUCTED, PLEASE START TRACKING "

The GSM modem on our monitoring system also received the SMS which included the GPS coordinates of the individual wearing the belt. A total of 18 messages was sent by the belt tracker device during the 12 minutes duration, this is due to the fact that the belt tracker sends a new SMS every 40 seconds. The Longitude and Latitude readings were accurate and reflected the exact location of the individual wearing the belt, and we were also able to trace the route of the individual. The GPS coordinates as received in the monitoring system is shown in fig.3, and the route taken by the individual wearing the belt tracker as seen on the monitoring system is shown in fig.4. It was observed that the delivery of the SMS messages was network dependent, thus a reliable GSM network connection is needed to improve the effectiveness of the device, and thus greatly enhance the reliability of the platform for combating dangerous kidnap situations.
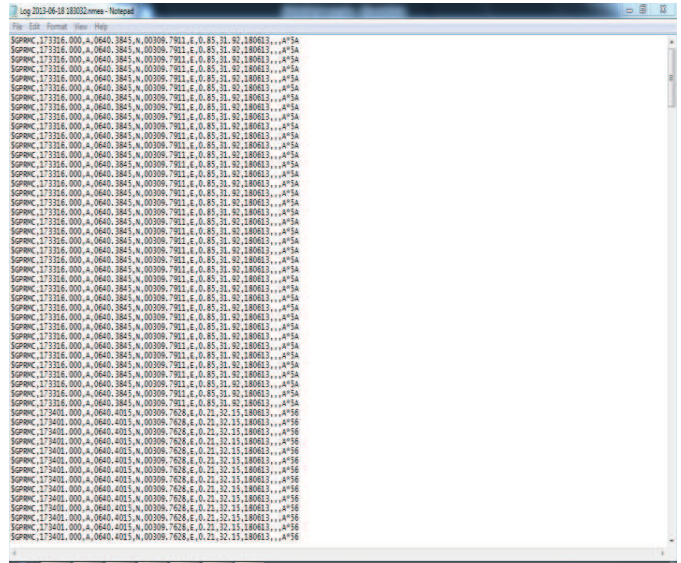

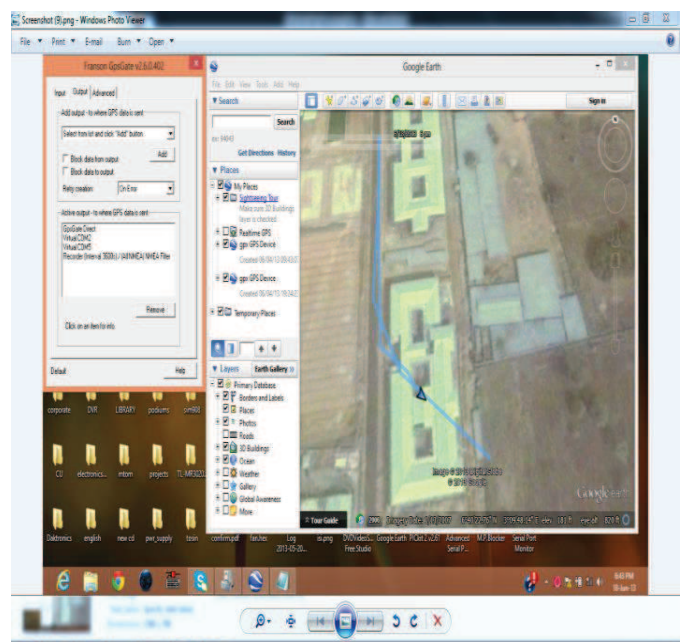Fig 3. GPS Coordinates Received on the Monitoring System

Fig. 4: Google Earth and Franson GpsGate Snapshot Showing the Live Location Route of the tracked kidnap victim

The various pictures taken while CKALI prototype was being built in the workshop and the final prototype are shown in fig.5.
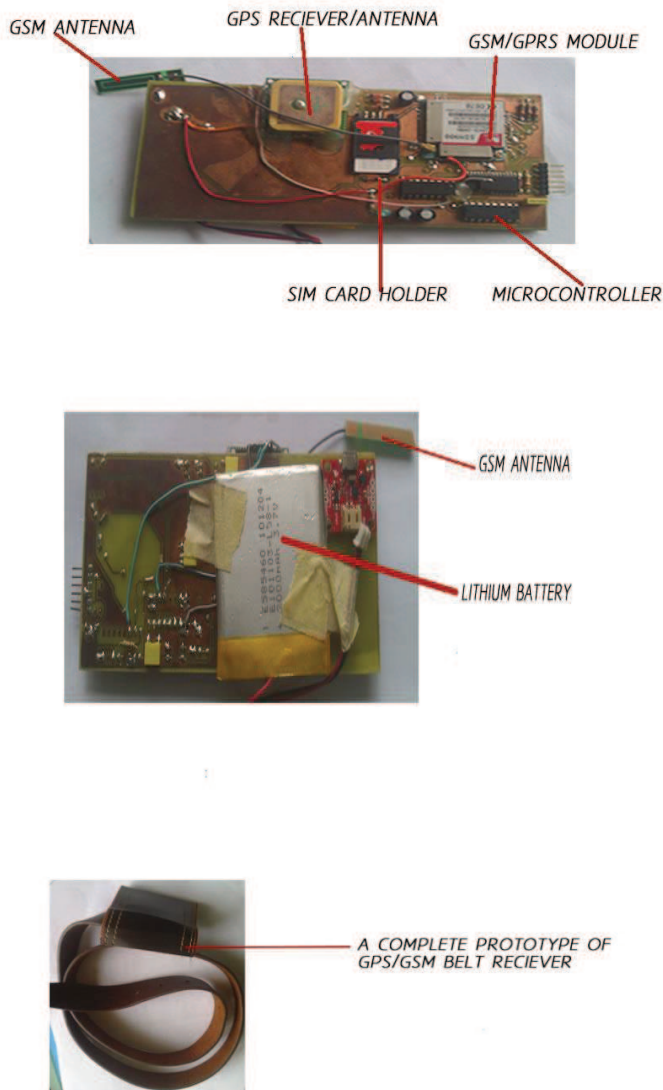
Fig.5 Prototype

IV. ACKNOWLEDGMENT

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V CONCLUSION

In order to develop CKALI, three main players were identified i.e. the belt incorporating a machine-to-machine (M2M) device (GPS/GSM module with a trigger activator),

the mobile operator and the security monitoring organizations, where all players are joined by the geographic information network.In this research work, we have designed a platform for prompt rescue of a kidnap victim and developed a prototype and tested it. We identified the possible drawbacks and dealt with them. Therefore, the platform operates effectively and efficiently.

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