Wildlife Tracker

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SUMMARY

Our Engineering clinics project is called proximity sensor. As the name suggests the sensor measures the proximity of the point of reference and point/object of interest. It also warns the user when the point/object of interest leaves the safe zone (i.e. it comes either too close to the point of reference or goes too far away from the point of reference).

The main components of our project include a GPS module (Ublox neo-6m), GSM 900A, Arduino Uno. The GPS module is used to find the position (latitude and longitude) of the point/object of interest. The GSM module is used to send messages from Arduino to user. All these components are then connected to Arduino Uno which performs the arithmetic and logical tasks required. They are all connected together using jumper wires and a bread board and a potentiometer is used to vary the brightness of the LCD screen.

The main application of our device is to prevent loss of life (both human and animal) due to violent human animal encounters. It can be installed along the roads to warn the drivers if animals are nearby. It can also be installed in settlements which are isolated and are surrounded by wildlife. It can be used as a tracker on pets and other monetarily valuable objects which will warn the user if it leaves the safe zone. It can also be used on criminals as it will warn the guards in case of a prison break.

By doing this project we learned about the different modules that are used in are device. We understood their functioning and importance in projects such as ours. This knowledge that we gained will be beneficial for us in future projects and in pursuing our career. We also learned the importance of creating new and unique projects which have real life applications as they prove to be of major help to the target users.

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INTRODUCTION

In this world we humans tend to forget that there also exist other living species of animals which are also very much alive and existing all around us. Being the dominating and intellectual species of this planet, it becomes our duty to protect, preserve and make sure that these animals' lives are not lost in vain.

Our country is still a developing one and has only currently began to adopt the foreign polices related to preserving the eco system and its other inhabitants. We have also decided to be a part of this change by contributing our share through our engineering project which is an "Proximity Sensor". The main application of our device hence is to prevent violent confrontations between animals and humans thereby preventing loss of life on both sides. It also has other application such as being a basic tracker and GPS locator.

Every year millions of animal and human lives are lost due to violent encounters between the two. Most of these incidents happen in the form of animal-vehicle collisions also known as roadkill. Animals end up on roads on which vehicles travel at very high speeds. In most of such cases a roadkill occurs despite the driver of the vehicle trying to avoid it. In such accidents the animals always end up being harmed or many a times end up dead. In a significant number of cases the humans involved in these accidents also end up injuring themselves and in worst case condition they die.

There are many people who live away from urban cities in small settlements surrounded by the wild. This is mostly seen in cases of villages and far away factories where the workers are given living space in and around the factory itself. Such isolated establishments are prone to animal attacks. Our project also aims at preventing these kinds of incidents by forewarning the inhabitants when an animal is nearby.

Apart from these cases our device can also be used as a basic tracker and GPS system. Hence it can be used on anyone and anything. By doing this you can track the whereabouts of whatever the device is placed on and it will warn you as soon as it exceeds a certain distance from you.

The following pages of the report will throw light on the functioning, applications, problems encountered and end result of the project.

PROBLEM DEFINITION

- Every year many animal lives are lost due to violent animal human interactions. The number of deaths due to these incidents can go up to 1,000,000 each year. These incidents mostly take place in the form of roadkill and animal attacks.
- Thieves target the convoy which carries the money from one bank to another. These thieves end up stopping the convoy and stealing the vehicles along with the money and other valuable items.
- Pets are one of the most precious things for their owners. One of the biggest fears of a pet owner is when their pet leaves the home on itself and wanders off and the owners are unable to find it. This type of incident occurs many more times than we would like to accept.
- Large valuable objects are always a target for thieves. These thieves always execute their plan when you are away from the aforementioned object. This causes huge monetary losses for the victims.
- Many accidents and crimes happen due to there being no real-time knowledge of the thing that gets involved in the accident and crime. This always results in huge monetary and sentimental damage to the victims.
- Jail breaks sadly happen to be a very common phenomenon. Dangerous criminals end up breaking out of their correction facilities. This endangers the lives of all the people who are exposed to the jail breakers and also it takes up a lot of time and resources in order to relocate these criminals.

OBJECTIVES

- To find the GPS coordinates i.e. the latitude and longitudinal values of the point/object of interest.
- To find the distance between the point of interest and the object/point of interest using their respective latitude and longitudinal values.
- To set up safe zone (circular in shape) around the point of interest till a certain distance.
- To send a warning to the user when the point/object of interest leaves the safe zone.
- To send a warning to the point of interest when it leaves the safe zone.

Methodology:

1.) GPS Module

The GPS module we used is ublox NEO 6M. The power requirement for this module is 2.7V – 3.6V. The module has an update rate of 5 Hz. While the accuracy of the module is 2.5m. The start up time of the module is 27 secs but due to weather effects and other weather changes this time might change.

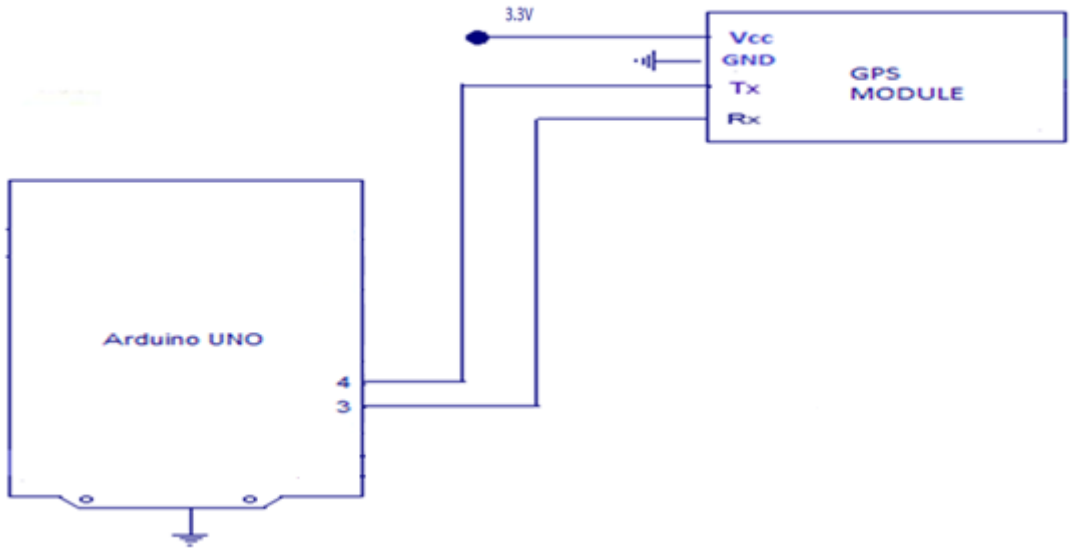
The antenna used with the module has a minimum gain of 15 dB and maximum gain of 50 dB. The baud rate required for the module is 9600.The operational limit of the module is that the altitude of the module should be less then 50000m and the velocity should be less then 500 m/s.

The module has 4 pins. The pins are Tx for transmission of data, Rx for receiving commands, Vcc for power input and GND is the ground pin.

In our project we are using the module to collect the latitude and longitude of the object carrying the module. The GPS module sends NMEA data to the Arduino which is decoded using the TinyGPS++ library.

Using the Software Serial library, we define the Tx and Rx pin the Arduino to which the Tx and Rx pins of the module need to be connected.

While declaring the pins in Arduino the order is (Rx,Tx).The circuit diagram for connecting the GPS module to Arduino ,



2.) GSM Module

The GSM module we used for our project is SIM900A. The 900 in the name signifies its working frequency that is 900 Hz or 1800 Hz. The power requirement for this module is 12V and 1A adapter. The module has three led which help us in finding if the module is working correctly. The baud rate can be varied between 9600 – 115200.

The first led is power which glows red when the dc power is given to the module. The second led is the status led which will glow blue if the power provided is sufficient for the working of the module. The third pin is the network led will blink green with the blink rate of 1 blink per second which means the module is searching for network. When the module is connected the network, we see the blink rate drops to 1 blink per 3 sec.

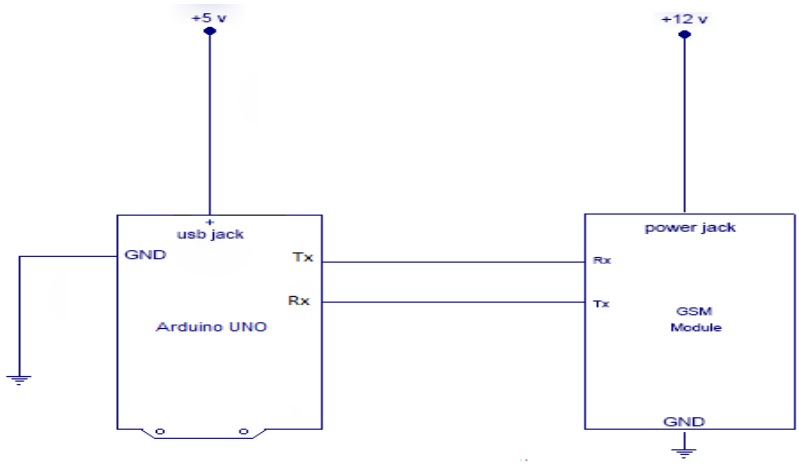
The antenna used with the module is a SMA antenna which stand for standard male antenna.

The module has 10 pins but for this project we only require 3 pins, namely Tx, Rx, GND.
The Tx pin is connected to the Rx pin of the Arduino and the Rx pin to Tx while GND to ground.
The Tx pin is connected to Rx of Arduino because Tx stand for transmission end and Rx for receiving end. So, when one transmits other should receive so Tx is connected to Rx and vice versa.

The work of the module in our project is to send a warning with the help of a SMS to a specified number when the object carrying the GPS module comes inside a specified range.

Using the AT command, we control the module. First, we take the module in text mode then we give the number to which the message needs to be send. After providing the phone number we provide the message statement.

The circuit diagram of only GSM module connected to Arduino is



3.) Libraries

Software serial library

The Arduino hardware has built-in support for serial communication on pins 0 and 1.
But two pins are not enough when we use many modules at once. To overcome this problem the SoftwareSerial library has been developed to allow serial communication on other digital pins of the Arduino, using software to replicate the functionality (hence the name "SoftwareSerial"). It is possible to have multiple software serial ports with speeds up to 115200 bps.

In our project we use a speed of 9600 bps because it is the defines baud rate for GPS and GSM modules.

TinyGps++

The library is developed by Mikal Hart. The library takes the NMEA data of the GPS module and shows the latitude and longitude of the module.
Using other features of the library we can calculate the distance and speed of the GPS module.

In the project we used the library to know the modules latitude and longitude and distance between the object the point of reference.

4.) Arduino

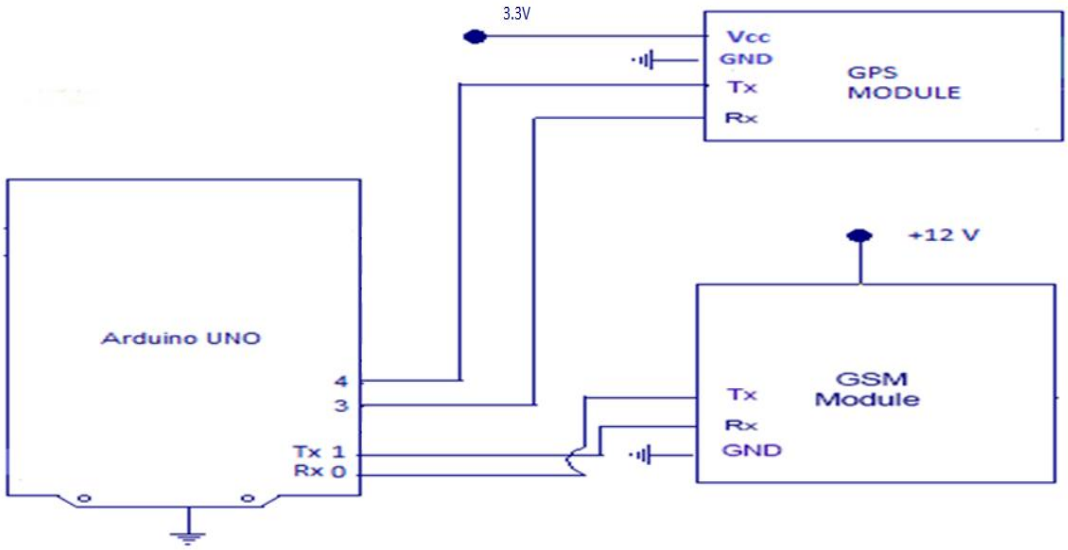
The Arduino uses ATmega328 microcontroller which requires a working voltage of 5V. But the input voltage can vary between 7V to 20V.There are 14 digital pins in Arduino and 6 Analog pins. There are two power ports, one of 5V other of 3.3V. It has 3 GND pins.

The Arduino is capable of collecting data and do some calculations using that data and give output has per the result of the function and conditions written in the code. The programming for Arduino is done in Arduino IDE which is a free software.

In our project the Arduino to collect the GPS data and calculate distance between the object and point of reference and if the distance is less then a specified value it sends the command to GSM module to send a warning message to user. The library used are software serial library and TinyGPS++.

We used 4 digital pins and 1 GND pin and 3.3V power pin.

The final circuit diagram for the project is


3.3V
Vcc
GND
Tx
Rx
GPS
MODULE
+12 V
Arduino UNO
4
3
Tx 1
Rx 0
GSM
Module
Tx
Rx
GND

Conclusion and Future Scope:

In conclusion we see that using PS we can measure how far an animal or vehicle from a constant reference point is and this data helps us in setting up a system that can warn the presence of animals near a road, villages or any point of interest. It can be also used in wildlife conservation.

This system will also help us in monitoring vehicles which carry valuable goods such as money, important official paper etc. It can also be used in monitoring pet animals by making a radius around the reference point so if the pet animals go out of that radius alarm can be sounded off. It can be also be used in jails to ensure that no prisoner goes out of the jail.

This device can be used anywhere where there is need of tracking system and the object that is been tracked need to follow a specified path or need in a specified region.

This device is a great for bioreserves where endangered or vulnerable species need to be continuously monitored. This can be achieved by setting up the reference point as the latitude ang longitude of the boundary of the fence.

Through our project we showed that how the GPS data and different alarm system can be integrated and used at once using Arduino Uno and minimum cost.

This project helped us in learning different about how new library are included in Arduino IDE, analysis NEMA data and sending SMS and displaying data over an LCD screen using Arduino.

The device is only in its prototype form at present. In the future we will be aiming at reducing the power consumption of the device along with decreasing the start-up time drastically in order to make it more efficient. Another improvement which we will be aiming at is to make both the reference and the point/object of interest movable.

By making such improvements we will be increasing the number of applications for our device by a great margin. It will then be used in prisons, on pets and also precious and valuable items.

Result and Discussions:

The result of this project is that we were able to integrate different modules at once. We were able to set up an alarm system that could alarm the person of interest if the animal or vehicle goes out the specifies region around the point of reference point.

All the objectives of the project were met.

Using TinyGps library we were able to abstract the NMEA data of the GPS module and use the data to calculate the distance between the point of interest.

Using the GSM module, we were able to send SMS when the object of interest was outside the region of interest.

Using the LCD module, we were able to display the warning message to the object in concern in cases of vehicle tracking and jail security system.

The objectives with which we began our project were accomplished. We were successful in creating a device which created a safe zone around the reference point. The device was also successful in alerting the user when the point/object of interest left or entered the safe zone.

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Code:

```
#include <SoftwareSerial.h>
#include <TinyGPS++.h>
TinyGPSPlus gps;
SoftwareSerial ss(9,8) ;                    //RT

void setup()
 {
   Serial.begin(9600);
   ss.begin(9600);
}

void loop() {
 while (ss.available() > 0)
  gps.encode(ss.read());
  Serial.print("LAT=");
  Serial.println(gps.location.lat(), 6);
  Serial.print("LONG=");
  Serial.println(gps.location.lng(), 6);
const double OBJ_LAT = 18.5204;  //latitude of point of reference
const double OBJ_LNG = 73.8567; //longitude of point of reference
double distanceKm = TinyGPSPlus::distanceBetween( gps.location.lat(),
gps.location.lng(),OBJ_LAT,OBJ_LNG) / 1000.0;
if(distanceKm <1)  //distance in Km
{
  Serial.print("AT+CMGF=1\r\n");   //textmode entered
  delay(5000);
  Serial.print("AT + CMGS = \"");
  Serial.print("+91*********") ;    //Enter the Number you want to send message on
```

```
  Serial.print("\"\r\n");
  delay(2000);
  Serial.print("DANGER");
  Serial.write(0x1A);
  Serial.println("DANGER")
}
}
```