VEHICLE MONITORING SYSTEM

Project Proposal

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Team #35

Introduction

Our project, "Vehicle Monitoring System," is an addition to traditional car alarms that will increase users' situational awareness of vehicle security threats via the real-time transmission of on-site images. We believe that many consumers would prefer to visually judge their vehicle's safety during times of crisis rather than rely purely upon traditional alarms or the alerts of next-generation systems. Our system provides users with this ability and represents the next stage in evolution of automobile security systems. Additionally, we feel that this product has the potential to quickly gain a niche market share in the vehicle security space.

Existing Technology

Traditional car alarm systems are ineffective and inefficient due to the frequency with which they sound, providing little protection nor security to vehicle owners. This has resulted in the proliferation of "next-generation" car alarm systems. State-of-the-art vehicle security systems, such as the Viper 3303 or Python 991, offer real-time threat alerts and two-way communication. Threat alerts are transmitted to a remote or a smartphone and displayed via a "car security dashboard". These alerts consist of a combination of text and audio and provide detailed information regarding the security incursion. Additionally, we found one product capable of transmitting a low-resolution image of the vehicle to the user (ScyTek's Vision Guard 8000, which is no longer supported by the company); however, this system is range-limited and of questionable quality. The two-way communication that many of these devices support permits the user to remotely start the engine, disarm the system, and turn on the lights. Other recent car alarm innovations include cabin strobe lights, local video recording, and synthetic graphical car representations.

Objectives

Our primary goal is to improve user situational awareness during vehicle security threats. A cabin-mounted camera will be triggered to capture images when a threat is detected (via the existing car alarm system). These images will be processed by the microcontroller and sent to the user's smartphone via GSM/GPRS networks. The user will be able to visually judge the situation and take action. Another goal of ours is to permit the user to remotely control the system using SMS. After a security alert, the user will be able to send commands to the microcontroller to deactivating the car alarm or capture additional images. Additionally, we would like to permit the user to capture images even when a security threat has not been detected. We believe that these systems are most valuable when the user is far away from his/her vehicle; therefore, we will implement long-range wireless transmission/alert access.

Benefits

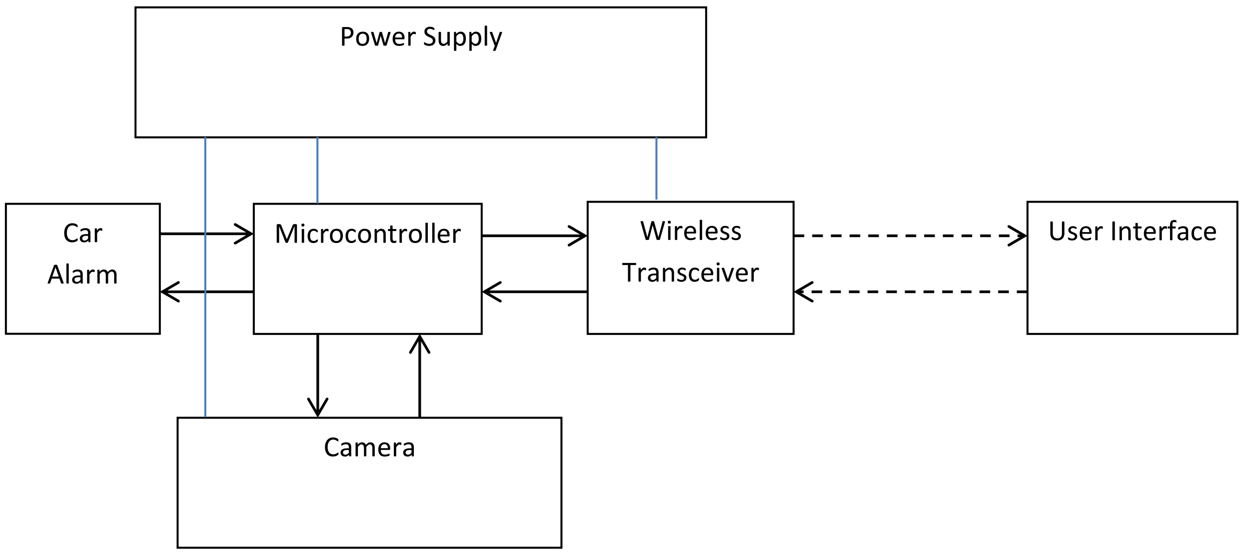
- Increased vehicle situational awareness during automobile security threats
- Improved wireless transmission to user device – no remote required and unlimited range
- Supports both on-command and automated image capture abilities

Features

- Access to GSM/GPRS wireless networks
- Real-time wireless transmission of images to users
- System control using SMS commands
- Mountable low-resolution CMOS camera for customized vehicle image

Design

Block Diagram



Block Descriptions

Car Alarm

Car Alarms typically have a wide array of sensors such as microphones, pressure sensors, mercury tilt/shock sensors, and door sensors that keep track of the environment in and around the car to detect intrusion. When the sensor detect something happening they send that signal to a microcontroller that determines whether or not a threshold has been surpassed and then the controller will turn on the alarm of the car through a siren and activate the interior and exterior lights.

We would implement our system in between the siren and the controller to stop the alarm from going off without just cause. Once the alarm is trigger the control unit will send a signal to the siren. This signal will be intercepted and then processed by our microcontroller and will be sent to the siren if the user determines there is a threat.

Camera

A cabin-mounted CMOS camera will be used for image capture. It will be low-resolution (640x480) and will potentially implement JPEG compression. It will be interfaced with and controlled by the microcontroller. These devices will likely communicate using either a RS232 or I2C interface.

Microcontroller

We will be using a microcontroller that is capable of supporting interfacing with two devices simultaneously (for interfacing with both the CMOS camera and wireless module). The memory demands will be driven by the CMOS camera; we will likely need as much on-board memory as possible to store and transmit RGB images. This device will also respond to and implement user SMS commands. We are considering using either an Arduino or PIC32 device.

Wireless Transceiver

This will provide our system the ability to send images to the user and respond to SMS commands. There are two ways that we can do this and meet our long-range wireless transmission requirements:

1) Connect the microcontroller to the GSM/GPRS networks using a module such as the SIM900.

   This will provide us with the largest coverage and allow us to easily implement SMS system control; however, a SIM card is required and the data transmission may be costly.

2) Make use of integrated WiFi chipsets in vehicles to upload pictures to an FTP server.

   This would be an inexpensive option; however, there may be a significant time-delay between car alarm activation and the car gaining WiFi connectivity. Additionally, this would limit the ability our ability to implement on-command image capture.

After reviewing these options, we have tentatively chosen to attempt to use GSM/GPRS networks due to the SMS support and coverage.

Performance Requirements

- Transmit photo of at least 200 kB to user's smartphone and be able to receive SMS commands back from the user.
- Have user receive alert within 5 minutes of security incursion (based upon the bottleneck of sending and receiving data over cellular networks).
- Make the system affordable by being under $300.
- Make the system user-friendly and easy-to-install by using less than 10 inputs and outputs.

Verification

Testing Procedure

- We need to simulate a real car alarm signal input and test that the microcontroller will recognize that it needs to act upon it.
- We need to have the microcontroller take in a picture command where it will communicate with the camera by telling it to take a picture and testing that it stores the picture the camera sends back.
- We need to make sure that the microcontroller will communicate with the wireless chipset. Test that it can send and receive SMS and MMS messages to a phone over a network.
- We need to have the microcontroller send the car alarm signal input through to the audible alarm part of the system. Test that the signal is sent through correctly.
- We need to test the standby functionality of the system making sure it stays within maximum power consumption requirements to make sure it does not drain the battery of the car.
- We need to test the battery backup system that we implement to keep the system running even if the battery is disconnected.
- We need to test the system as a whole so that once the car alarm is activated and the picture is sent the audible alarm will sound once the user sends the SMS command.

Tolerance Analysis

The system needs to be able to work with low power consumption while providing high reliability and fast response time. The microcontroller must manage efficiently the turning on and off of the wireless communication when not needed to save power. The system also needs to be able to run off of battery back-up in case the battery is unplugged by the thief. We will test the time required for the microcontroller to accomplish both easy and difficult tasks under varied supply voltages to determine the effect on performance.

Cost and Schedule

Cost Analysis

Cost of labor

40 $/hr x 20 hrs/week x (2.5) x 13 weeks = $26,000 per person

$26,000/person x 2 people = $52,000 labor cost

Cost of components

Part	**#**	**Cost per part**	**Total**
Microprocessor	1	$20	$20
Camera	1	$15	$15
GSM/GPRS Module	1	$50	$50
Prepaid SIM Card (2MB)	3	$12	$36
Back up battery	1	$5	$5
PCB or bread board	1	$10	$10
Box for project	1	$10	$10
Misc. Circuit components	20	$ .5	$10

Grand total for components = $156

Total cost

$52,000 labor + $156 parts = $52,156

Schedule

Week #	Dates	Chris Blount	Mike Jermann
1	2/6	Research for proposal	Research for proposal
2	2/13	Research and design camera interface with microcontroller.	Research and design wireless interface with microcontroller.
3	2/20	Complete design review and order parts for camera.	Complete design review and order parts for wireless interface.
4	2/27	Build the circuit for the camera .	Build the circuit for the wireless interface.
5	3/5	Build the circuit for the camera and debug.	Build the circuit for the wireless interface and debug.
6	3/12	Begin testing of picture storage in the microcontroller.	Begin testing of MMS sending and SMS receiving in the microcontroller.
7	3/19	(Spring break) Put project pieces together.	(Spring break) Put project pieces together.
8	3/26	Test full project functionality and do mock demo.	Test full project functionality and do mock demo.
9	4/2	Debug full project together and continue testing.	Debug full project together and continue testing.

10	4/9	Continue full project debug and testing. Show concept functionality in demo car.	Continue full project debug and testing. Show concept functionality in demo car.
11	4/16	Start writing the final paper and making the slides for the presentation. Check project for full functionality.	Start writing the final paper and making the slides for the presentation. Check project for full functionality.
12	4/23	Demo the project and continue the writing process. Finish and practice final presentation.	Demo the project and continue the writing process. Finish and practice final presentation.
13	4/30	Do final presentation and turn in final paper.	Do final presentation and turn in final paper.