MARITIME BORDER INDICATION DEVICE

by

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BONAFIDE CERTIFICATE

Certified that this project report entitled "**MARITIME BORDER INDICATION DEVICE"** is a bonafide work of **K MANOJ MADHAV(15BEC1078), M CHANDU NIRMAL(15BEC1085), A R SAI YASASWI (15BEC1122), N SHANMUK KUMAR(15BEC1167), CH NIKHIL CHAKRAVARTHY(15BEC1184), M HEMANTH REDDY(15BEC1208), M S S AVINASH(14BEC1193)** who carried out the Project work under my supervision and guidance.

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ABSTRACT

Countries with the International Marine Time Boundary Line (IMBL) will always has security problems and continuous life threatens for those fishermen whose family's main economic support is fishing.

Even in the peninsular country like India has their boundary limit in the ocean, the people of these coastal regions has the main work of fishing, due to carelessness or without knowing their boundary limit of their country they cross the borders. In such situation the lives of fishermen continued to be difficult. They may face bullets and attacks from opposite Navy, at the end of attack fishermen are being abducted and their boats are being captured.

The Tamil Nadu factor in India-Sri Lanka relations that had been quiet for long has come to the fore in the form of the fishermen issue. Frequent incidents of fishermen from Tamil Nadu getting shot in the Sri Lankan's maritime boundary have enraged all citizen of the state. From Tamil Nadu about 18,000 boats of different kinds conduct fishing along the India - Sri Lanka maritime border. Ever since violence broke out in Sri Lanka two decades ago, fishing activity has not been peaceful. Tamil Nadu fishermen are arrested, or shot, by the Sri Lankan Navy.

Our project coins a low cost maritime border indication system that helps the fishermen to know their boundary limits when they go out for fishing.

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1. INTRODUCTION

1.1 Introduction

The island like Sri Lanka and peninsular India are the countries separated by their maritime borders. The people's livelihood in coastal area of these countries purely depends on fishing occupation in the sea. Crossing the border is a serious violation of maritime laws. Fishermen have been facing a problem of trespassing the maritime border accidentally since ages. In order to get a better catch at the seas, they go farther and farther, near the Katchutheevu island thereby entering the Sri Lankan waters and undergoing the legal procedures of that country. Especially, in Tamil Nadu nearly 18,000 boats go fishing in the Bay of Bengal. Being unaware of the boundary limit, the fisherman used to cross the maritime borders. Once they cross the border, they arrested or killed by the Sri-Lankan navy and they are being abducted and their boats are being captured by the neighbourhood country's coastal guards. In such situation the lives of fishermen continue to be in threat. It is a major threatening issue and leads to loss in the both humans as well as their economic incomes.

The proposed prototype is used to devise a low-cost alert device for fisherman that gives an alert when the boat/ship crosses beyond other country's border. It helps the fishermen not to go close to the border. If the fishermen violate the border, an alarm (danger signal) is generated indicating that the fisherman has to immediately change his direction course.

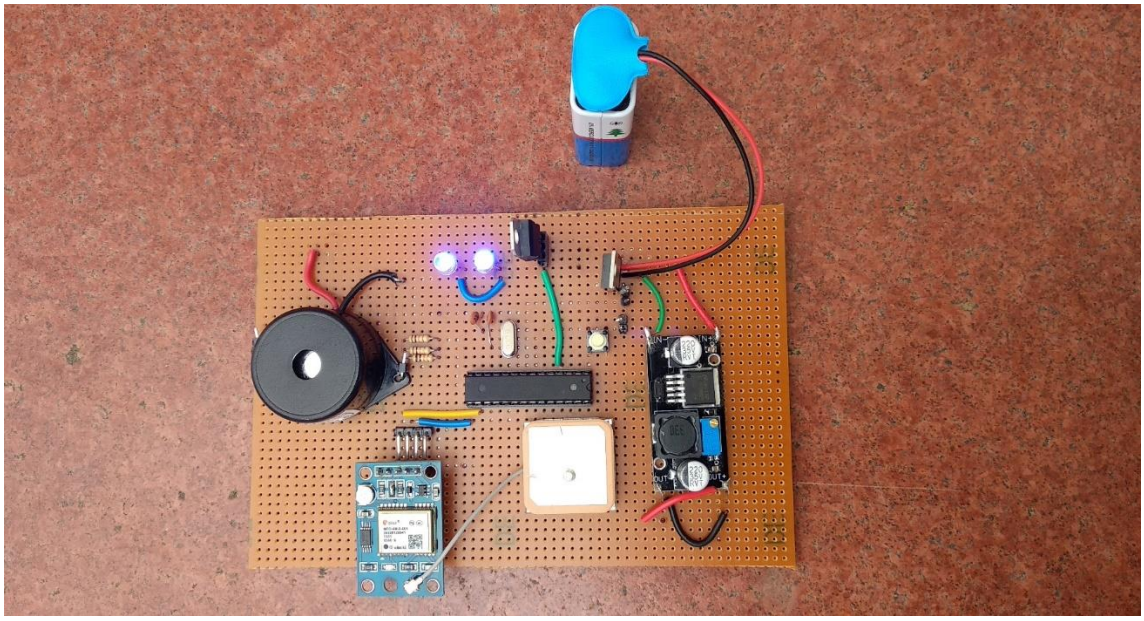
2. DESIGN

2.1 Design

We intend to solve this issue by alerting the fishermen based on their location using GPS.

- If the boat is very close to the maritime border (as programmed in the device), it will alert the sailor to turn back.

We are using a GPS receiver which receives signal from the satellite and gives the current position of the boat. The proposed system is used to detect the border of the country through the specified longitude and latitude of the position, not only between Sri Lanka and India but all over the world. The particular layer level i.e. border can be predefined and this can be stored in microcontroller memory. The current value is compared with predefined values and if these values are same, immediately the particular operation will be done i.e., the microcontroller gives instruction to the alarm to buzzer.



2.2 COMPONENTS

1. ATMEGA328p
2. Neo 6M – GPS Module
3. Buck Converter (12V – 5V)
4. AMS1117(5V-3.3V)
5. Power LEDs
6. TIP 120
7. Buzzer

ATMEGA328p

- The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines.
- Also, 32 general purpose working registers, three flexible timer/counters with compare modes,
- Internal and external interrupts
- Serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter,
- Programmable watchdog timer with internal oscillator, and five software selectable power saving modes.
- The device operates between 1.8-5.5 volts.

Neo 6M – GPS Module

- Ublox Neo 6M (Ublox NEO6MV2) is a I2C compliant GPS module.
- This module has an external antenna and built-in EEPROM.
- Interface: RS232 TTL
- Power supply: 3.3V
- Default baud rate: 9600 bps
- Works with standard NMEA sentences
- The NEO-6M GPS module has four pins: VCC, RX, TX, and GND.
- The module communicates with the Arduino via serial communication using the TX and RX pins.
- These sentences can be either viewed in a serial monitor or can be exploited for our purpose.

Buck Converter

- It’s an electronic device used to step down voltages from a range of 24V up to 5V.
- The input voltage rating can also be controlled by using the 10K potentiometer.

TIP 122

- It’s a high current rated transistor with up to a current rating of 60A.
- In this particular application we used this transistor to switch the terminals of a solenoid valve to stop the fuel flow into the engine.

Connection with ATMega328p

VCC - 3.3V

Tx – To Rx pin of ATMega328p

Rx – To Tx pin of ATMega328p

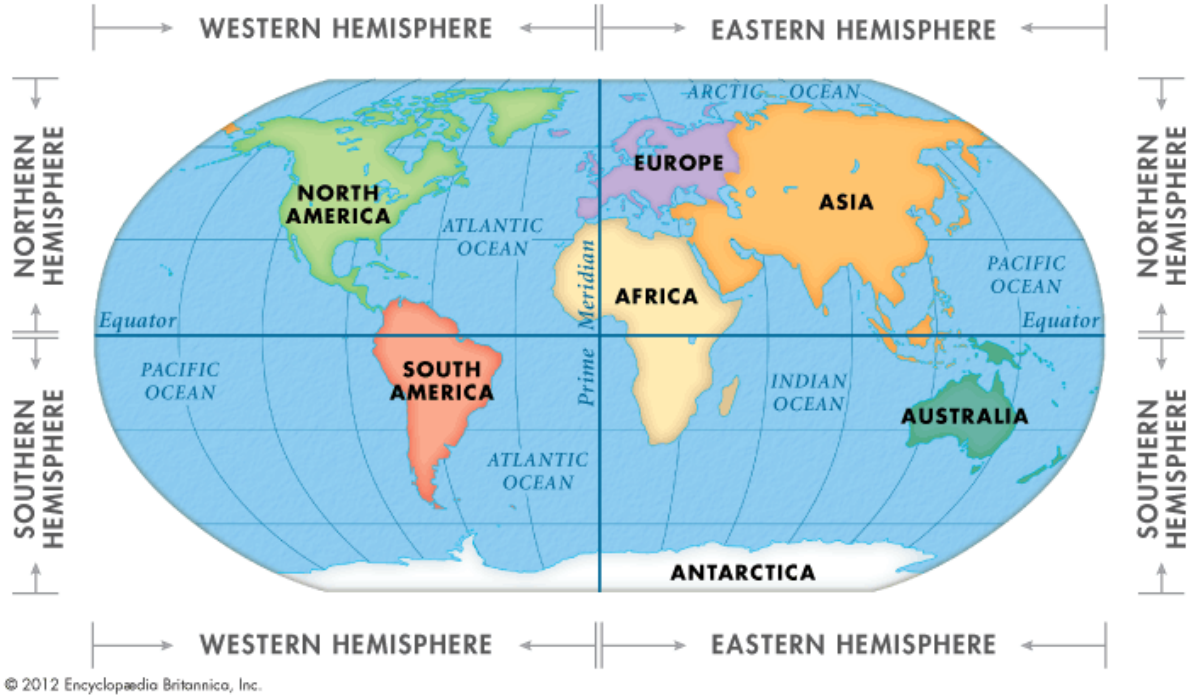
Gnd- ground

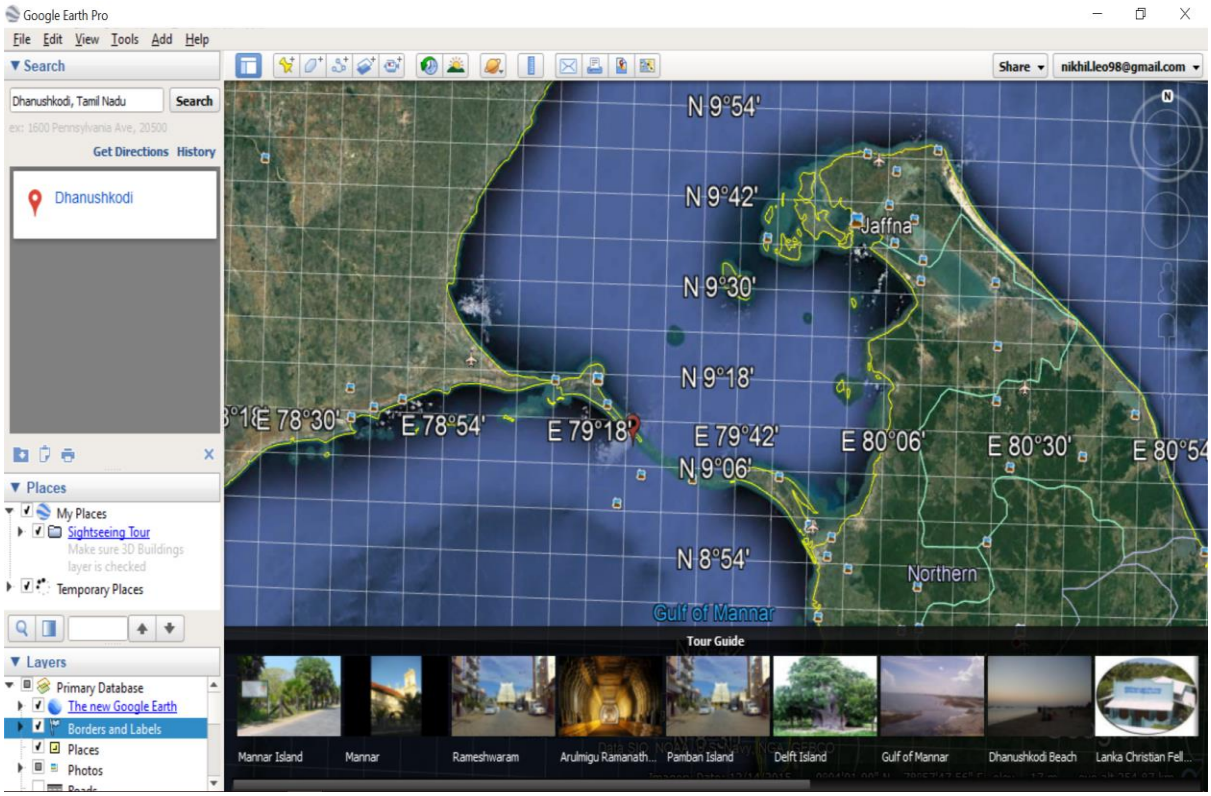
2.3 METHODOLOGY

Line Equation Method

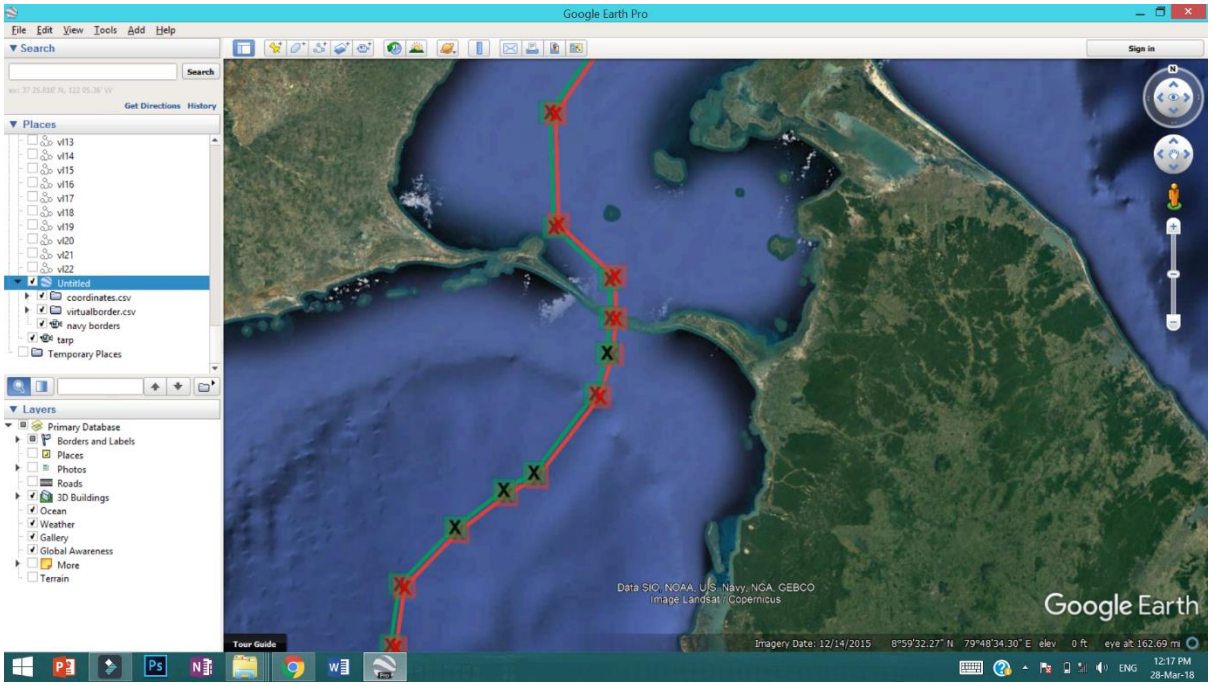
- The coordinates in degree, minutes and seconds have been converted into decimals.
- We created a virtual boundary at a distance of 1 nautical mile from the real border.
- Line equations have been formed using the virtual Border co-ordinates (with accuracy up to 6 decimals).
- Threshold coordinates for their corresponding line equations have to be used while developing to code, to identify the border.

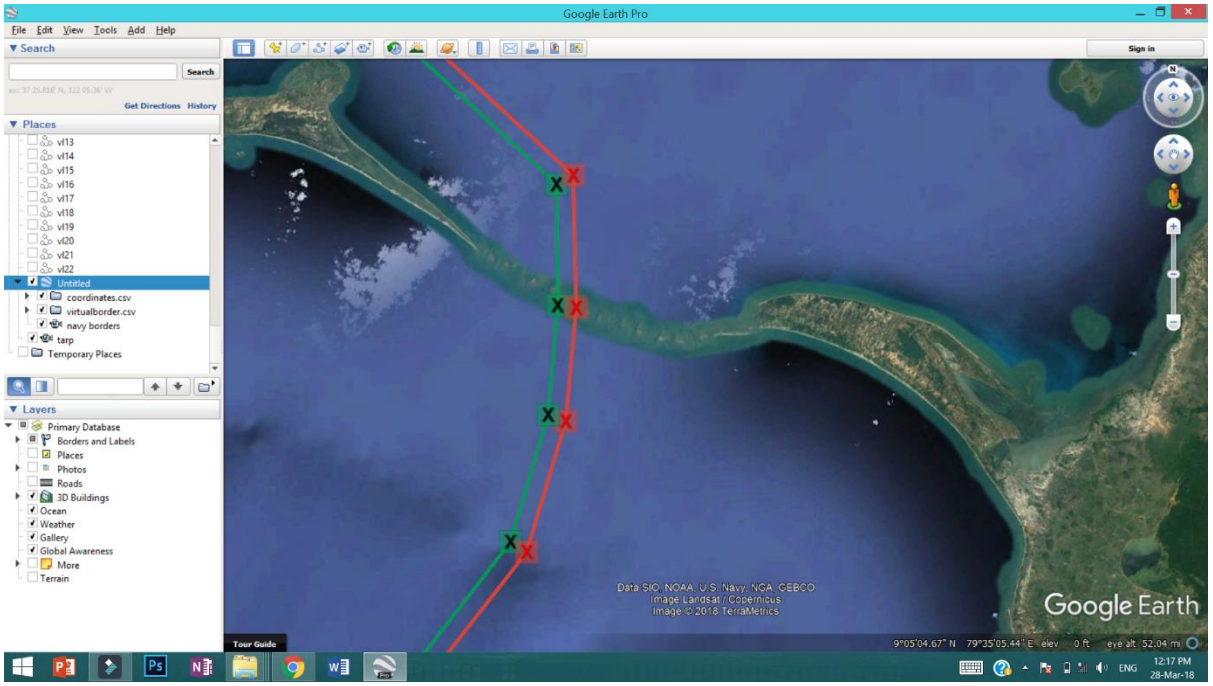
Co-ordinates Variation





Real Border and Virtual Border:





SOFTWARE ANALYSIS

3.1 Arduino Code

Code:

```
#include <TinyGPS++.h>

#include <SoftwareSerial.h>

/* Create object named bt of the class SoftwareSerial */

SoftwareSerial GPS_SoftSerial(9, 10);/* (Rx, Tx) */

/* Create an object named gps of the class TinyGPSPlus */

TinyGPSPlus gps;


volatile float minutes, seconds;

volatile int degree, secs, mins;

volatile int green=11; /*WARNING LED*/

volatile int red=2; /*SAFE LED*/

volatile int blue=13;

double x,y;


void setup() {

  Serial.begin(9600);   /*   Define   baud   rate   for   serial
communication */

  GPS_SoftSerial.begin(9600); /* Define baud rate for software
serial communication */

  pinMode(green,OUTPUT);

  pinMode(red,OUTPUT);

  pinMode(blue,OUTPUT);

}
```

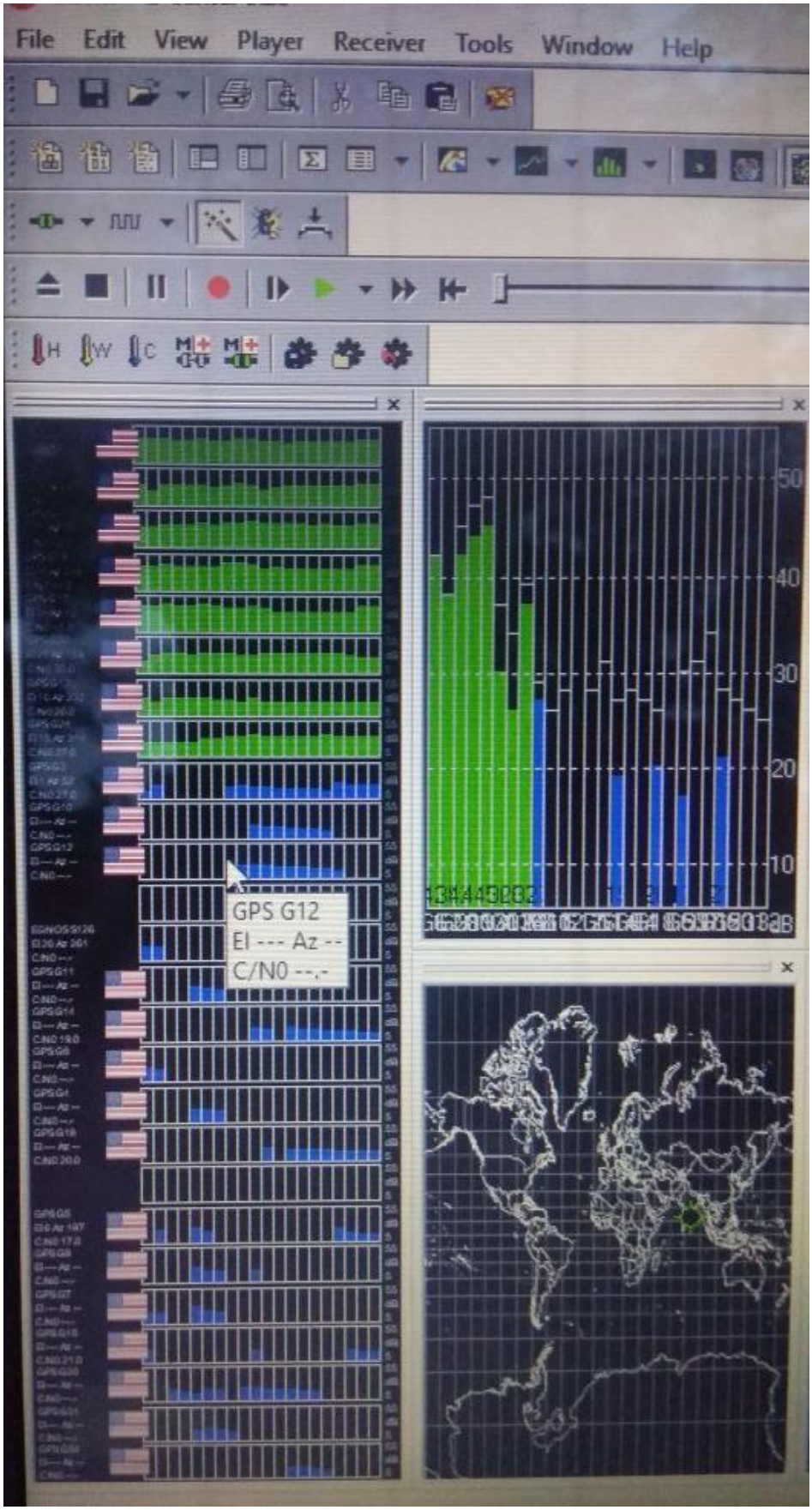
```
void loop() {


       LatLong();

      Serial.println(x,6);

       Serial.println(y,6);


       if(0.0002*x-0.0006*y>=0.0083257   &&   y>12.841591   &&
y<12.841731  &&  x>80.153035  &&  x<80.153683)  //  VIT  CHENNAI
PARKING LOT

       {

        warn();

       }

       else  if(0.0001*x+0.001*y>=0.0208571  &&  y>12.841687  &&
y<12.841731  &&  x>80.153683  &&  x<80.154636)  //VIT CHENNAI MGR
STATUE

       {

        warn();

       }

       else

       safe();

}


static void smartDelay(unsigned long ms)

{

  unsigned long start = millis();

  do

  {

    while  (GPS_SoftSerial.available())   /*  Encode  data  read
from GPS while data is available on serial port */
```

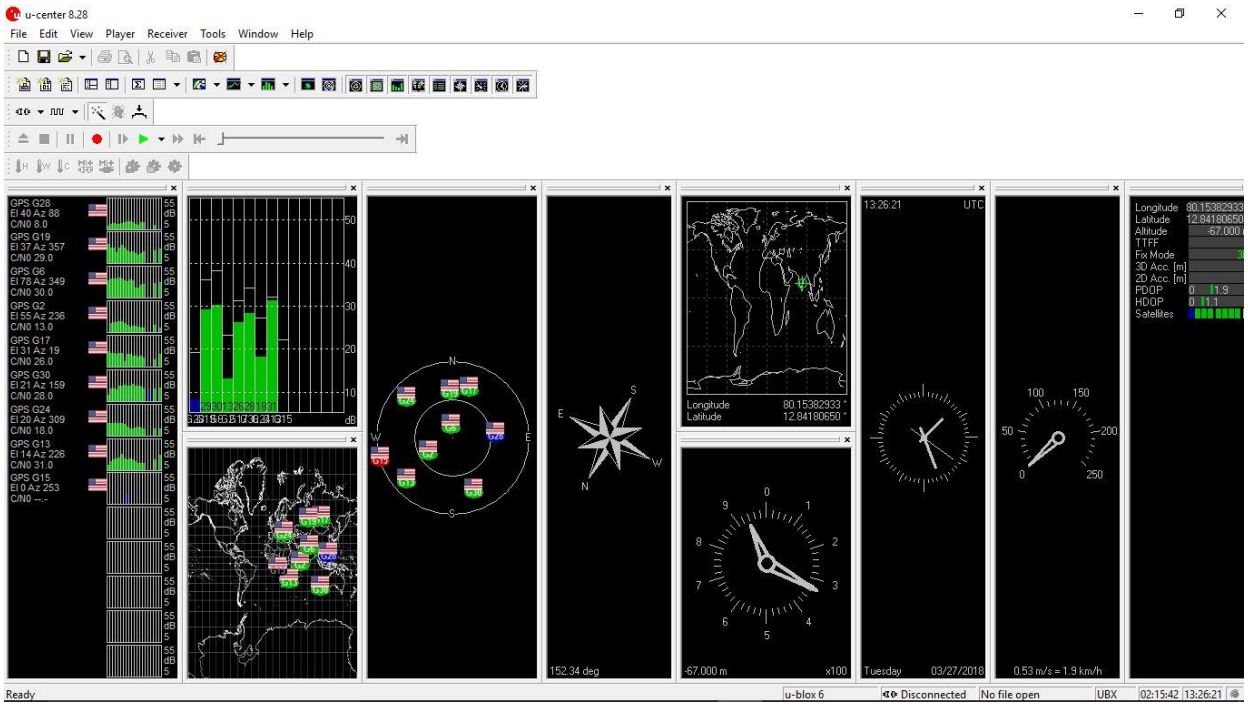
```
      gps.encode(GPS_SoftSerial.read());
    /* Encode basically is used to parse the string received
by the GPS and to store it in a buffer so that information can
be extracted from it */
  } while (millis() - start < ms);
}

 void DegMinSec( double tot_val)    /* Convert data in decimal
degrees into degrees minutes seconds form */
{
  degree = (int)tot_val;
  minutes = tot_val - degree;
  seconds = 60 * minutes;
  minutes = (int)seconds;
  mins = (int)minutes;
  seconds = seconds - minutes;
  seconds = 60 * seconds;
  secs = (int)seconds;
}


void warn(){
  Serial.println(" !!!!   DANGER  !!!!! ");
  setColor(255, 0, 0);
  delay(250);
  setColor(0, 0, 0);
  delay(250);
  }
```

```
  void safe (){
  setColor(0, 255, 0);
  delay(1000);
  setColor(0, 0, 0);
  delay(1000);
}
void LatLong(){
        smartDelay(1000); /* Generate precise delay of 1ms */
        unsigned long start;
        double lat_val, lng_val, alt_m_val;
        uint8_t hr_val, min_val, sec_val;
        bool loc_valid, alt_valid, time_valid;
        lat_val = gps.location.lat(); /* Get latitude data */
        loc_valid = gps.location.isValid(); /* Check if valid
location data is available */
        lng_val = gps.location.lng(); /* Get longtitude data
*/

        if (!loc_valid)
        {
          Serial.print("Latitude : ");
          Serial.println("*****");
          Serial.print("Longitude : ");
          Serial.println("*****");
          setColor(0, 0, 250);
          delay(500);
          setColor(0, 0, 0);
          delay(500);
```

```
        }
        else
        {
          DegMinSec(lat_val);
          Serial.print("Latitude in Decimal Degrees : ");
          Serial.println(lat_val, 6);
          y=lat_val;

          DegMinSec(lng_val); /* Convert the decimal degree
value into degrees minutes seconds form */
          Serial.print("Longitude in Decimal Degrees : ");
          Serial.println(lng_val, 6);
          x=lng_val;
  }
}
void setColor(int redValue, int greenValue, int blueValue) {
  analogWrite(red, redValue);
  analogWrite(green, greenValue);
  analogWrite(blue, blueValue);
}
```

3.2 u-centre simulation




u-center 8.28
File Edit View Player Receiver Tools Window Help
GPS G28
El 40 Az 88
C/N0 8.0
GPS G19
El 37 Az 357
C/N0 29.0
GPS G6
El 78 Az 349
C/N0 30.0
GPS G2
El 55 Az 236
C/N0 13.0
GPS G17
El 31 Az 19
C/N0 26.0
GPS G30
El 21 Az 159
C/N0 28.0
GPS G24
El 20 Az 309
C/N0 18.0
GPS G13
El 14 Az 226
C/N0 31.0
GPS G15
El 0 Az 253
C/N0 --.-
Longitude 80.15382933 °
Latitude 12.84180650 °
13:26:21 UTC
Tuesday 03/27/2018
152.34 deg
-67.000 m x100
0.53 m/s = 1.9 km/h
Longitude 80.15382933
Latitude 12.84180650
Altitude -67.000
TTFF
Fix Mode
3D Acc. [m]
2D Acc. [m]
PDOP 11.9
HDOP 1.1
Satellites
Ready
u-blox 6
Disconnected
No file open
UBX
02:15:42 13:26:21

CONCLUSION

It is a useful device for safer navigation, especially for fishermen. Since Sri Lanka and India have got lots of problems regarding the maritime boundary of the country, this device is made to identify the maritime boundary and to provide assistance if needed.

The main advantage of this device is, it is compact and low-cost**.** The project generates alarm if they cross the border by mistake. With the simple circuitry and the use of low cost components makes the project a low-cost product, which can be purchased even by a poor fisherman.

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