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A System for Distance Control and GPS Mapping for Automotive Applications

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***Abstract*— In our study, it is presented an anti-theft vehicle system that has a Global Positioning System (GPS), that alerts the user with messages via (or through) mobile network. In order to succeed it, there were used several systems and materials such as the Arduino mega, an accelerator sensor, the GPS system, a SIM card device, an RFID system and a back-up battery. Our device empowers by the vehicle and rechargeable lithium battery, in order to achieve autonomy for a brief period of time. The user shall be able to activate and deactivate the system with the use of an electronic RFID in any case. Furthermore, the system will alert the user the moment the vehicle receives a power, by sending the coordinates in the geographic map. Finally, it is going to have the ability to inform and alert about the situation of the system function by providing further information.)**

Keywords—Alarm system; RFID; GPS; Arduino

I. INTRODUCTION

1) What is an alarm system

An alarm system is a series of electronic sensors and instruments that, with the help of a processor, it has the ability to communicate with each other by transmitting the corresponding messages. Depending on the sensor to be used, it has the ability to record, see and feel various stimuli from the environment and it informs us of anything that one wants to protect. The processor is basically a central signal control unit that processes and gives us the corresponding results-outputs such as an audio or visual indication or data. In this way, protection is achieved through the immediate notification of a violation of a site or object for immediate intervention.

2) Application examples

The alarm is divided into two types which it is depending on the connection that exists:

- The wiring where a specialist installs the necessary circuit with cables.
- Wireless that does not require any kind of wiring and it can be installed by anyone.

The use of an alarm system divided into the following categories:

- a house
- a factory
- a store
- a car
- a motorcycle
- a bike
- an open area

The price of the alarm system is depending on the categories which they have various factors such as the demand, the brand, the service ability and the installation difficulty. An alarm system can be used to secure or to inform currently the owner of an object. A house with an alarm system may have internal and external sirens, magnetic contacts for doors and windows, motion detectors and vibration sensors. It also divides the area into zones, informing the owner on his telephone or any other means with as much information as possible. In the case of a business, an alarm system may have additional sensors like the smoke the gas, the flood, the humidity, the seismic and photoelectric sensors. It may also be connected to security cameras, recording systems, and in any breach the occupant will be informed by the company providing the security system and the police.

II. THE ALARM SYSTEM ON THE VEHICLES

This system can be used in any type of vehicle. A vibration detection sensor is usually installed by activating the alert system when an attempt is made to breach the vehicle when the expected thief attempts to enter or lift it up. A simple alarm system may have a simple such sensor and a sensor for audible alert, as shown below.

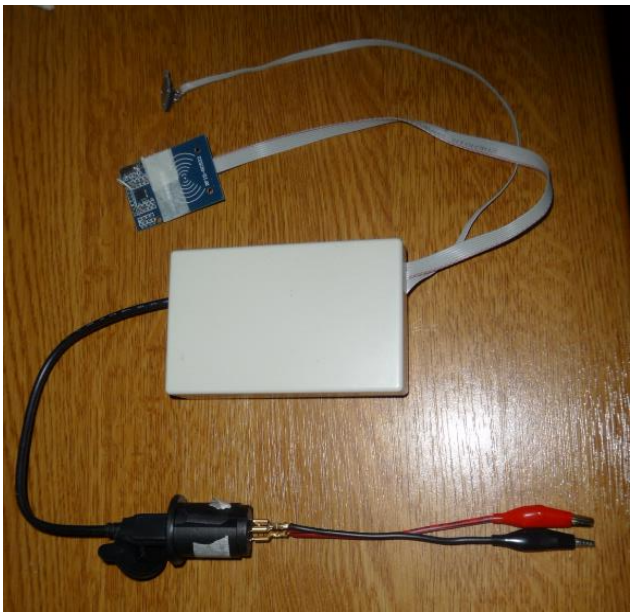

Fig. 1. Final edition of the alarm system

A more complete vehicle alarm system may have more than one vibration sensor. For example, it can be combined with a GPS system, a SIM card using data for conveying information such as vehicle position and speed. In some cases, video and audio can be transmitted from special cameras inside and outside of it, with independent power supplies for the system, without being based on the vehicle's main power source. Still, the user may be able to intervene remotely by parameterizing vehicle functions or by switching off the engine. Many of the alarm systems now have applications for smartphones and other devices, providing more and more information to the user in a very short space of time.

III. PROJECT'S ACCESSORIES

a) Microcontroller ATmega2560

Fig. 2. Microcontroller ATmega2560

b) USB adapter (with case)

Fig. 3. USB adapter with case

c) Accelerometer MPU6050

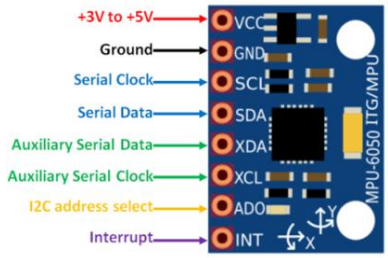

Fig. 4. Accelorometer MPU6050

d) Arduino GSM Shield V2

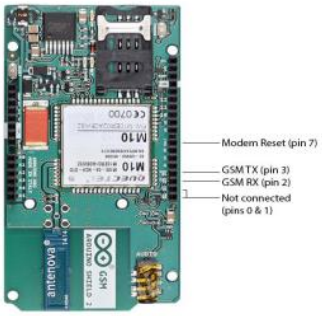

Fig. 5. Arduino GSM Shield V2

e) RFID MFRC-522

Fig. 6. RFID MFRC-522

f) NEO-6M GPS Module

Fig. 7. GPS Module

g) Battery Charger FC-75

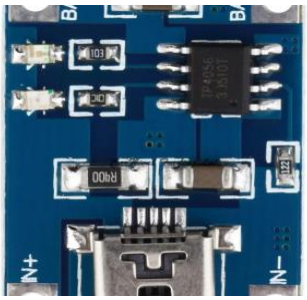

Fig. 8. FC-75 battery charger

h) Lithium battery

Fig. 9. Lithium battery

i) Vehicle's battery

Fig. 10. Vehicle's battery

IV. THE ELECTRONIC CIRCUIT

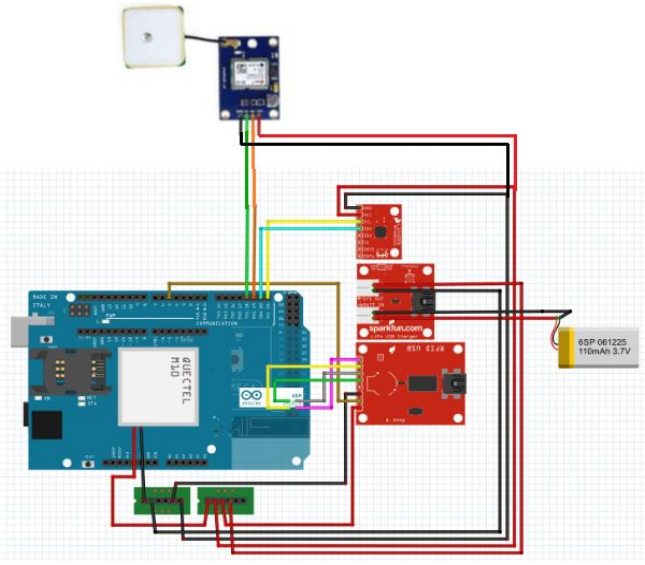

Fig. 11. Alarm system's electronic circuit

A. System description

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, 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 3.7V to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

The Mega 2560 is an update to the Arduino Mega, which it replaces. It can communicate with the RFID MFRC-522 and when an appropriate RFID card will pass the access then the Arduino will give order to activate the communication of components. These components are the Accelerometer MPU6050, the NEO-6M GPS Module and Arduino GSM Shield V2.

The first one is responsible to understand a little movement from the vehicle. When someone will breach it then the NEO-6M GPS Module will send the location to Arduino.

After that the Arduino will communicate serially with the Arduino GSM Shield V2 and then the owner of the vehicle will receive a message. The message can contain the location of the vehicle and a message that the owner can define. If the owner wants to turn off the alarm system, then he will put the other one specific RFID card. Also the owner can know if the system is turn on or turn off because of he will receive the suitable message.

B. Flowchart diagram

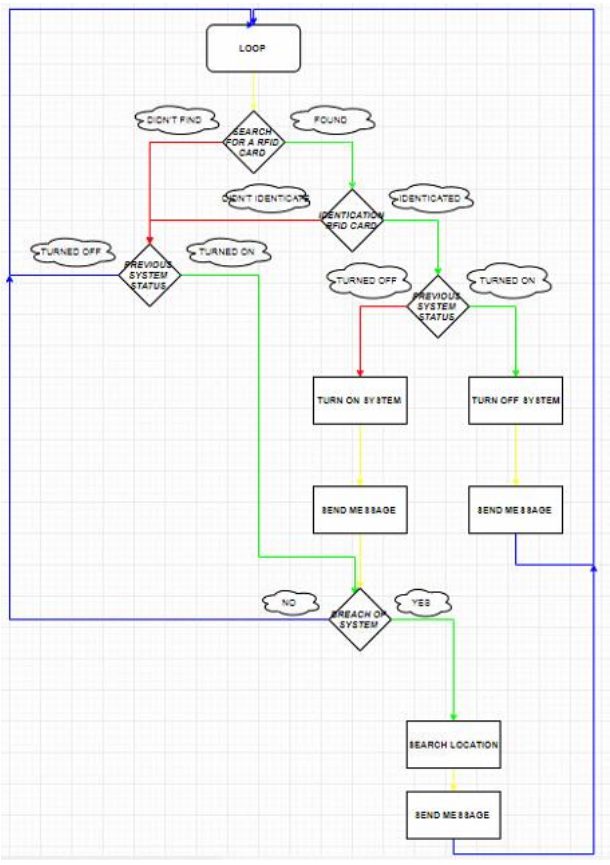

Fig. 12. Alarm system's flowchart diagram

C. Function

```
//-----------------Coordinate search function --------------------
void gpsdump(TinyGPS &gps)
{

//-----------------If someone breach the vehicle ----------------
if (mp==1){
  xx=x;
  yy=y;
  zz=z;
//------------------Find of coordinates GPS----------------------
  long lat, lon; float flat, flon;
  unsigned long age, date, time, chars;int year;
  byte month, day, hour, minute, second, hundredths;
  unsigned short sentences, failed;
  gps.get_position(&lat, &lon, &age);
  String content;content="#";content+="+";
  content+=(lat);content+="+";content+="~";
  String lat1,lat2,north;
  lat1=(content.substring(2,4));
  lat2=(content.substring(4,10));
  north=String(lat1 + "." + lat2);
  String lon1,lon2,east;
  content="#";content+="+";content+=(lon);
  content+="+"; content+="~";
  lon1=(content.substring(2,4));
  lon2=(content.substring(4,10));
  east=String(lon1 + "." + lon2);
  String location;
  location=String("https://www.google.gr/maps/place/" +
north + "," + east + "//K3G ALERT\\");
  Serial.println(location);
  cell.begin(9600);
  cell.Verbose(true);
  cell.Boot();
  cell.FwdSMS2Serial();
  cell.Rcpt("+30**********");
  char kk[location.length()] ;
  location.toCharArray(kk,location.length()+1);
  cell.Message(kk);
  cell.SendSMS();
  }mp=0;
}
```

D. Observations

During the experiments, the accelerometer takes some values after a period of repetitions. A certain condition was added to avoid any errors.

Commenting on code:

The first lines code calls the libraries needed for programming to work with their help. Each electronic component was then adjusted with the appropriate parameters. For the operation of the code and activation of the respective communications it was necessary to define the necessary initial conditions.

In the main part of the code, the first step is to check if any of the selected RFID identities has been identified. Depending on the identity, reinforcement and disarming of the system is made and the corresponding message is sent. If the system is armed and the vehicle receives some force it perceives it as a violation and sends a corresponding message with its coordinates. The above procedure is repeated continually.

V. Conclution

In this work the alarm system can be performed with absolute success. Each component of the circuit was carefully studied and each program value was checked. Their combination managed to bring the desired result where it was intended to send a message, to any violation in the vehicle, to inform its owner.

VI. Future upgrade

The alarm system is a circuit that can be adapted to the needs of the person concerned. Therefore, it may include elements such as the audible display and some kind of illumination for both the operating mode of the system and the indication of a violation. Also, equipment used in addition to simple messages can make voice calls to the system owner or even provide live information such as location, speed, even video from cameras inside and outside the vehicle.

An alternative supply could be to connect the alarm to the vehicle's main switch or a cable associated with the ignition on the engine so that when the system is armed it is not possible to start the vehicle. System activation and deactivation can also be done via messages or calls from the user's personal phone.

Finally, a breach update could be done by combining (like message and email at the same time) with more than one person, at the same time informing the security officer or the police.

VII. Acknowledgements

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