

Woman Tracking System Using GSM, GPS & Arduino Microcontroller

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Abstract - Women safety is a very important issue due to rising crimes against women these days. Many woman are working in corporate sector in night shifts. There is a feeling of insecurity among the working women. The proposed device is more like a safety system in case of emergency. This device can be fitted in a purse or in jacket (similar to a blazer for women). To help resolve this issue we propose a Woman tracking system using GSM, GPS and Arduino Microcontroller. This device consists of a system that tracks the location of woman when in trouble. This system can be turned on through a wireless remote by a woman in case she even thinks she would be in trouble. The wireless remote provides the advantage of turning it on from a distance up to 5 meters. The device is easy to carry, conceal and have low power requirements with rechargeable battery.

The system is provided with a Li-ion battery, which is charged using Li-ion battery charger which adds over-current and over-discharge protection to the battery. The authorised mobile number of receiver can be saved and changed any time by sending mobile number in the specified format through SMS. The location sharing cycle is triggered wirelessly with the help of RF remote. The location, time and date are fetched from GPS and delivered to the saved mobile number through an SMS, this is a cycle which repeats itself in every 15 seconds until it is turned off.

This device will prove to be very useful in saving lives as well as preventing atrocities against women. The device uses GPS sensor along with a GSM modem, RF Decoder, Li-ion battery charger, Boost converter, LED's and microcontroller based circuit to achieve this system.

Key Words: GPS, GSM, RF Decoder, Li-ion battery charger, Arduino.

1. INTRODUCTION

Even in this modern era women are feeling insecure to step out of their house because of increasing crimes in our country like harassment, abuse, violence etc., The corporate and IT sector are booming. Many women are working night shifts. There is a feeling of insecurity among the working women. The proposed device is more like a safety system in case of emergency. This device small and easy to carry [1]. The emergency push button can be made into a keychain or can be fitted into a watch. The main purpose of this device is to inform

friends or the police that a crime is about to occur along with that the current location of the woman. A GPS is used to trace the current position of the victim and a GSM is used to send the message to the registered numbers which is triggered using wireless remote.

2. EXISTING SYSTEMS

In Women and children based security system victim has to press the emergency button, but in emergency conditions pressing the button located on the device or purse may not be possible. Using Smartphone the child cannot send his location by himself. The parent of that child has to send the message to the child's system to know their location. In "Mobile Tracking Application for Locating Friends", a tracking application software must be installed in the mobile phone and friends must be previously registered in the application [2]. To track their friends mobile phones are needed in both sides. In an Intelligent System based on RFID and GPS Technologies for Women Safety [3-4] has some limitations in terms of cost, signal interferences and also the information access to invalid and unauthenticated users.

This paper presents new method to provide protection for women or children by ringing the buzzer and send the location to the nearby police station where the victim is present.

3. PROPOSED SYSTEM ARCHITECTURE

The architecture of proposed system as shown in Fig1. It consists of Arduino controller [5] as a main source and it receives input signal from RF remote, where thereby the RF remote is pressed by a human who is in threat or in danger or in abnormal situations.

The components described in the architecture are GPS, GSM, Arduino microcontroller, RF Decoder, Li-ion battery Charger, Boost Converter, transformer, rectifier, filter. GSM is used to send the alert message to the registered contact number where as GPS is used to track the location of that

person(women) [6-7].Arduino handles the communication between all components.

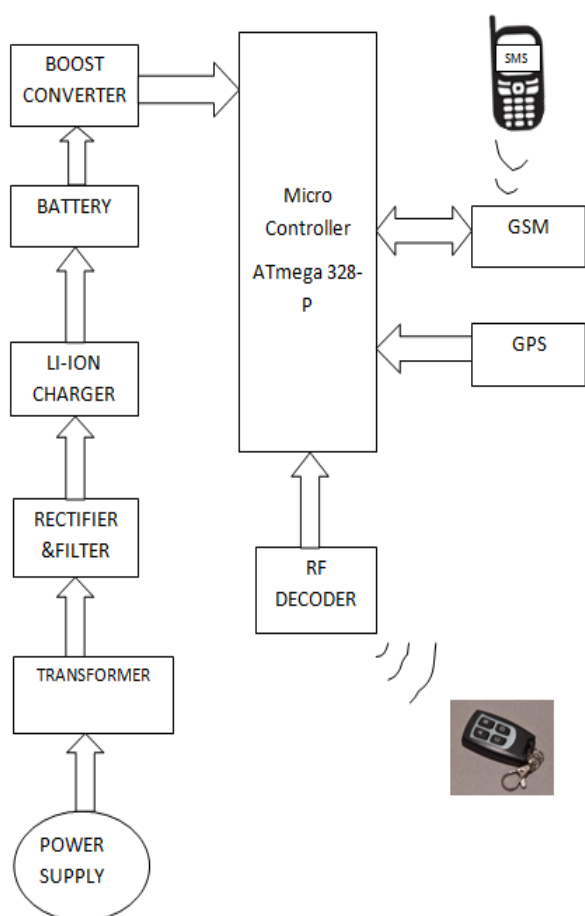


Fig1: Architecture of the Proposed System

RF decoder receives triggering signal to trigger messages from RF remote. Li-ion battery provides over-discharge and over-current protection.

4. WORKING

Our device has two modes that is i) Configuration mode, to feed receiver's number in the EEPROM. ii) Operational Mode, to trigger the location sharing through SMS.

i) Configuration Mode: a) The configuration mode is initiated by pressing the configuration button which is attached to the I/O digital pin 3 of Arduino, this turns ON the yellow LED connected to the digital I/O pin 13 of Arduino. b) GPS now gets deactivated and GSM enters listen/active mode and wait for SMS carrying the receiver's mobile number. c) The SMS text contains the receiver's mobile number in between

special characters '\$' at the start preceding the mobile number followed by '@'. d) When the SMS is received by GSM module, the mobile number is fetched from SMS text and saved in EEPROM. e) After this operation LED connected to digital I/O pin 13 turns OFF indicating the completion of the process. f) Hence the device exits the configuration automatically.

ii) Operation Mode: a) Since the receiver's mobile number is now saved in EEPROM, the RF Decoder waits for the RF signal. b) To trigger the location sharing process the button 'B' of RF remote is pressed (this button start/stop the location sharing), the RF signal is detected by RF decoder activates the GPS. c) GPS now fetches latitude, longitude, time, date from constellation of satellites. d) Now GSM gets activated. The aforementioned data is NMEA form which is decoded into text form. e) The message containing the date, time and link to the victim is sent to the receiver. f) This whole process is repeated in every 15s until button 'B' is pressed again.

5. HARDWARE DESCRIPTION

1. *Arduino*: The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started [8].



Fig 2: Arduino UNO

Sensors Interfacing To Arduino: The Arduino comprises of 28 pins, where there are 20 I/O pins. There are 14 digital pins and 6 analog pins. Here in this system all the respective sensors are connected to

the analog pins of Arduino. The analog pins A0, A1, A2, A3, A4, A5 from Port B of Arduino are used for interfacing with the sensors. The digital pins (2, 3, 4, 5, 7, 6, 7, 8) Port C of Arduino are used here to connect to the data lines of respective LCD display. The power supply of 5v is supplied to the Arduino through the USB cable. The output pin of Arduino i.e., 13th pin is connected to the buzzer to determine the output of the project. The main components of this project i.e. GSM and GPS are connected to Arduino. Hence in this proposed system the Arduino is completely used for implementation of the security system.

2. GPS Module: Global positioning system (GPS) as shown below in Fig 2 is a navigation and precise positioning tool, which tracks the location in the form of longitude and latitude based on Earth by calculating the time difference for signals from various satellites to reach the receiver [9-10].



Fig3: GPS module:NEO-6m

In six different orbits approximately 12500miles above the earth, 24 MEO (Medium-Earth Orbit) satellites revolve around the earth 24 hours and transmit location every second. It receives the data of location and transmits it to the Arduino. The Arduino thereby receives the signal from GPS and hence it performs further operations

3. *GSM Module:* Global System for Mobile communication (GSM) SIM card is inserted inside the mobile device to send and receive the messages using GPRS. The GSM SIM card number is registered with the system.GSM is used to send data from control unit to base unit [11]. We can use GSM 800L which operates at frequency 900MHz. It has up link band of 890MHz to 915MHz and down link Band of 935MHz to 960 MHz GSM takes advantages of both FDMA & TDMA.

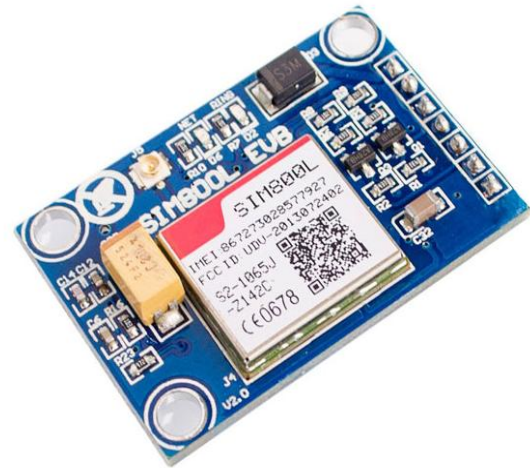


Fig 4: GSM module: SIM800L

In 25MHz BW, 124 carriers are generated with channel spacing of 200 KHz (FDMA). Each carrier is split into 8 time slots (TDMA) [9]. At any given instance of time 992 speech channels are made available in GSM 800L .

4. *RF Decoder:* PT 2272 is a remote control decoder paired with PT 2262 utilizing CMOS Technology. It has 12 bits of tri-state address pins providing a maximum of 531,441 (or 3^{12}) address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. PT 2272 is available in several options to suit every application need : variable number of data output pins, latch or momentary output type

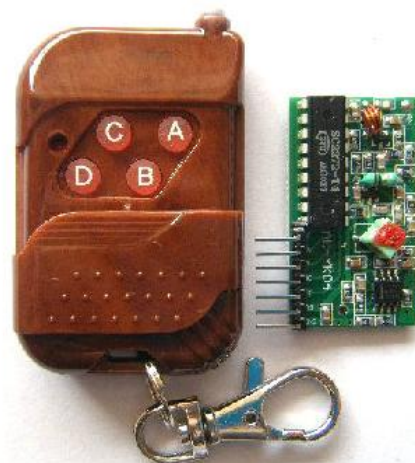


Fig 5: RF Decoder: PT2272

Some features are CMOS Technology, Low power consumption , very high noise immunity, Up to 12 Tri state code address pins,Wide range of operation $V_{cc}=4 \sim 15$.

5. Li-ion Battery charger: The TP4056 is a complete constant-current/constant-voltage linear charger for single cell lithium-ion batteries. Its SOP package and low external component count make the TP4056 ideally suited for portable applications. Furthermore, the TP4056 can work within USB and wall adapter.

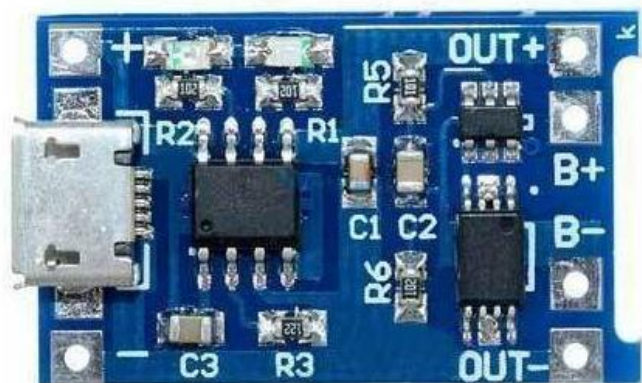


Fig 6: Li-ion Battery charger: TP4056

No blocking diode is required due to the internal PMOSFET architecture and have prevent to negative Charge Current Circuit. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The TP4056 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached. TP4056 Other features include current monitor, under voltage lockout, automatic recharge and two status pin to indicate charge termination and the presence of an input voltage.

Some features are Programmable Charge Current Up to 1000mA, No MOSFET, Sense Resistor or Blocking Diode Required, Preset 4.2V Charge Voltage with 1.5% Accuracy, Automatic Recharge, Charges Single Cell Li-Ion Batteries Directly from USB Port.

6 .Boost converter: In modern days, Lithium batteries are enriching the electronics world [12]. They can be charged very fast and provide good backup, which along with their low manufacturing cost makes lithium batteries the most preferable choice for portable devices. As a single cell lithium battery voltage range from minimum 3.2 voltage to 4.2V, it's difficult to power those circuits which requires 5V or more. In such case we need a Boost Converter which will boost the voltage as per the load requirement, more than it's input voltage.



Fig 7: Boost converter

Features: Input voltage: 1V ~ 5V, Output voltage: 5V, Output current: 500mA, High conversion efficiency, up to 96%, Ultra-small size, with the installation in a variety of small equipment.

6 .ARDUINO SOFTWARE

Integrated Development Environment (IDE):

Here the Arduino IDE is used on computer (picture following) to create, open, and change sketches (Arduino calls programs as "sketches"). The Mega 2560 board can be programmed with the Arduino Software (IDE) [13]. The ATmega2560 on the Mega 2560 comes pre-programmed with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP . The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository.

The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Mega 2560 board is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB).

6. IMPLEMENTATION OF THE PROPOSED SYSTEM

The implementation of our project is shown in the following picture:

1) Configuration Mode:

i) The configuration mode is initiated by pressing the configuration button, this turns ON the yellow LED of Arduino.

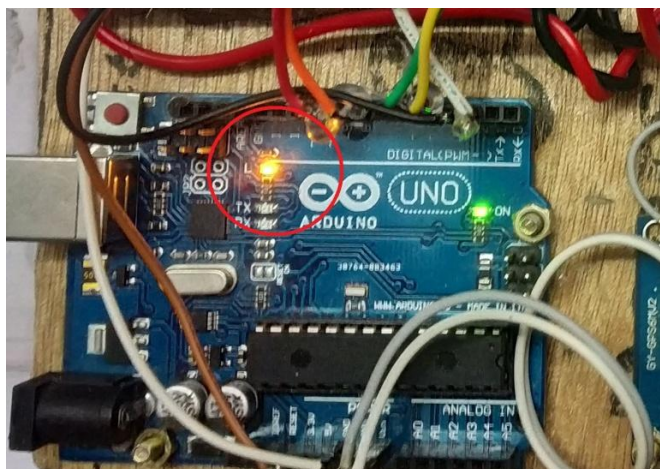


Fig 8: Device in Configuration Mode: Yellow LED turns ON

ii) GPS now gets deactivated and GSM enters listen/active mode and waits for SMS carrying the receivers mobile number. The SMS text contains the receivers mobile number in between special characters '\$' at the start preceding the mobile number followed by '@' [14]. As shown in Fig9.

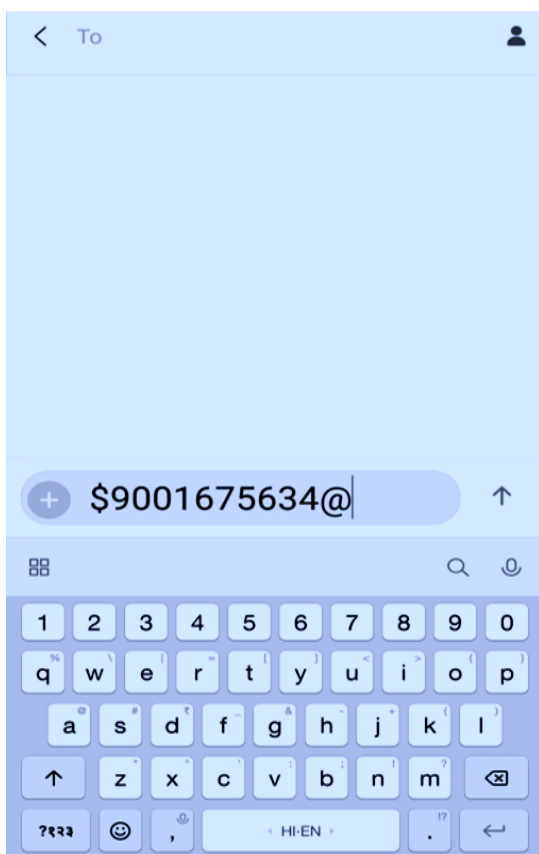


Fig 9: SMS to store receiver's mobile number in EEPROM

iii) When the SMS is received by GSM module, the mobile number is fetched from SMS text and saved in EEPROM. After completion of this process yellow LED of the Arduino turns OFF indicating the completion of the process.



Fig 10: Device exits Configuration Mode: Yellow LED turns OFF

2) Operation Mode:

i) To trigger the location sharing process the button 'B' of RF remote is pressed (this button start/stop the location sharing), the RF signal is detected by RF decoder which activates the GPS.



Fig 11: Button 'B' on RF remote initiates message sending cycle

ii) GPS now fetches latitude, longitude, time, date from constellation of satellites. After location is fetched then GSM gets activated. The aforementioned data is in NMEA form which is decoded into text form by the microcontroller[15].

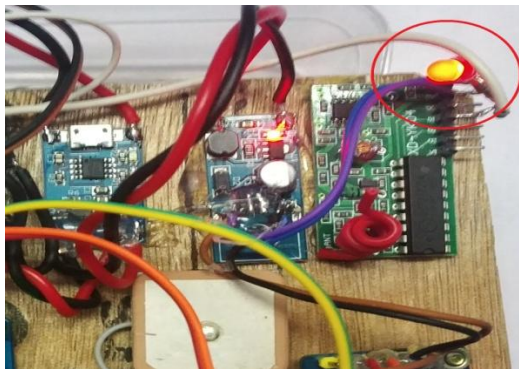


Fig 12: RF Decoder LED turns ON when button 'B' is pressed which denotes device is now in operation mode

iii) An alert message containing the date , time and link to the victim is send to the receiver. This whole process is repeated in every 15s until button 'B' is pressed again.

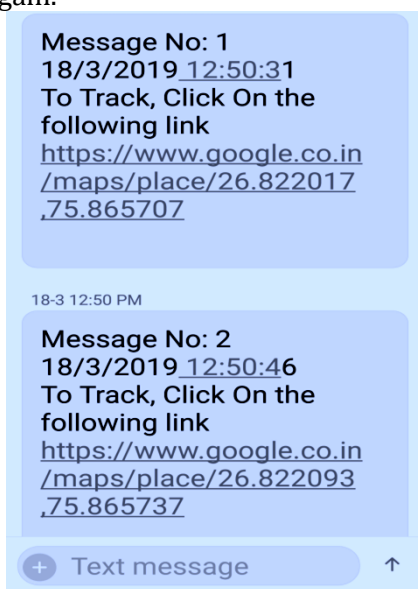


Fig 13: Format of alert SMS received on the saved number

3. Snapshot of complete project:

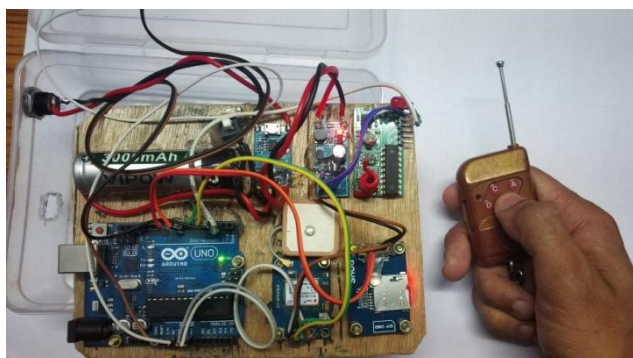


Fig 14: (a) Snapshot of final project



Fig 15: (b) Snapshot of final project (with the configuration button on the lid)

7. CONCLUSION

In this paper, we have proposed the designing and implementation of a safety system for women devices it focuses on tracking of the woman (victim) through a device of a size of a 'handbook' which can be easily concealed and run for days on a single charge, Remote triggering gives it an edge over it's counterparts. Going serially as per the objectives mentioned, the tracking subsystem was successfully implemented. The further implementation of the system will be performed in accordance with the goals mentioned in the future scope. This project will overcome the fear that scares every woman in the country about her safety and security.

8. FUTURE SCOPE

Some proposed improvements in the system can be:

1. We can develop an android application which can show the real time location of the victim using maps provided by websites like Google Maps, Open Maps.Org.
2. To make tracking even faster we can convert the longitude latitude coordinates to address using 'reverse geolocation', this will be beneficial for low cost systems where receiver is deprived of internet connection.

In this fast paced world, the world has progressed at a rapidly but reliable help is often delayed and crime cannot be averted in time. Therefore there is a need to provide deterrence to our system. Some proposed deterrence techniques are 1. H.V. shock gloves which can give electric shock to the perpetrator. 2. H.V. Radio Frequency body enclosed net. Any one tries to touch the woman gets a shock.

Any or all of these above mentioned techniques can be implemented to our project to the device more 'woman friendly'.

9. REFERENCES

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