PROJECT 01

MOBISAFE

HCI 6750 | Fall 2010 | Professor Bruce Walker

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I. system overview and why it is needed

UNSAFE PLACES are everywhere, whether they are truly dangerous, or simply perceived by the user as treacherous. We aim to tackle the issue of safety and enhance awareness of the surroundings when approaching personal transportation vehicles (automobiles). Through feedback obtained by a survey of 53 car owners, we have determined that users generally feel unsafe when they are alone in environments with inadequate lighting and low visibility. Being alone in a potentially life-threatening situation generally causes increased anxiety, leading to a less efficient and even problematic fight-or-flight response. With our product, we hope to reduce anxiety of car users by giving them easier access to information about the status of their vehicle and surroundings, especially while they are away from the vehicle or on the way to retrieve their vehicle from a parking lot.

Risk means different things to different people. Slovic (1987) argues that public perceptions of risk are shaped by the "dread" factor of the event (whether it is uncontrollable, consequential, fatal, involuntary, not equitable, etc.) and by the severity of "unknown" characteristics (unobservable, delayed manifestation of harm).[1] While local authorities may judge how dangerous their neighborhoods are based on expected annual statistics of hazards, perception of safety by public may be influenced by a single horrifying case. One crime case is enough to make city/neighborhood/campus residents feel unsafe. These social patterns are reflected in our survey responses. A dimly light environment increases the "unknown" factor and being alone increases the "dread" factor (increases the possibility of fatal consequences since no one can save you).

Parking lots are a typical haunt for criminals. The most common crime in parking lots in metropolitan areas is theft and vandalism, but violent crimes such as robbery, carjacking and abductions can also occur (see, http://www.crimedoctor.com). Parking lot robbers are usually "opportunists" who are on the look for "easy" victims in settings that allow them to get away:

> They cowardly prey on older persons and women most often and prefer to attack them away from witnesses or security officers. These predators like to hang out in the parking lot looking for potential victims. They will pretend to talk on a telephone or watch from inside a car. They will try to get close to their intended victim before they strike. Most victims have said that they never saw the robber approach. (http://www.crimedoctor.com/parking.htm, Sept 21, 2010).

Young women represent a vulnerable population that could make use of additional safety and security technologies. About 8% of cases of rape occur in parking garages (http://www.oneinfourusa.org/statistics.php, Sept 21, 2010). One study of forcible rapes reported that out of 22% of outdoor assault about 9% were on road/street, about 5% were in parking lots and another 5% were in vacant lots (Footnote: Alaska Justice Forum, vol 20 (4), winter 2004), available http://justice.uaa.alaska.edu/forum/20/4winter2004/a_rapes.html, Sept 21, 2010). The same study reported that the assaults occurred mostly in urban centers on weekends, with criminals typically targeting young people. The national statistics reports the rate of about 35 incidences of sexual harassment per 1,000 women in universities.

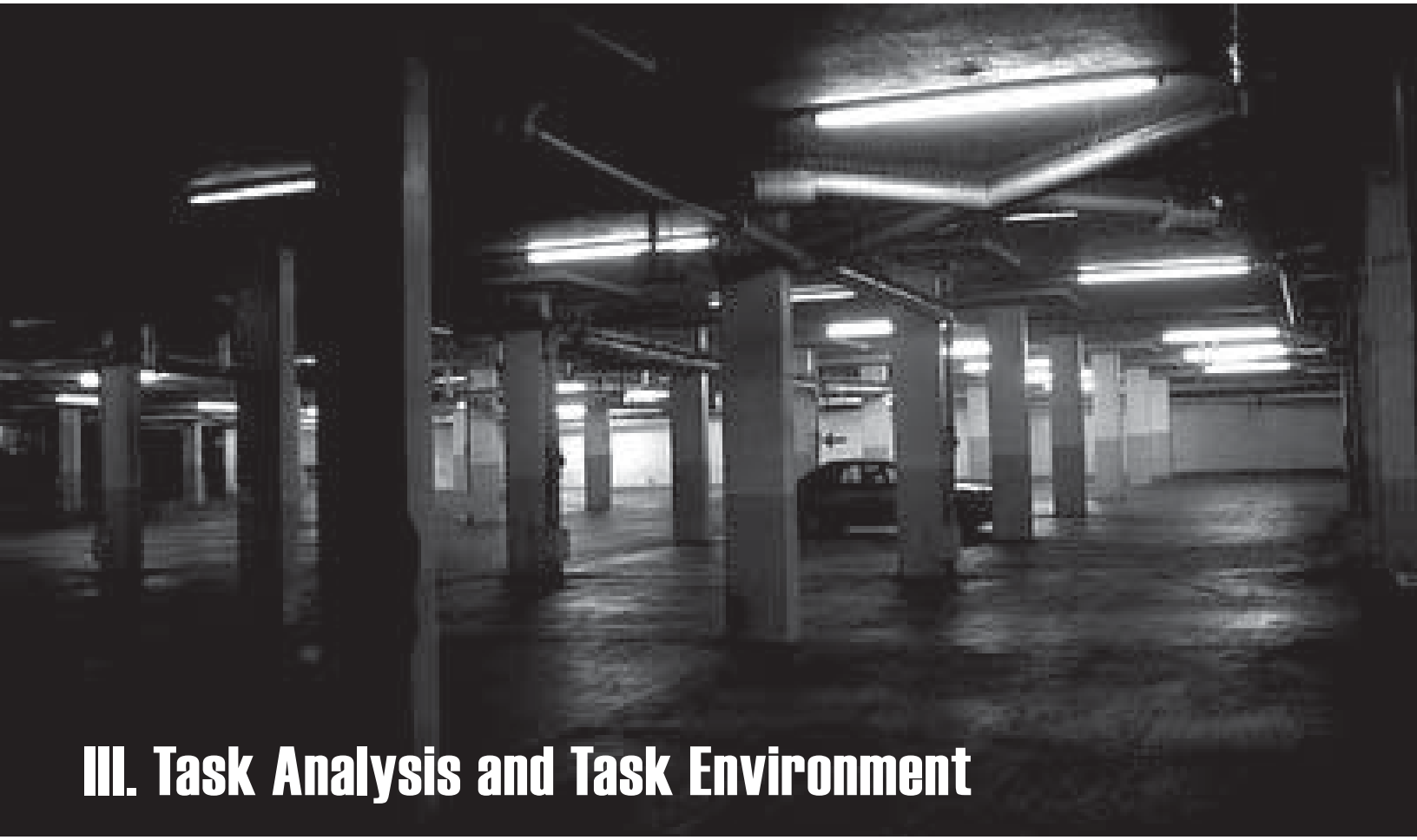
High crime rates in cities combined with poor infrastructure (bad lighting, remote locations, lack of security) put car drivers at risk and raise the need for increased security in reaching parked vehicles in parking lots and street-side parking areas. Our system is being designed to provide access to information on vehicle condition, awareness of surrounding area, monitoring of a potentially dangerous situation with the ability to call for help when needed. It will utilize a series of existing or attached car sensors and alarms (the exact nature of these sensors is yet to be determined) to provide information communication between drivers and vehicles. The sensors will provide feedback of the safety of the surrounding environment and the vehicle's status to a remote device, possibly attached to the users key chain. The system will also contain a light-emitting-device that will allow the user to illuminate the area from a distance during an approach and provide increased visibility in dark environments. This remote device will have controls for the systems light source and a panic button that can be activated if dangerous situation is immanentt.

II. User Description

OUR TARGET USER is a young to middle-aged urban car-owner. They are native English speakers, typically in their early twenties to late forties, and lack the resources to purchase a luxury automobile with advanced security systems. They have no disabilities due to age, and possess familiarity with their cars and technology such as cell phone interfaces. Urban areas and cities are their homes, and are presented with higher crime rates, urban infrastructure issues, and higher safety risks. Daily travel and commute is usually done alone for this user as they are independent in their lifestyle, and it is not uncommon that they arrive at home late in the evening or are returning to their car late at night after a long day of work. While many cities try to provide streetlights and police patrols to help provide a safe environment, some neighborhoods do not have adequate lighting and police patrols can be infrequent and unpredictable.

CITATION:

[1] Slovic, P. (1987). Perception of Risk. Science, 236, 280-285.

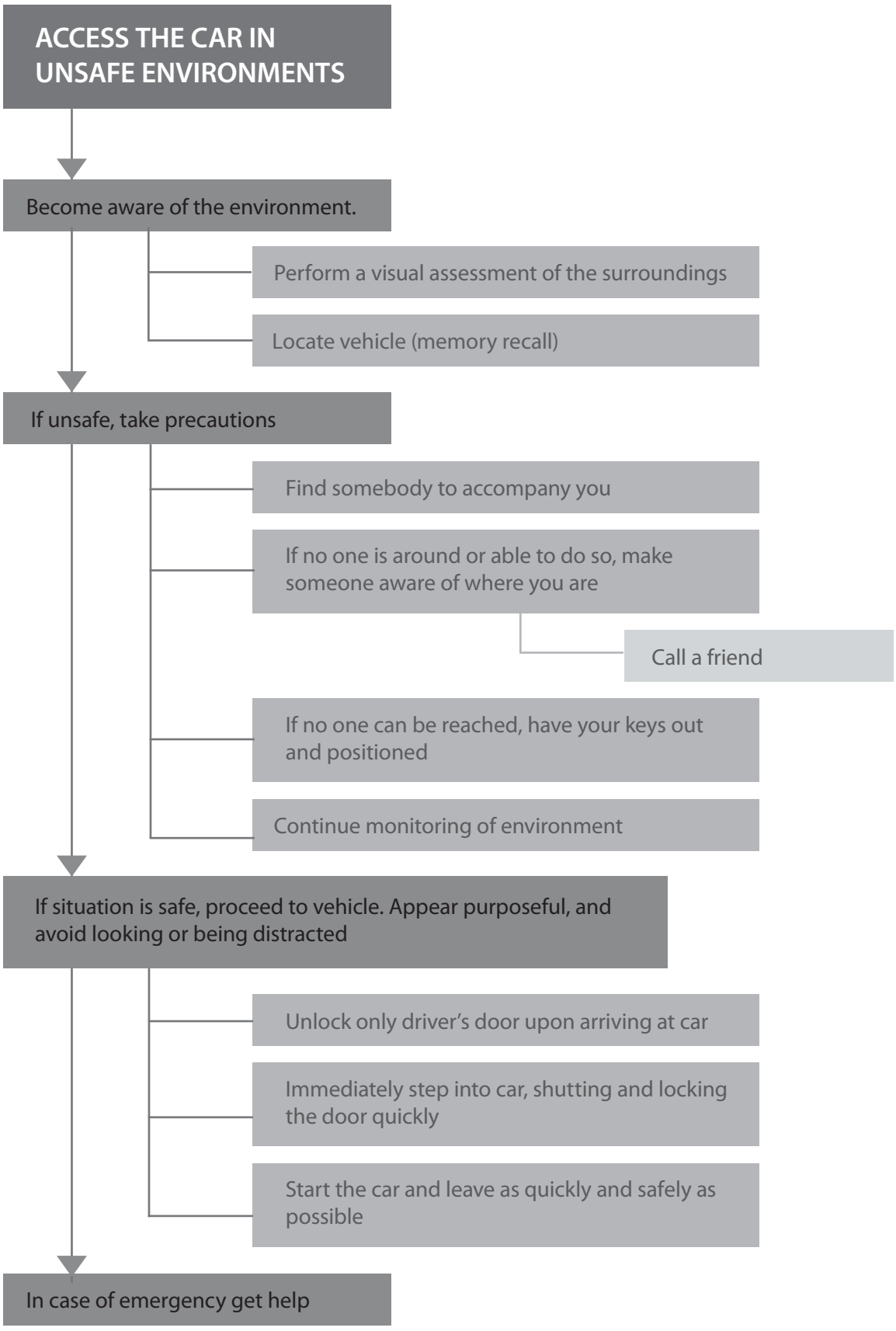


III. Task Analysis and Task Environment

THE TASK we analyzed was accessing a car in an unsafe environment. First, the users have to assess the environment itself: Is it dark? Where is their car? Is there any lighting or people around that they could be trusted? The users needs to walk to the car, make sure it is fine, unlock their car, start the car, and leave the area. However, in an unsafe condition, speed and urgency seemed to be key to users. They noted that they would "position the key in their hand" so that unlocking the door would be more efficient. It seemed that many were more comfortable with the presence of a phone, or some kind of device that could reach outside help. They would then move quickly to their vehicle, unlock the door as fast as they could, and lock the door before driving away.

THE TASK ENVIRONMENT that we are targeting is an "unsafe" environment. Users define this environment as a low-visibility environment (for example, at night with very few street lights). There is the possibility of an inoperative vehicle (a tire blew out, battery is out), or damage has been done to the car. The feeling of insecurity can come from being alone, or feeling that an unknown person is following behind. Also, neglected neighborhoods and abandoned infrastructures all contribute the user's perception of the risk.

HIERARCHAL TASK ANALYSIS



IV. EXISTING SYSTEMS

IN ORDER TO become more familiar with the problem space and to be sure that our product is novel and useful, or improves upon an already existing design, we examined existing security systems.

I. HOME SECURITY SYSTEMS

Home security systems can be sorted into two general categories: unmonitored and monitored. Unmonitored systems are very popular because they are cheaper. Alarms are first triggered by the burglar via sensors (usually motion sensors), and produce a loud noise on both inside and outside of home in order to frighten the intruder and force them to escape. The issue with this system is that it will not automatically notify any authority; the user must be the one to contact police or emergency help. Monitored systems are linked to a central call center when a burglar sets them off. When the alarm is switched on, the call center attempts to reach the user and obtain verification of the situation. If there is no response, they will notify the authorities. There is a little delay in response time, but in the case that the user is away from their home this system is a definite advantage. Systems such as these are not only used for preventing theft: smoke, fire and carbon monoxide detectors as well as video cameras can be attached to these systems. However, all of these sensors have a limit, so there are possibilities of gaps in security. Also, if sensors are not set up properly or with careful consideration, they can easily be set off by children or pets.

As an example for task analysis, ADT (http://www.adt.com)is a company that offers a large variety of home monitoring services, ranging from medical alert systems to intrusion detection. With the home alarm system, the user has a passcode that they enter into the alarm system to switch system modes. There is an "off" mode that turns all sensors off, a "on" mode that turns all sensors on, and finally a "at home" mode in which certain censors (such as the ones at the door) are turned on while the others within the house (say, next to the stairs) are off. Users are encouraged to set the system to on while they have left the house or while they are at bed. In the case of leaving the house, the user enters the passcode into the system and chooses "alarm on". They are then give a 60-second leeway in which they can exit the house, before the alarm is turned off. When coming home, there is another 60-second leeway between when the user opens the door and enters the passcode in order to shut off the alarm. Sensors and security systems are now an everyday part of people's lives, and we have developed a dependency on the convenience of safety that such devices offer.

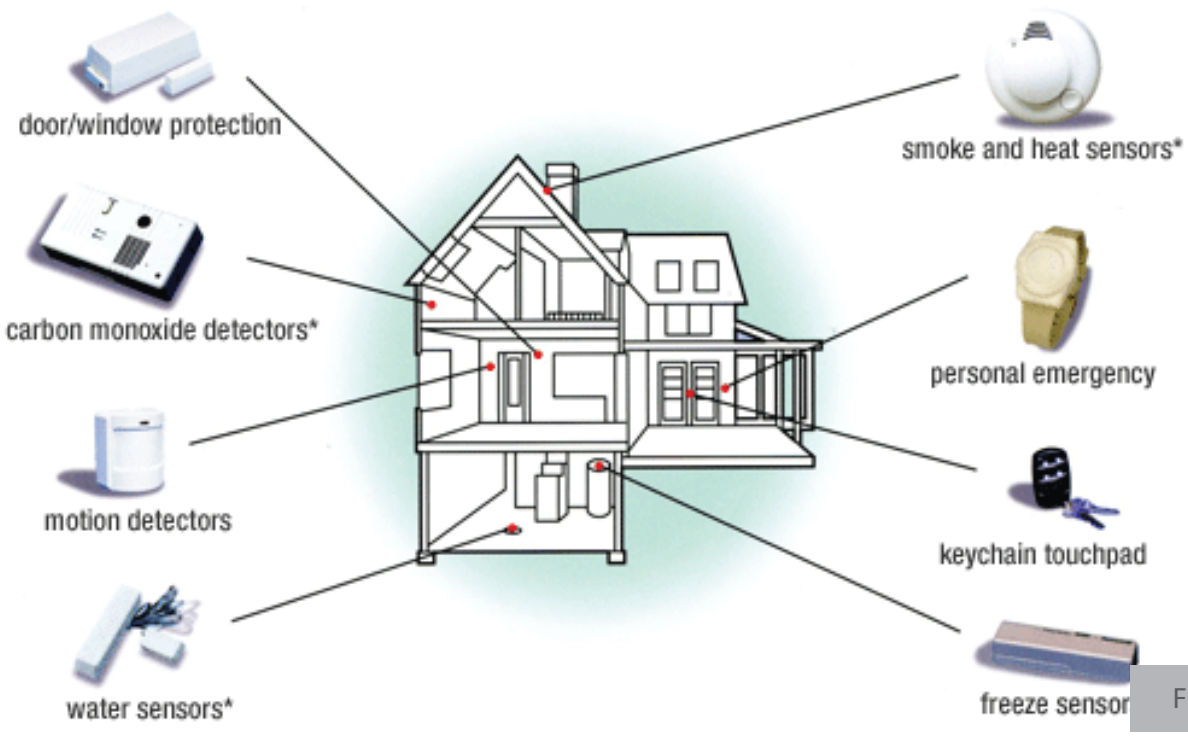


Figure A

II. CAR SAFETY, SECURITY, & COMMUNICATION SYSTEMS

Car manufacturers were the first to realize the importance of safety and security to their customers. Their solution was a 24/7 button activated communication with a call-center. In 1996 GM introduced its pioneering OnStar system for GM vehicles. Since then many car manufacturers had copied the GM system. Most of the car safety & security systems utilize a dedicated cellular phone (dual-mode CDMA/analog/digital), Global Positioning Satellite (GPS) technology and 24-hour live-operator support. One of the hardest problems that car manufacturers encountered was that the life cycle of the car far outlived the life cycle of consumer electronics. They learned that new technology had to be updatable (providers cannot offer services to analog system/phone subscribers).

Below we list some of the existing systems and then compare them side by side.

ONSTAR is the "world's most comprehensive in-vehicle safety, security and communication service" for GM vehicles since 1996 (http://www.onstar.com, accessed Sept 20, 2010). OnStar is marketed as a "tool of convenience." Two plans of services are available for GM drivers: Safe & Sound and Directions & Connections. The interface is extremely simple and easy to use: a Phone button, OnStar button and Medical Help button. The system is oddly located on the rear-view mirror. OnStar system is mainly for "on the road" assistance. The providers maintain OnStar Call Center staffed 24 hours/day and 7 days a week with OnStar Advisors. Users can also call OnStar system from a personal phone. OnStar system offers Speech Recognition but one needs to be willing to learn the commands. Other drawbacks include 1) lack of privacy which cannot be guaranteed over the wireless network; 2) limited coverage, the system support is only available in areas covered by cellular communications; and 3) OnStar is dependent on vehicle battery power. [Figure B]

Figure B

BMW ASSIST is marketed as "Safety & Convenience Services" to add confidence and convenience to driving experiences ("a piece of mind"). It is an intelligent integration of the driver, the vehicle, and the environment. It combines GPS location technology with hands-free wireless communication. The system tracks car location, so driver never have to explain where he/she is. The safety plans are offered for cars starting with 2007 models (with 5-series, 6, 7). Different plans provide different features, so not all features are available in the most basic package. [Figure C]

Figure C

MERCEDES-BENZ started marketing its system Mbrace (TeleAid) in 2000. The assistance is provided along the three categories: Safety and Security, Navigation and Convenience. The interface is very straightforward. It has three buttons i-Button, SOS, and the Tool button. It is the only system that provides an iPhone application with some helpful features (see the comparison Chart). Below are the pictures of the buttons and the iPhone interface [Figure D.

Figure D

LEXUS LINK was launched in 2000, is the only system that provides a dead battery notification. The system can also contact driver's friend or family if he/she needs a ride and cannot drive. The buttons are advantageously positioned above the rear-view mirror as seen in the picture to the right. [Figure F]

AAA ROADSIDE ASSISTANCE offers Towing, Emergency Starting, Battery Service, Flat Tire service, Vehicle Locksmith Service, Extrication/ Winching, Vehicle Theft Reward, Travel Books, discounts on car rentals, Fuel Delivery, passport photos, travel accident insurance, vehicle return, Home Lockout Service, 24-hr Concierge, Emergency and Medical Services, Accident/ Ride Assist, Reduced Airline Processing Fees.

LOWJACK provides tolen vehicle recovery, also notifies the owner if his/her vehicle has been moved.

Figure E

Features	GM Onstar	BMW Assist	Benz Mbrace	Lexus Link
Crash/Collision Response	√	√	√	√
Emergency Service	√	√	√	√
Stolen Vehicle Assisstance	√	√	√	√
Remote Door Unlock	√	√	√	√
Roadside Assisstance	√	√	√	√
Crisis Assisstant	√	√	√	
Hands-Free Voice-Activated Calling	√			
Vehicle Location Assistance	√	√	√	√
Driving Directions/POI	√		√	√
Assistance with Getting a Ride	√	√		√
Personal Concierge/Traffic Information	√	√	√	√
Send Messages with Addresses to/from the car	√	√	√	
Loss of Battery				√
Search (Bloomberg & Google)		√		
Call Car Dealer/Financial Services			√	
Vehicle Diagnostic	√			
Smart Phone Application			√	
Memo Record				√

Cons and Tradeoffs between current systems and possible alternatives:

1.Existing systems seem to copy each other and offer little or no provisions for ensuring driver safety when getting into the car. Most of the commercial systems provide “on the road” help.
2.We did not find a system that will inform drivers if any damages have been done to their vehicle (though, Lowjack can report that your car has been moved, and Lexus-link can tell you if the battery is dead).
3. Commercial safety & security systems are available mainly for high-end cars and they are rather expensive which makes them less affordable for our user group.
4. While Lowjack and AAA Roadside Assistance services are more affordable they do not address safety.

Our system has a potential to provide and/or integrate the existing safety and security features and address the neglected by all existing systems area of monitoring and safely accessing your car.

III. CAR ALARMS

Car alarms are the most important means of security in cars today and they are available in various levels of sophistication, both in terms of detection mechanism, and the response to the detection.The very simplest alarm consists of a switch on the driver’s door, and it is wired in such a way that if someone opened the door, the siren would start wailing.Most modern car alarm systems are much more sophisticated than this. They consist of different sensors like door sensors, window and pressure sensors, motion and tilt sensors and shock sensors. Most alarm systems also have an auxiliary battery so that the alarm can operate even if the main battery gets disconnected and a computer control unit that monitors everything and sounds the alarm -- the “brain” of the system.The brain in most advanced systems is actually a small computer. The brain’s job is to close the switches that activate alarm devices -- horn, headlights or an installed siren -- when certain switches that power sensing devices are opened or closed.The brain and alarm features are wired to the car’s main battery, but they usually have a backup power source as well. This hidden battery kicks in when somebody cuts off the main power source (by clipping the battery cables, for example). Since cutting the power is a possible indication of an intruder, it triggers the brain to sound the alarm. Security systems differ mainly in which sensors are used and how the various devices are wired into the brain.

The alarms respond in different ways when they detect the presence of an intruder.The most basic ones honk the horn and flash the headlights when a sensor indicates an intruder. They may also be wired to shut off the ignition starter, cut off the gas supply to the engine or disable the car by other means. Some alarm systems have a separate siren that produces a variety of piercing sounds. Making a lot of noise brings attention to the car thief, and many intruders will flee the scene as soon as the alarm blares. With some alarm systems, we can program a distinctive pattern of siren noises so we can distinguish the alarm on your car from other alarms.A few alarm systems play a recorded message when somebody steps too close to the car. The main purpose of this is to let intruders know that we have an advanced alarm system before they try anything at all.A lot of alarm systems include a built-in radio receiver attached to the brain and a portable radio transmitter we can carry on your keychain. Onboard GPS receivers have opened up a wide range of security possibilities. If the receiver were connected to the alarm-system brain, it could tell us and even the police where your car is at all times. This way, even if somebody does bypass our alarm system, he or she will be caught soon.

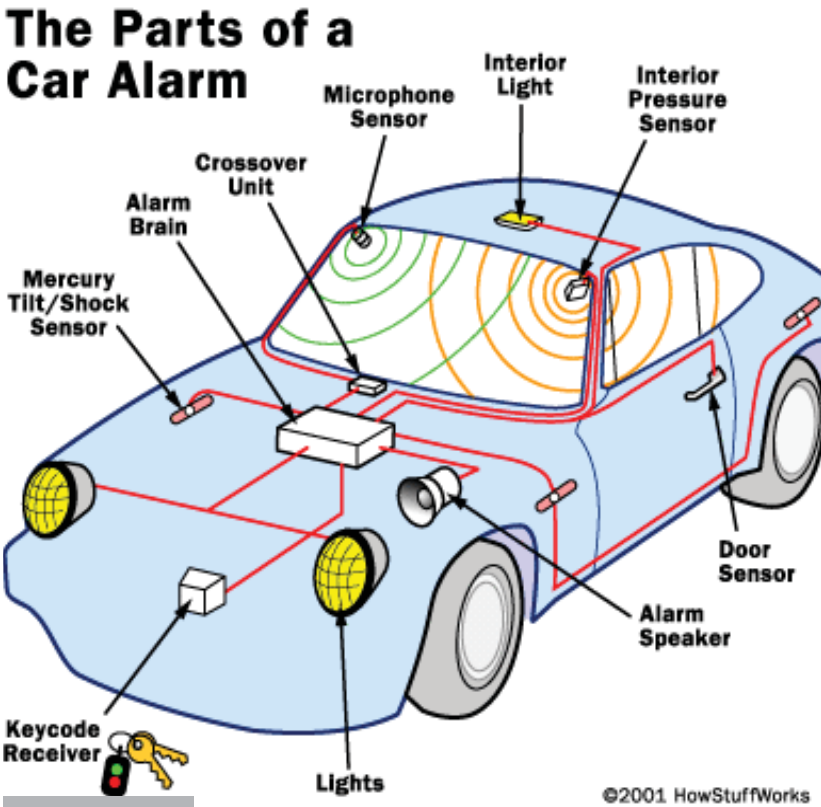


Figure F

IV.CAR REMOTE

The system consists of a remote, commonly called a "keyfob" and a receiver module located somewhere on the car. This module may be incorporated inside another module or computer on the car, or it may be a stand-alone, separate module. When you press the keyfob button, a signal is sent out by the keyfob. This signal includes a numeric pass code. In other words a series of numbers that could be several digits long. You could compare this to the combination of a combination lock. If the combination agrees with the stored information that has been programmed into the receiver module, the doors unlock, lock, or whatever is supposed to happen, happens. Below are two products that we examined.

1) Prestige Security Remote Car Starter and Keyless Entry APS620N. [Figure G]
It featured the ability to remotely start your car from up to 400ft. away to warm it up in winter and cool it down in summer. Locks and unlocks doors, pops the trunk and turns the engine on/off using the 4-button remote (included). Programmable 15 minute run time and automatic cold start. 4-button long range remote. Parking light confirmation and keyless entry. For use with vehicles with fuel injection and automatic transmissions only. U.S.A.Keyless Entry: Yes, Multi Function Remote: Yes, Remote Included: Yes, Range (ft.): 400, Works With: Fuel Injection/Auto Transmissions, Temperature-sensing Start: Yes

2) Deluxe Remote Car Starter w/ Keyless Entry and Basic Alarm 24927 [Figure H]
A deluxe remote car starter system for those looking for more security and convenience features in addition to remote start:
Two 5-button remotes
Remote control works from up to 1,000 feet away
Built-in remote car start relays
Works on gasoline and diesel engines
Keyless Entry outputs
Ignition controlled door locks
2-zone security system with active and passive arming (voltage and ignition sense)
Horn output
Built-in parking lights relays
Remote headlight control
Daytime Running lights
Panic alarm
Hood safety switch
Foot Brake Safety Switch input
Daily Start
Cold Start
Anti-scan technology prevents code grabbing
Installation DVD with Spanish and French subtitles included
Trilingual clamshell packaging
Limited Lifetime Warranty
For automatic transmission vehicle only

Figure G

Figure H

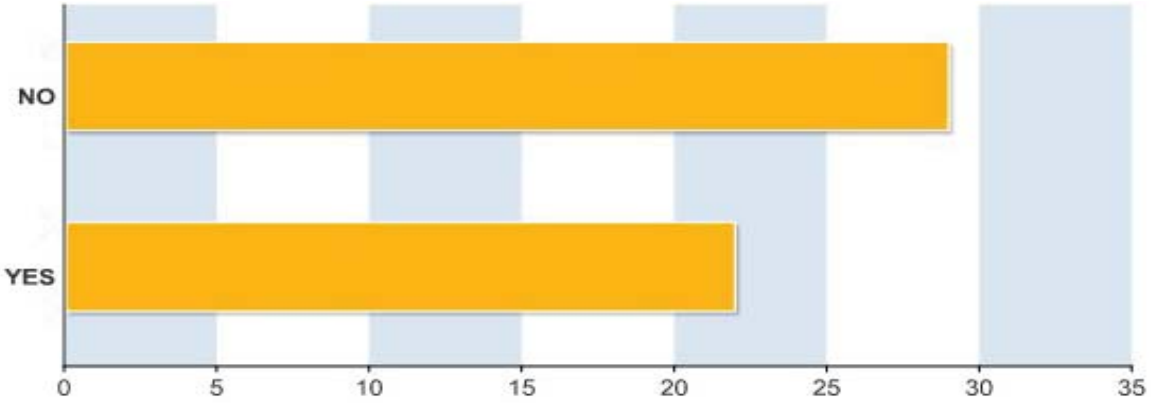
IV. TRENDS IN SURVEYS

N=53 RESPONDENTS

Most interesting and revealing to our case findings:

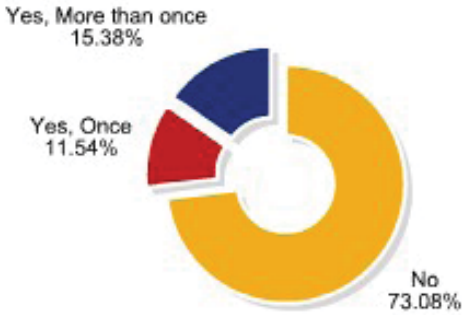
1. A large proportion (43.1%) of the respondents admitted to staying for a hile in their cars for either after they were parked or before starting their car.

Do you often stay in the car for a while after you have parked or before starting the car?



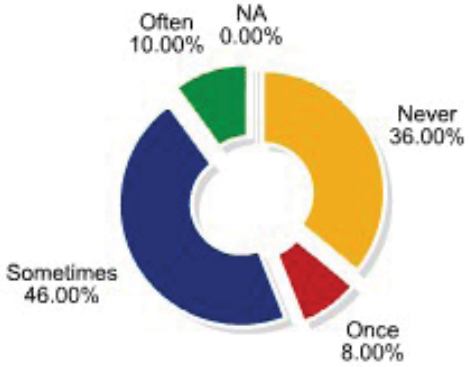
2. 12%-27% of respondents reported various incidents that happened more than once to their car (e.g. I had something stolen from my car; I had my car broken into; parts of the car were broken). Its interesting to note that more incidents happened to men than women. The most frequently occurring incident was that car parts were broken (27%).

D. Some parts of my car were broken

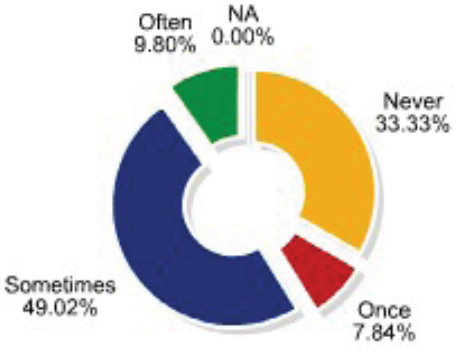


3. 83% of users reported that parking in an unsafe area detracted from their feeling of safety. 66% of users said that they felt unsafe at least once while getting into their car at night. Walking to a car alone (52% reported feeling this sometimes, and 10% often) contributed to a feeling of insecurity.

A. Walking to your car at night



B. Going to your car alone.

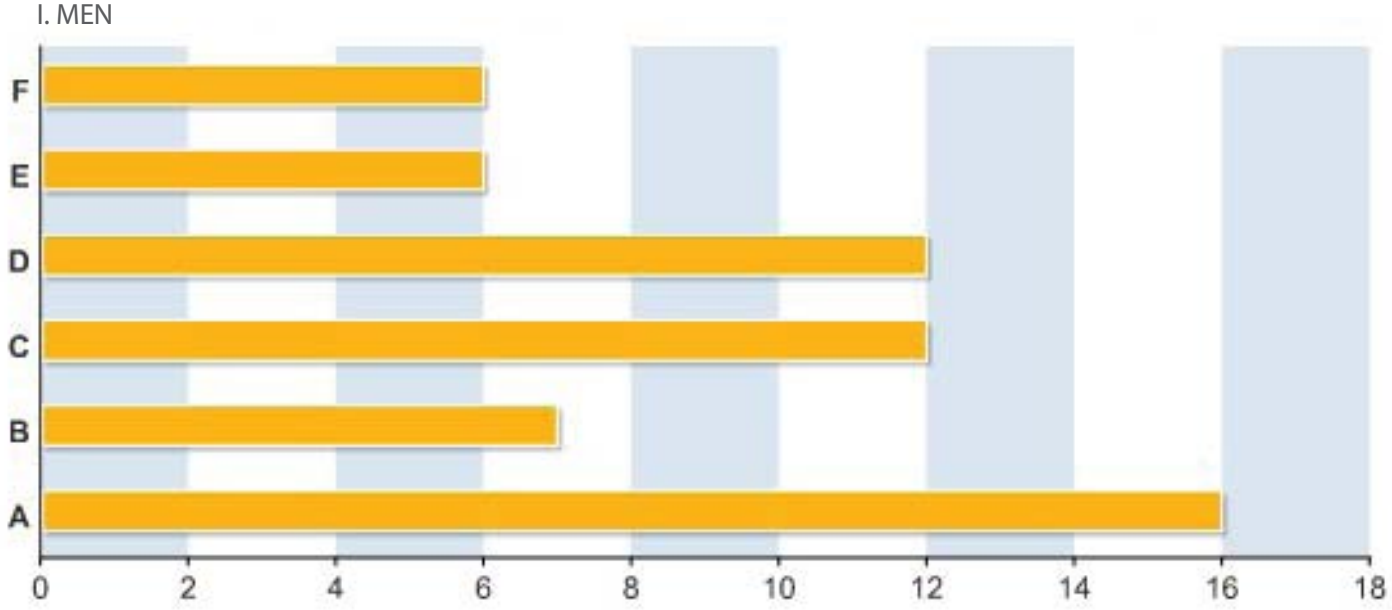


4. It is surprising that the responses for men and women seem mirrored. The general perception is that women are more scared to drive alone and are scared of unlit areas. These graphs show that men have the same fears.

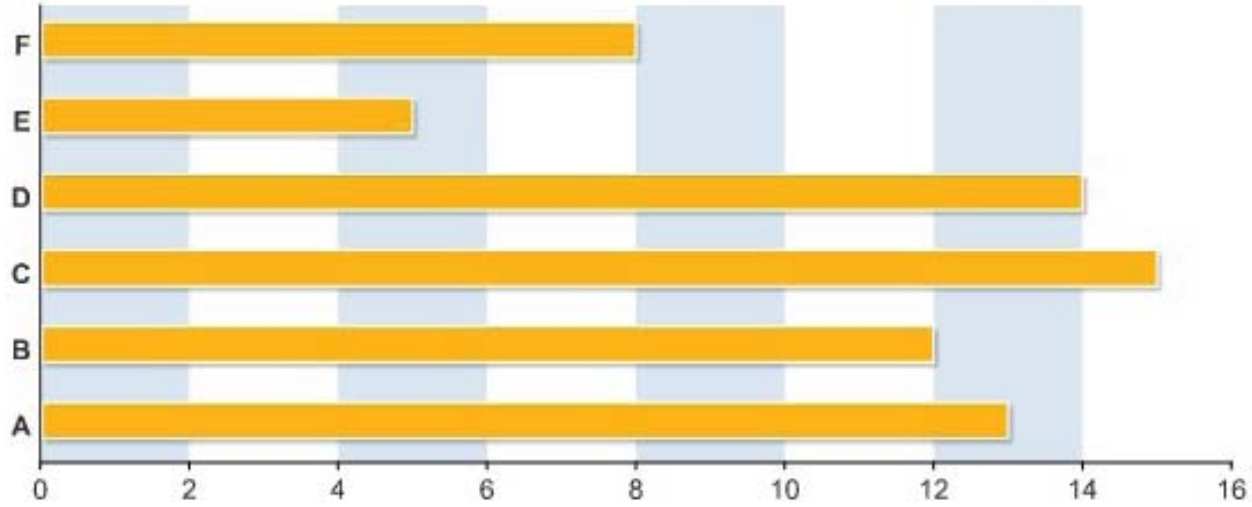
If you ever had a safety concerns when leaving/accessing your car, please describe the situation (check all that apply)

A - It was in unsafe area
B -The area was empty
C - The area was badly lit
D- You were by yourself
E- You did not have a working phone on you that you could use to call for help
F-You were doubtful that help could get to you
Filter applied based on Gender.

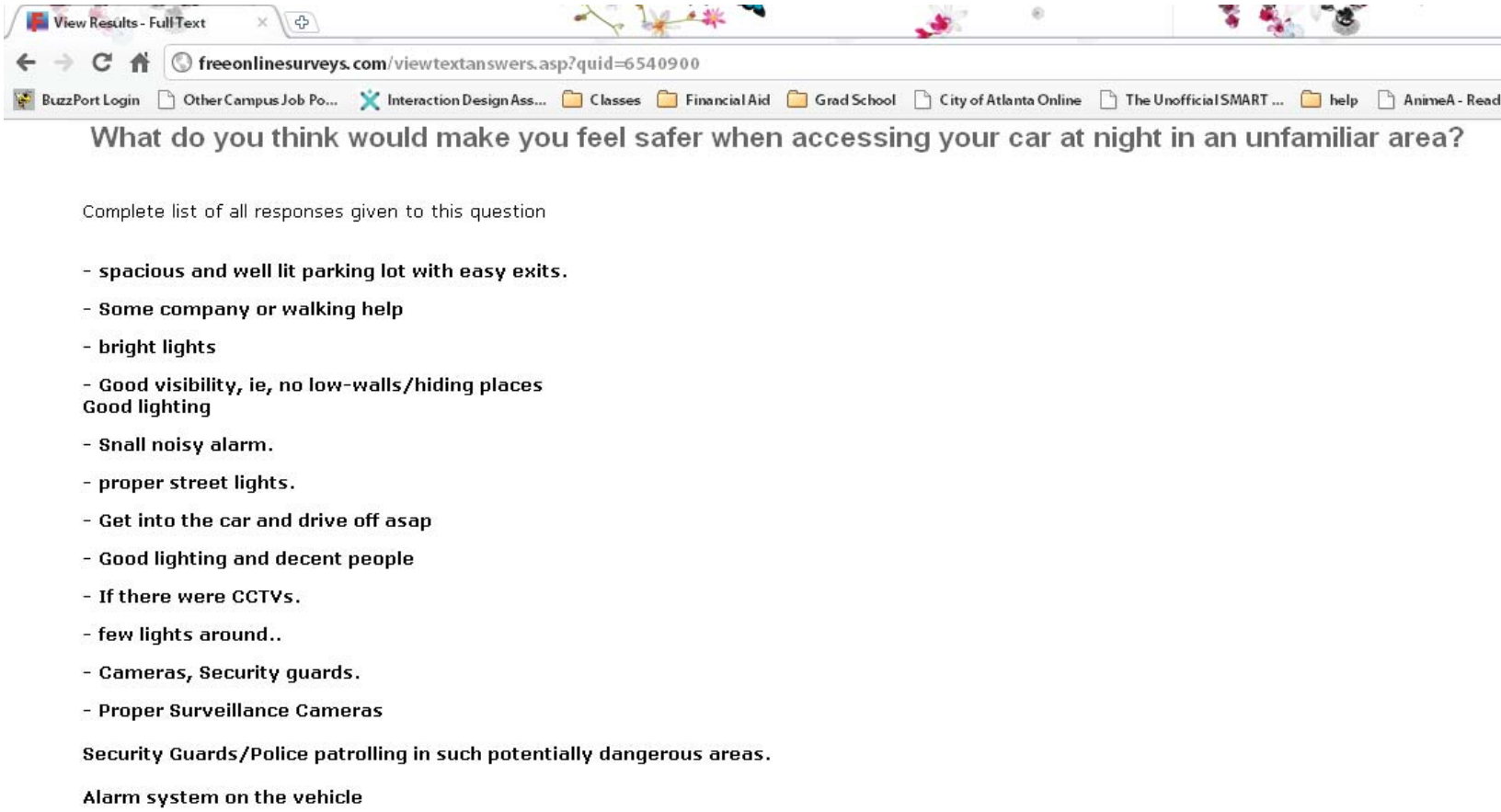
I. MEN

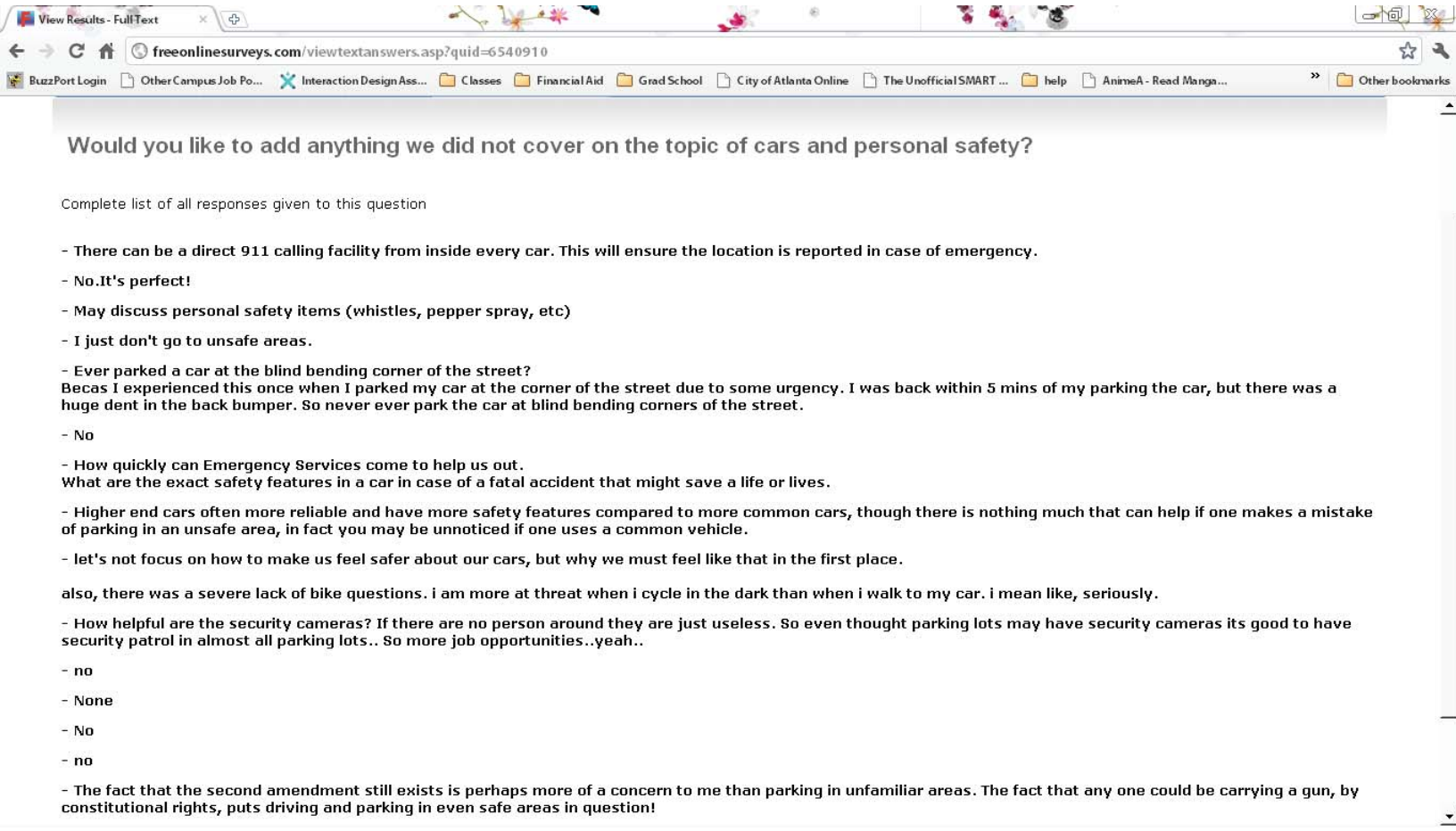


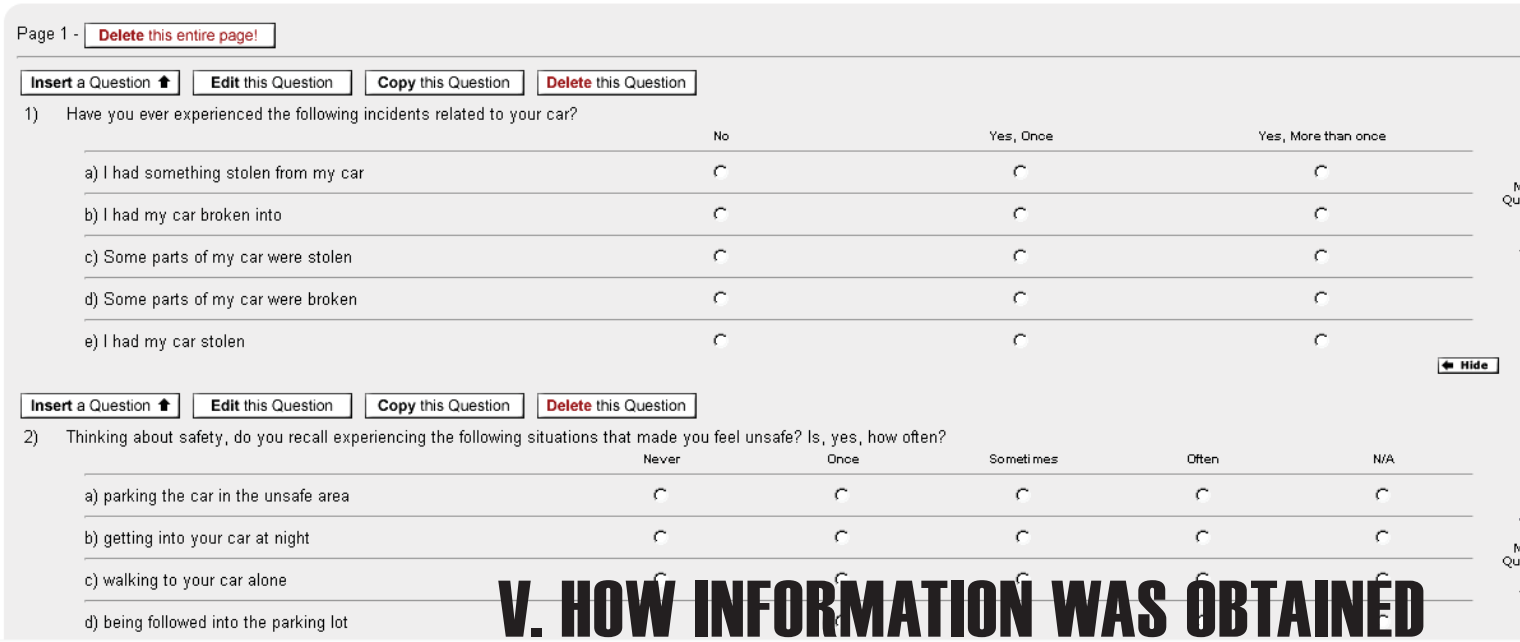
II. WOMEN



Screenshots of responses to open-ended questions.






Safety and Low-Visibility Environments Edit Title & Introduction

We would like to ask you about your experience with safety and your car, followed by some general questions.
Thank you very much for your effort, and for participating in our survey.

Page 1 - Delete this entire page!

Insert a Question | Edit this Question | Copy this Question | Delete this Question

1) Have you ever experienced the following incidents related to your car?

	No	Yes, Once	Yes, More than once
a) I had something stolen from my car			
b) I had my car broken into			
c) Some parts of my car were stolen			
d) Some parts of my car were broken			
e) I had my car stolen			

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2) Thinking about safety, do you recall experiencing the following situations that made you feel unsafe? Is, yes, how often?

	Never	Once	Sometimes	Often	N/A
a) parking the car in the unsafe area					
b) getting into your car at night					
c) walking to your car alone					
d) being followed into the parking lot					

V. HOW INFORMATION WAS OBTAINED

TO GAIN PERSPECTIVE on the user perception of risk and unsafe situations, we first looked at crime statistics and tips related to parking lots and potentially vulnerable populations. However that information told us nothing about the severity of the problem or experiences of real users.

IIn order to learn about safety and security issues of actual car users, we performed an exploratory online survey of car drivers. A total of 53 drivers were surveyed, spanning the ages of 19 to 68. 48% surveyed were male, and 52% were female. Our survey covered questions related to awareness, safety, security, and the definition of an unsafe environment.

We researched online the existing car safety/security systems, hardware and related security solutions (home monitoring systems) to learn about the available hardware and solutions.

1) We studied car safety systems (GM OnStar, BMW Assist, Mercedes-Benz Mbrace, Lexus Link), we to learn what safety features were commercially available and how car companies conceptualized and addressed safety and security issues. We learned that existing systems did not ensure driver safety when accessing the car and were only available mainly for high-end cars.

2) We looked at home security systems to learn about the security protocol as an example of an alternative security monitoring system that users may be familiar with.

3) We looked at car alarms to survey the range of alarms and sensors currently utilized in cars that are standard and can be deployed to inform the users about the status of his/her car.

4) We examined the features of car remotes as an example of an already existing convenience and safety device.

VII. USABILITY CRITERIA

Success of design will be measured by three criteria: suitability, learnability, and cost. Because of our user group, we must ensure that cost remains at a reasonable level so that they may also afford the protection offered by luxury cars. The effectiveness of the system is measured by the amount of awareness the user has of the surroundings of their car and themselves, especially in potentially unsafe environments. Satisfaction of the design can be measured by the overall feeling of safety of the user that results from the insurance of access to help when needed.

A. SUITABILITY FOR THE TASK

1) Satisfaction: Does our system make users feel safer?
2) Efficiency: Can users access help more easily and time efficient? (comparison between existing system and our system)

B. EFFECTIVENESS:

1) Did the system provide users with critical information about their car or surroundings?
2) System must be always on
3) Must be fault/error tolerant (cannot be out of service, or easily broken).
4) Must be easy to carry on person at all times
5) Must work remotely

C. LEARNABILITY

1) How long does it take to learn the system that we create?
2) How easy is our system to use under "unsafe" situation (rating scale)
3) Familiarity
4) The User should get an insight of the system's basic operation on the very look of the device.
5) The system's design should reflect a common structure as in other secure design products .

D. AFFORDABILITY:

1) The system has to be affordable so our target group could perceive it to be useful for the price of the system

Figure I

VIII. IMPACT OF DESIGN

OUR SYSTEM will be located within and intersect with the larger social and technical systems and contexts. We have identified the following relevant contexts:

1) Cities are known for high crime rates and poor city infrastructure (any parking lot, parking garage, badly lit streets, etc.)

3) Urban lifestyle and space constrains place parking lots in outskirts or other odd/secluded areas.

4) American lifestyle where most people rely on driving for commute.

5) Social and economical system not addressing the roots of crime and allowing crimes to persist. Persistence of technological solutions (various security/monitoring systems) to social problems (crime).

6) Social structure promoting independent lifestyle and lone commutes. Lack of efficient public transportation spurs this independent growth. Because people drive alone and live alone, they need someone/something to "watch their back".

7) Stakeholders: car users, car manufacturers, emergency services, police department, insurance companies, parents, state & local legislature.

8) Inefficient communication with emergency services. Effectiveness of help mechanisms is as good as the emergency services themselves. Our system will be able to notify but cannot ensure rapid response of emergency services (police and medical assistance).

9) A potential to change the way people think about and communicate with cars. People will think of cars as tools that could further enhance personal safety.

IX.WHAT WE LEARNED...

A) We learned that access to and knowledge of users is critical to an effective design solution.

B) We learned that our users really represent diverse populations (e.g. gender, age, income level, where they live) with various needs.

C) We learned of many existing systems and where our product could fit or further improve the existing systems.

D) We learned the characteristics of our user group (20-40, independent, living in urban city areas, low to mid-level income, and a lifestyle that reflects that income) introduced specific constraints for our design. The need for our product arises because our user group cannot afford higher-end cars or solutions such as OnStar. We need to be aware of how much technology our user has access to (for example, 39% of our respondents do not have access to smart phones).

E) We learned that perception of risk and number of accidents vary according to gender.

F) Although existing technology seems comprehensive, but we found that there is a lack of solutions for our problem (access to automobiles in low-visibility environments) and our user group.

G) Because of the critical nature of the system the interface has to be extremely easy to use.

H) We learned that many users are not willing/cannot afford to pay for security "monitoring" solutions. As a result, the "cost of the system is an important constraint for our system.

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