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Car Tracking System Based on GPS and Image Transmission

Hazim Faisal Abdelwahid Elsayed [1], Ting Chek Ming[2]

Electronic Division, Faculty of Engineering,
Universiti Selangor, Bestari Jaya Campus, Bestari Jaya, Selangor Darul Ehsan, Malaysia

eng.hazimfaisalabdelwahid@gmail.com, cmtingsteffi@yahoo.com

Abstract At present days, the tracking systems in cars, together with the navigation systems, is one of the most robust businesses in car industries. This project will track the location of the car by using a GPS together with images transmitted to receivers. The purpose of the project is to solve stolen cars issues: by designing car tracking system based on GPS and images received through email. A comparison would be made between images captured before the car is stolen and after the car is stolen, to detect the image differences. The images would be received through emails. The tracking and navigation systems would be able to give the exact location of the car and the image of the person who is taking the car away. This will allow car owners to monitor their cars; it will also help the police to make judgments on car theft and penalize culprits.

1. Introduction

Car tracking systems are commonly used by fleet operators for fleet managements such as fleet tracking, routing, dispatching, on-board and security information. Similar to commercial fleet operators, urban transit agencies use this technology in several areas, including monitoring bus services that could make changes in buses destination pre-recorded messages for passengers.

Nowadays, most of the vehicles, namely, saloon cars, ambulances, police cars, etc. are equipped with GPS systems in developed countries. Known by many names such as the location of GPS Automatic Car Locating System (ACLS), Car Tracking and Information System (CTIS), Mobile Asset Management System (MAMS), these systems can be integrated to provide a more effective way of tracking the cars.

Car tracking systems is an integrated part of the "layered approach" to car protection systems. It is very important and recommended by the National Insurance Crime Bureau (NICB) to prevent motor car theft. This approach recommends four layers of security based on the risk factors related to a specific car. Car Tracking Systems is one of those layers, and is described by the NICB as “very effective” in helping police to find the stolen cars. Some car tracking systems integrate several security systems, for example by sending an automatic alert to a phone if an alarm is triggered, or the car is moved without authorization from the owners, and when it leaves or enters a geofence [2004].

Car tracking systems based on GPS system and the transmission of image through (email and FACEBOOK) is not so popular in consumer cars as a theft

prevention and retrieval device. But a lot of the people are on social media networks, therefore, it is effective to get the information across so that many people can help to locate the vehicle if helps are required. Moreover, social media networks are free. Police can easily track the tracking system's signals and locate the stolen car. When used as a security system, a Car Tracking System based on GPS system and the image through email and FACEBOOK could be used. And it also helps to control the car remotely, including lock up the doors or turning off engines in case of emergency. The existence of car tracking device has caused a high reduction in car insurance, because the risk of losing the car drops significantly [2004].

The block diagram shown in figure 1 below gives an accurate description of the different stages involved for achieving the real time car tracking system based on GPS.

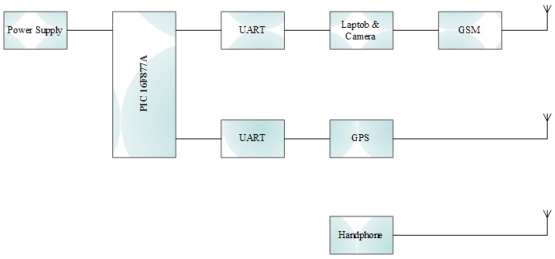

Figure 1: Block Diagram of the proposed system

2. Hardware Design

This study begins with the circuit design, follows by troubleshooting the circuits, and then verifying all the components are putted together correctly. Then the circuit will be printed and the soldering will take place to fix the components onto the PCB boards. After that the PIC is programmed to get the objectives. All the systems will go through a testing phase to obtain the results listed in the objectives. Below is a flow chart (Figure 2) that describes each phase and the methodology of accomplishing the desired objectives.

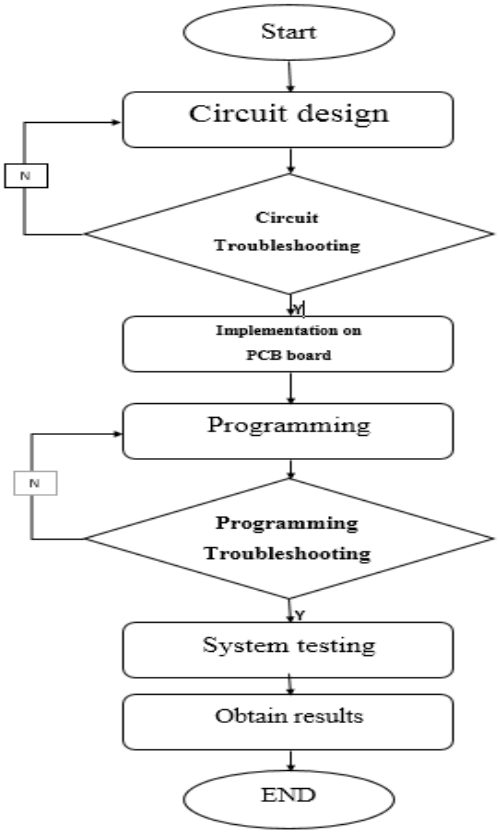

Figure 2: Overall methodology flow chart

Phase Control Circuit

Phase Control Circuit is considered as the most important circuit in this system. This circuit consists of the PIC Microcontroller (16F877A), Regulated power supply, LED indicator, GPS module, GSM modem, RS232 cable, camera and laptop. In the transmitter section, a PIC16F877A microcontroller is chosen to be used as the control system of the GPS and GSM modem as the power consumption is low (wide operating voltage range from 2.0 to 5.5V).

This car tracking system comprises a GPS-GSM module, and a base station to be known as the control center. Car tracking system is designed using sensors that are hidden in the car. If there is detection of any door being broken, it will automatically activate the security system of the car, by sending an SMS to the hand phone and also sending the picture to the email, including the time of the camera detection, the latitude and longitude of the car position. In order to track the car, the GPS receives signals from satellites, calculate the location and sends it to the GSM module, then to the owner's phone.

Design of Interfacing

Most PC's has 9 pin sockets on each side of computer. Recommended standard 232 converts data flowing from parallel to serial and changes the electrical representation of the data. The PC connector has a female pin, therefore the connected cable should have a male pin connector in order to terminate the DB9 (serial poet) and contrariwise.

Principle of Operation

The hand clap circuit is used as a switch to turn on and off the system, to establish the communication between the PC and the microcontroller, with the MAX232 chip serving as the interface. MAX232 converts parallel data (bytes) received from the Serial port (DB9) RS232 to serial bits stream because most digital devices require TTL or CMOS logic levels. From figure 3 it is seen that the output pin 10 of the CMOS or TTL is fed to pin 25 of the PIC16F877A and the output of pin 18 of the PIC16F877A is fed to CMOS or TTL. Hence, this is how the microcontroller communicates with the MAX232 IC.

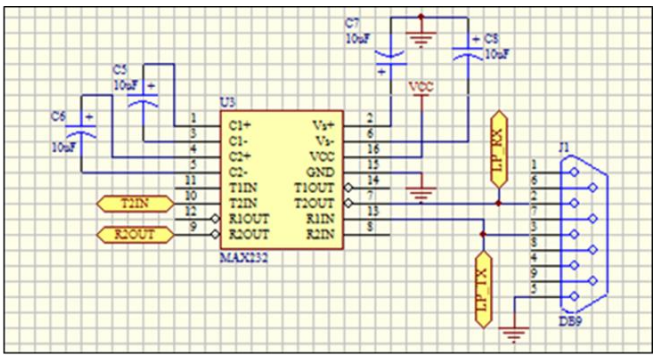

Figure 3: Interfacing MAX 232 with Serial DB9

Note 1:

1) The voltage levels for RS232 serial port are 0 and 5 volts.
2) The MAX232 is used to interface PIC16fF877A and the modem of the computer.

Electrical and Electronic Design

The design of the circuits and its implementation includes troubleshooting and testing, along with the explanation of the principle of working. The program used to design the circuits in this thesis is portal software. Table 1 indicates the RS232 Line Type and Logic Level.

RS232 Line Type and Logic Level	RS232 VOLTAGE	TTL VOLTAGE TO MAX232
Data Transmission (RX/TX) Logic 0	+3V To+15V	0V
Data transmission (RX/TX) Logic 1	-3V To-15V	5V
Control Signals (RTS/CTS/DTR) Logic 0	-3V To-15V	5V
Control Signals (RTS/CTS/DTR) Logic 1	+3V To+15V	0V

Table 1

Programming flow

The memory size of the PIC microcontroller is 4kb. C programming language was used for the programming of the circuit. The programming codes follow the NMEA standards.

Note 2:
The NMEA defines the electrical interface and the data protocol for communications between the marine instrumentation and the global satellite and other standards.

3. Results and Discussion

The results indicated that we had problems sending images using FACEBOOK, one of the most popular social websites. Therefore only Yahoo and Gmail are used. In this project, we were having difficulties in using both the external camera (web camera) and the internal camera (PCs camera). The software crashes until the computer system is rebooted. Therefore we can conclude that there is no 100% compatibility between the camera and the computer.

The Google Map

If the hand phone message received from the GSM alert having GPS readings: Latitude: 325.2071, N and Longitude: 10126.2802, E; we can look up the location on the Google Map.

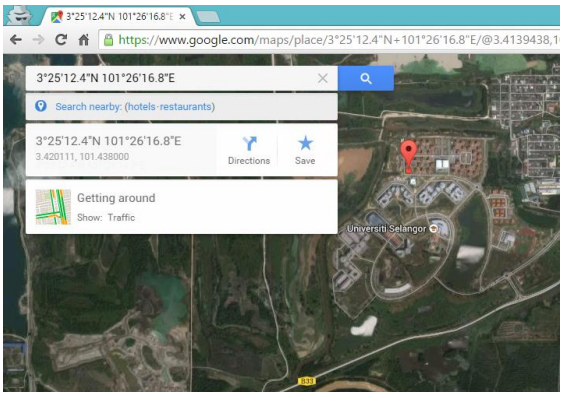

Figure 4: The Google map

Image Capture

This section explains the intensity classification of an image. The image histogram equalization (graphical representation of pixel) is used to stretch the pixels in the digital image and the median filter (Both in MATLAB functions) is used to remove the noise in a digital image sample. Image editors in MATLAB are used to recreate the image being modelled.

Figure 5, figure 6, and figure 7 show the email message received (YAHOO & GMAIL) from the transceiver module in the car that contains the transmitted image including the GPS location. The image transmitted is the replica of the image snapped from the camera source.

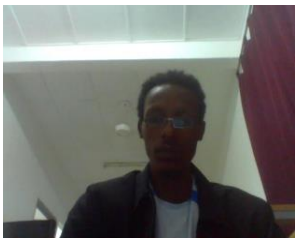

Figure 5: Original image

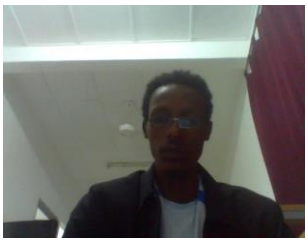

Figure 6: Received Image via Yahoo

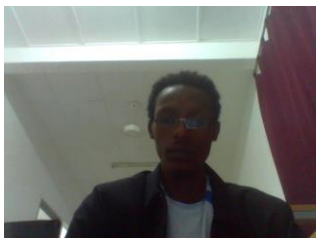

Figure7: Received Image via Gmail

The images obtained from Yahoo and Gmail will be tested and analyzed, and they will be compared to the original image, to see if there are any differences. The images are 640 by 480 pixels.

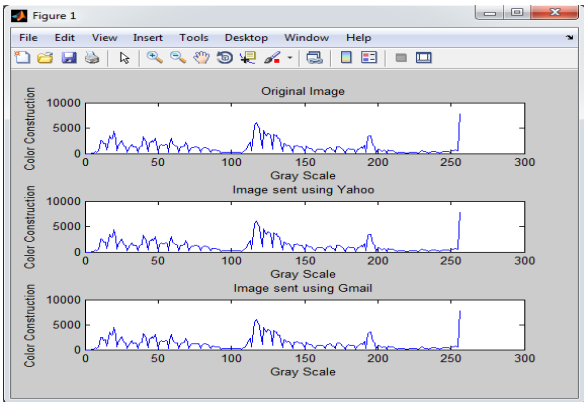

Figure 8: Show the result of combined images

The top right image in figure 9 is obtained by the histogram equalization method and the resultant image is brighter.

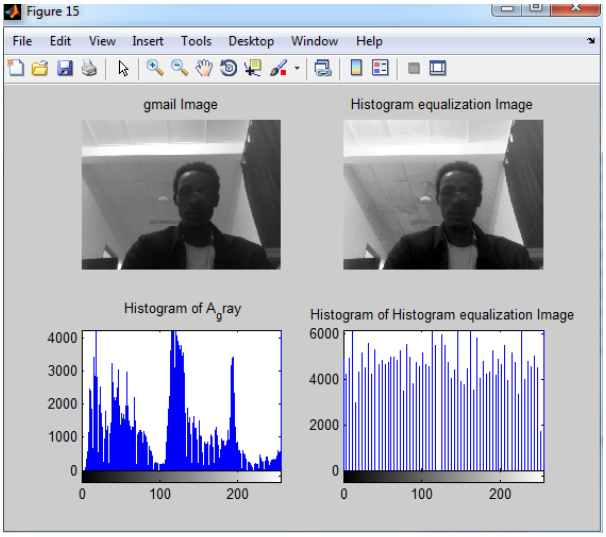

Figure 9: Histogram Equalization

The images in Figure 10 are obtained by applying the median filter. First the image is added with noise (salt and paper). It is achieved by using the commands (imnoise ('salt & pepper', 0.02)) in the MATLAB. Then for the enhancement of the image, the function (medfilt2 RGB,[5,5])) is activated. In median filtering, the value of the resultant element is set by the median of the adjacent pixels.

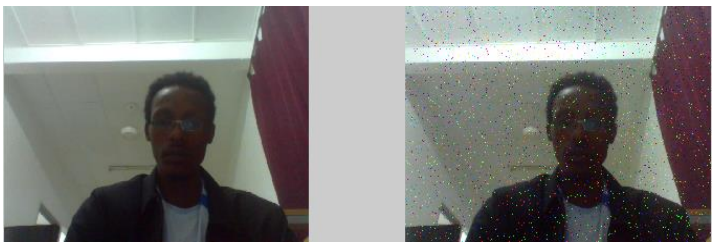

Figure 10: Shows image with Salt & Pepper noise

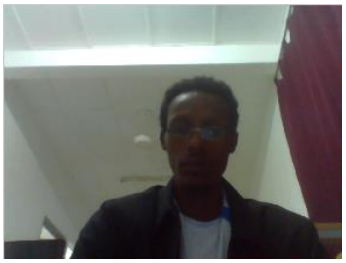

Figure 11: Image after enhancement

4. Discussion

The car tracking system based on GPS system is designed to function under GSM network. With GSM network encryptions, it is almost impossible to detect the systems phone number using frequency scanners. The system will be able to give the exact location of the car and the image of the person who is taking the car away. IC sockets were used in the system design to ensure that the components are easily replaced if they malfunction and also for upgrading of the component if needed. Also, the system can be reprogrammed by the user to change phone numbers and email addresses.

5. Conclusion

The goal of this project is to design a real time car tracking system based on GPS system, using PIC microcontroller. The project is strictly concerned with wireless communication; GPS tracking of vehicles based on real time image transmission via the email.

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