Smart Gun With Rfid, Gps And Gsm Modules For Remote Enabling/Disabling Of Trigger

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ABSTRACT
Violence against women has become a prominent topic of discussion in India in recent years. According to the National Crime Records Bureau of India, reported incidents of crime against women increased 6.4% during 2012, and a crime against a woman is committed every three minutes. One traditional and effective way of equipping women would be, providing them with guns. Guns are necessary because, pepper sprays have been proven ineffective. But, given the amount and magnitude of crimes that can be committed if guns come into existence, we are forced to think about ways in which guns can be made safe to use. To keep under control the gun related crimes, it is necessary to make guns smarter and safer to use. Such guns are called “Smart Guns” that come with a variety of features like authentication, trigger locks etc. In this paper, we propose the use of RFID chips and tags and GPS (eg,LS20031) and GSM modules to enable authentication and safe use of the firearm.


INTRODUCTION
A smart gun is a personalized gun that can be fired only when activated by an authenticated user [1]. To enable this authentication, we propose the use of RFID chips and tags. Also, to prevent the misuse of firearm by the authenticated user, the control of firearm is given to a separate department of officials [2], who with the help of GSM technology can remotely lock the trigger of the firearm just by sending an SMS. By doing so, the department officials can monitor the firearm by installing trackers such as the LS20030-3 series GPS modules inside the firearm and lock it when needed.

II. Rfid Reader And Tag For Smart Gun:
Commercial fully integrated RFID reader IC chips are available, which can be built into the handle of the smart gun. One such example of a fully integrated RFID reader IC chip is the TRF7962A. It comes completely integrated with protocol handling for ISO15693 and ISO18000-3. The features of TRF7962A are as follows:

- Input voltage range : 2.7v dc to 5.5v dc
- Programmable output power: (100mW) or (200mW)
- Programmable i/o voltage levels: 1.8v dc to 5.5v dc
- Programmable system clock frequency output (RF, RF/2, RF/4)

The reader is configured by selecting the desired protocol in the control registers [3]. The TRF7962A is a 13.56 MHz HF RFID reader IC comprising an integrated AFE (Analog Front End) and a built in data framing
engine for ISO15693 with all framing and synchronization tasks on-board. The receiver system has dual input receiver architecture. The received input bandwidth can be selected to cover a broad range of input subcarrier signal options. The TRF7962A device includes a receiver framing engine. This receiver framing engine performs the Cyclic Redundancy Check (CRC) or parity check, removes the Start Of Frame (SOF) and End Of Frame (EOF) settings, and organises data in bytes for the ISO15693 protocol [4]. Framed data is then accessible to the microcontroller unit (MCU) through a 12 byte FIFO register.

A parallel or serial interface (the SPI) can be used for the communication between the MCU and the TRF7962A reader. When the built in hardware encoders and decoders are used, transmit and receive functions use a 12-byte FIFO register.

Fig. 1:

A. Rfid Tag:

An RFID tag is comprised of an integrated circuit (called an IC or chip) attached to an antenna that has been printed, etched, stamped or vapour-deposited onto a mount which is often a paper substrate or Poly Ethylene Therephtalate (PET). The chip and antenna combo, called an inlay, is then converted or sandwiched between a printed label and its adhesive backing or inserted into a more durable structure.

As stated above, an RFID tag consists of an integrated circuit and an antenna. The tag is also composed of a protective material that holds the pieces together and shields them from various environmental conditions. RFID tags come in a variety of shapes and sizes and are either passive or active. Passive tags are the most widely used, as they are smaller and less expensive to implement. Passive tags must be “powered up” by the RFID reader before they can transmit data. Unlike passive tags, active RFID tags have an on-board power supply (e.g., a battery), thereby enabling them to transmit data at all times.

III. LS20031 Series Gps Chips:

The LS20031 is a complete GPS smart antenna receiver, that includes an embedded antenna and GPS receiver circuits. The GPS smart antenna will track up to 66 satellites at a time while providing fast time-to-first-fix, one-second navigation update and low power consumption.
B. Features:

- 5Hz output
- 57600bps TTL serial interface
- 3.3V at 41mA
- 66 Channel GPS
- Fast TTFF at low signal level
- Up to 10Hz update rate
- Capable of SBAS (WAAS, EGNOS, MSAS)
- Built-in micro battery to preserve system data for rapid satellite acquisition
- LED indicator for fix or no fix

The major reason for selecting the LS20031 is that the update rate is 10Hz. The update rate of a GPS module is basically how often it recalculates and reports its position. If we have a module with an update rate of 5-10Hz, it can be configured to run at an easier pace. One major drawback of going for higher update rates is, the microprocessor gets quickly overwhelmed trying to parse that much data. 5-10Hz is a normal update rate and hence, is relatively less overwhelming for the microprocessor. The second major consideration is the size of the GPS module. The tracker chip should be fitted inside a gun. The gun itself is heavy, and hence the added components must be light in weight to prevent it from becoming heavier. The LS20030–3 series of chips come in small sizes and are light in weight and also offer 5-10Hz update rates. Another major advantage of the LS20031 is that it comes with 66 channels, meaning, it can track up to 66 channels at any given time.

IV. Gsm:

GSM (Global System for Mobile Communications, originally Group especial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States).

C. Subscriber Identity Module (SIM):

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking.

The GSM module is required in a smart gun, to enable the respective department officials to remotely lock the gun in highly secured places like, crowded public spaces, airports, schools etc. The remote locking can be done by sending an SMS to the registered number on the SIM present in the GSM module inside the gun. Also, the gun can be unlocked by again sending an SMS. This way, misuse of guns by the authenticated user can also be prevented.

Since, all these modules are to be fitted inside the gun, we are forced to look for smaller, lightweight modules for the gun. Hence, GSM modules in the form of IC’s can be used. Many small sized GSM modules are available and are being manufactured by various manufacturers. Commonly, most of these modules are based on the SIM900 GSM MODULE.

D. SIM900 Gsm Module:

The SIM900 is a GSM/GPRS compatible quad-band cell phone which works on a frequency of 850/900/1800/1900 MHz Internally, the module is managed by an ARM926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and ( through an UART and a TTL serial interface). In addition, the GSM900 device integrates an analogy interface, an A/D converter, an RTC, an SPI bus, and a PWM module. The TTL serial interface is in charge not only of communicating all the data relative to the SMS already received and those that come in during TCP/IP sessions in GPRS, but also of receiving the circuit commands that can be either AT standard or AT enhanced SIMcom type. The module is supplied with continuous energy (between 3.4 and 4.5v ) and absorbs a maximum of 0.8A during transmission.

V. Prototype:

The image fig.4 below is a picture of the model we developed to demonstrate the use of RFID technology and an InduinoR3 ( clone of Adriano) with an ATMEGA 328 microcontroller. There is a servo motor in the
image which is used as a trigger lock. Other alternatives include shape memory alloys and linear solenoid actuators.

Fig. 2:

The above two images, fig.2 and fig.3 show the code used for demonstrating authentication feature using RFID tags. Only, when the tag is recognized, the servo motor unlocks the trigger. Otherwise, the servo motor keeps the trigger locked. Also, it is seen from the code that, after a delay of a few seconds after unlocking the trigger, the motor again locks the trigger. This delay can be varied for real time use.
Conclusion:

A smart gun is one of the solutions for curbing crime, but I cannot be taken as the only solution. A smart gun like any other technology has its own set of disadvantages. These disadvantages can be reduced but cannot be completely eliminated. Thus, improvements need to be done to make it completely usable. However, something is better than nothing and this can safely be used as a firearm for protection, as long as the suggested features are implemented.

REFERENCES

1. Smart gun technology project final report prepared by Sandia National Laboratories http://www.osti.gov/scitech/servlets/purl/285510
2. Texas instruments TRF7962A fully integrated 13.56 MHz RFID reader/writer IC for ISO15693 and ISO18000-3 standards