

University of Nevada, Reno
Computer Science and Engineering Department

CS426 Senior Project

Project Concept Document



Date: Feb 14, 2005.

Project Title: goSmart.

Team Name: JFMS.

Team Members:

- Jim Motta. (Project Manager).
- Fares Qeadan.
- Siraj Malik.

Instructor and Advisor: Sergiu Dascalu, PhD.

External Advisor: Fred Harris, PhD.

Rasoul Baghal, PhD.

Abstract

Smarthomes are homes which incorporate various types of technologies into their design. One such technology is called X10 [see Glossary]. X10 technology gives the user the ability to control electrical devices within the household via the electrical wiring in the house. This can be very useful for homeowners of homes that have already been built but would like to incorporate some new technology into their homes.

Our project design will be to create an interface that will allow the user to wirelessly control these devices within the house. This will be accomplished using the X10 Firecracker wireless module [see Glossary]. This hardware is currently on the market with a software package. The existing software package does not offer any type of scheduling or automation for these devices. Our interface, however, will offer both scheduling and automation for some or all of these devices. The hardware currently supports 16 house codes with each code supporting 16 devices for a total of 256 devices that can be controlled via this hardware. Our software will support this ability as well. goSmart will allow the user the option of utilizing several security features including profiles, password protected login information, and (in future work) security groups. goSmart will also use a proprietary encryption algorithm to secure a database where all user/device information will be kept.

Project Description

User Accessibility Features

The main functionality and characteristics of this project is control. The user interface will be designed to be fully functional with a mouse or text entry via keyboard. The view screen, which is considered the “main menu” of goSmart, provides a summary of all the defined devices within a house. From this screen,

you can access all of your devices. Each device will have an icon or image, the device name and the Function buttons (e.g., ON, OFF, DIM, BRIGHTEN, ALL ON, ALL OFF, and DISABLE). Commands are issued to the device by cursoring and clicking the buttons.

1. The user shall be able to walk back and forth to access the main menu or the device section.
2. The user shall be able to schedule one of the above features for a certain time using the scheduling engine.
3. The user shall be notified in case of security breach detected via the motion sensor device, which in turn will send an email to the system owner.
4. The user shall be able to modify/change the name of the device by using the add-device option.

Product User

This product is intended for use by home owners and their family members. There is no specific background or level of training the user must have to use the product. However, for safety and security reasons users must be of the age 10 or older. Finally, for operating purposes users should have a basic knowledge of home computers and how they work to be able to follow the operating instructions of the product.

Project Potential

This project has a very large potential within itself. We would like to extend the architecture to include an SMS server that can accept text messages which will control the X10 devices. For example, a user will be able to text message if they want a particular light in the house turned on/off. This project can also be extended into the full X10 home automation market to control devices for heating/cooling the house, webcams, audio/video equipment, and much more.

Ideally, we think that we can modularize the software so that packages can be included later on. For instance, we can create a module that could control TV access/recording, or we could create a module that could control an audio/video system to be used for things like setting wake up alarms, etc. The home automation market is very large and diverse so the possibilities for the software can become quite large.

Challenges

Some of our biggest challenges for this project will include the following:

1. Packetizing the command codes.
2. Creating a reliable security protocol.
3. Creating a reliable encryption algorithm for the goSmart data.
4. Creating a reliable base module for scheduling events.

Technology

For this project we will be using the Code Blocks software package with the C++ language and the open source version of QT 4.0.1. We will also be utilizing existing hardware for our interface (i.e. the Firecracker module and various others).

Professional Growth

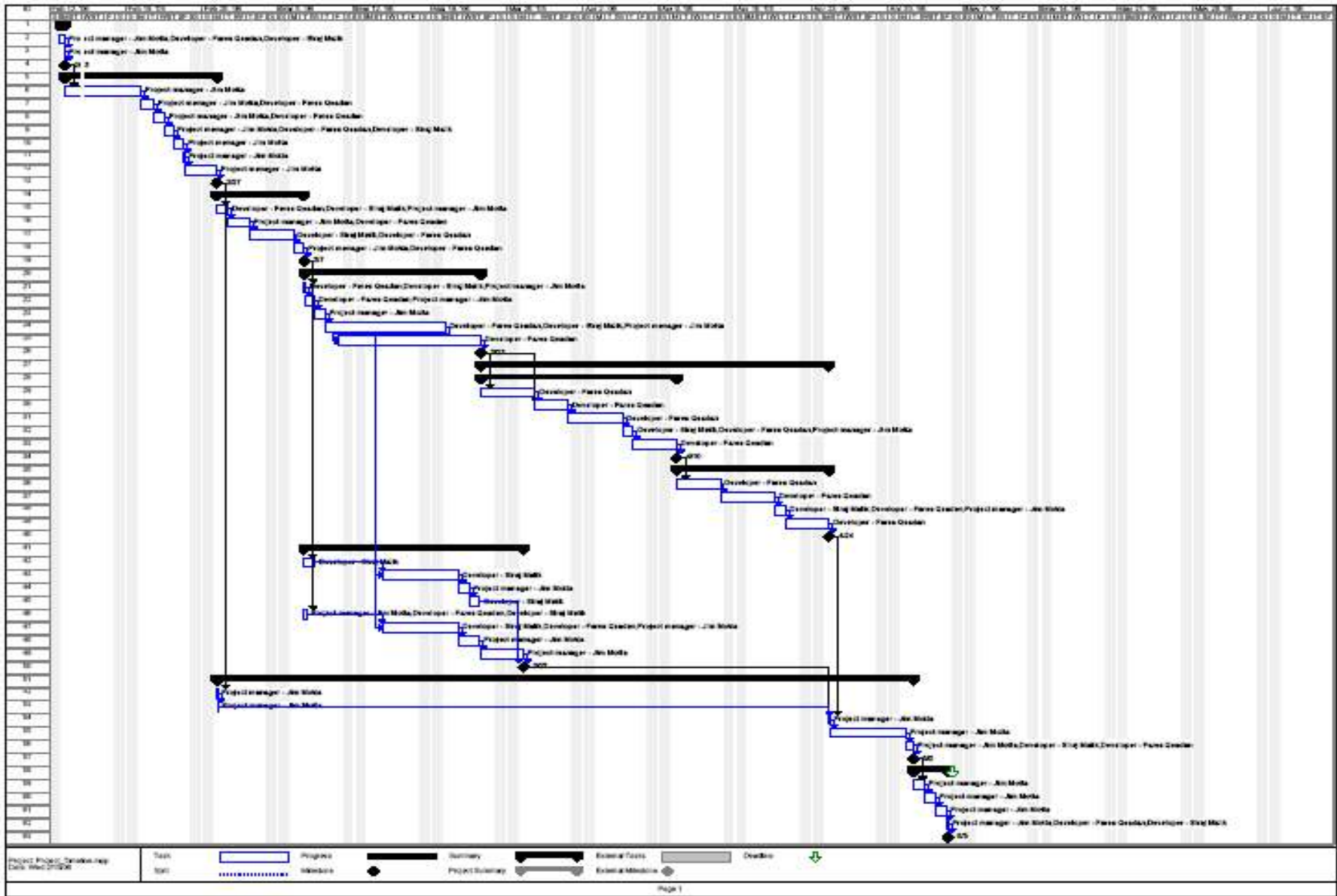
This project provides a very viable market solution. We will be able to gain extensive knowledge on how the market works by utilizing and fulfilling current consumer requests of other similar products being sold on the market. This could be very beneficial for us to see how the actual consumer market reacts to various solutions so that we may anticipate them in the future.

Project Timeline

	Name	Duration	Start	Finish	PrD	Resource names
1	Scope	0.29 d	2/13/2006	2/13/2006		Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
2	Determine project scope	1.33 h	2/13/2006	2/13/2006		Project manager – Jim Motta Developer - Fares Qeadan Developer - Siraj Malik
3	Define preliminary resources	1 h	2/13/2006	2/13/2006	2	Project manager - Jim Motta
4	Scope complete	0 d	2/13/2006	2/13/2006	3	
5	Analysis/Software Requirements	9.96 d	2/13/2006	2/27/2006		Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
6	Conduct needs analysis	5 d	2/13/2006	2/20/2006	4	Project manager - Jim Motta
7	Draft preliminary software specifications	1.5 d	2/20/2006	2/21/2006	6	Project manager - Jim Motta Developer - Fares Qeadan
8	Develop preliminary budget	1 d	2/21/2006	2/22/2006	7	Project manager - Jim Motta Developer - Fares Qeadan
9	Review software specifications/budget with team	2.67 h	2/22/2006	2/23/2006	8	Project manager - Jim Motta Developer – Fares Qeadan Developer - Siraj Malik
10	Develop delivery timeline	1 d	2/23/2006	2/24/2006	9	Project manager - Jim Motta
11	Obtain approvals to proceed (concept, timeline, budget)	1 h	2/24/2006	2/24/2006	10	Project manager - Jim Motta
12	Secure required resources	1 d	2/24/2006	2/27/2006	11	Project manager - Jim Motta
13	Analysis complete	0 d	2/27/2006	2/27/2006	12	
14	Design	6 d	2/27/2006	3/7/2006		Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
15	Review preliminary software specifications	1 d	2/27/2006	2/28/2006	13	Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
16	Develop functional specifications	2 d	2/28/2006	3/2/2006	15	Project manager - Jim Motta Developer - Fares Qeadan
17	Develop prototype based on functional specifications	2 d	3/2/2006	3/6/2006	16	Developer - Siraj Malik; Developer - Fares Qeadan
18	Review functional specifications	1 d	3/6/2006	3/7/2006	17	Project manager - Jim Motta; Developer - Fares Qeadan
19	Design complete	0 d	3/7/2006	3/7/2006	18	
20	Development	12.58 d	3/7/2006	3/23/2006		Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
21	Review functional specifications	0.33 d	3/7/2006	3/7/2006	19	Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
22	Identify modular/tiered design parameters	0.5 d	3/7/2006	3/8/2006	21	Developer - Fares Qeadan; Project manager - Jim Motta
23	Assign development staff	1 d	3/8/2006	3/9/2006	22	Project manager - Jim Motta
24	Develop code	7 d	3/9/2006	3/20/2006	23	Developer – Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
25	Developer testing (primary debugging)	9 d	3/10/2006	3/23/2006	24	Developer - Fares Qeadan
26	Development complete	0 d	3/23/2006	3/23/2006	25	
27	Testing	22 d	3/23/2006	4/24/2006		Project manager - Jim Motta; Developer - Fares Qeadan; Developer - Siraj Malik
28	Unit Testing	12 d	3/23/2006	4/10/2006		Developer - Fares Qeadan
29	Review modular code	3 d	3/23/2006	3/28/2006	26	Developer - Fares Qeadan
30	Test component modules to product specifications	3 d	3/28/2006	3/31/2006	26;29	Developer - Fares Qeadan
31	Identify anomalies to product specifications	3 d	3/31/2006	4/5/2006	30	Developer - Fares Qeadan
32	Modify code	1 d	4/5/2006	4/6/2006	31	Developer - Siraj Malik Developer - Fares Qeadan Project manager - Jim Motta
33	Re-test modified code	2 d	4/6/2006	4/10/2006	32	Developer - Fares Qeadan
34	Unit testing complete	0 d	4/10/2006	4/10/2006	33	
35	Integration Testing	10 d	4/10/2006	4/24/2006		Project manager - Jim Motta Developer - Siraj Malik

36	Test module integration	4 d	4/10/2006	4/14/2006	34	Developer - Fares Qeadan
37	Identify anomalies to specifications	3 d	4/14/2006	4/19/2006	36	Developer - Fares Qeadan
38	Modify code	1 d	4/19/2006	4/20/2006	37	Developer - Siraj Malik; Developer - Fares Qeadan; Project manager - Jim Motta
39	Re-test modified code	2 d	4/20/2006	4/24/2006	38	Developer - Fares Qeadan
40	Integration testing complete	0 d	4/24/2006	4/24/2006	39	
41	Documentation	14.33 d	3/7/2006	3/27/2006		Developer - Fares Qeadan Developer - Siraj Malik Project manager - Jim Mott
42	Develop Help specification	1 d	3/7/2006	3/8/2006	19	Developer - Siraj Malik
43	Develop Help system	1 w	3/14/2006	3/21/2006	24;	Developer - Siraj Malik
44	Review Help documentation	1 d	3/21/2006	3/22/2006	43	Project manager - Jim Motta
45	Incorporate Help documentation feedback	1 d	3/22/2006	3/23/2006	44	Developer - Siraj Malik
46	Develop user manuals specifications	0.67 d	3/7/2006	3/7/2006	19	Project manager - Jim Motta Developer - Fares Qeadan; Developer - Siraj Malik
47	Develop user manuals	1 w	3/14/2006	3/21/2006	24;46	Developer - Siraj Malik; Developer - Fares Qeadan; Project manager - Jim Motta
48	Review all user documentation	2 d	3/21/2006	3/23/2006	47	Project manager - Jim Motta
49	Incorporate user documentation feedback	2 d	3/23/2006	3/27/2006	48	Project manager - Jim Motta
50	Documentation complete	0 d	3/27/2006	3/27/2006	45;49	
51	Pilot	45.96 d	2/27/2006	5/2/2006		
52	Identify test group	1 h	2/27/2006	2/27/2006	13	Project manager - Jim Motta
53	Develop software delivery mechanism	1 h	2/27/2006	2/27/2006	52	Project manager - Jim Motta
54	Install/deploy software	1 h	4/24/2006	4/24/2006	40;50;53	Project manager - Jim Motta
55	Obtain user feedback	1 w	4/24/2006	5/1/2006	54	Project manager - Jim Motta
56	Evaluate testing information	2 h	5/1/2006	5/2/2006	55	Project manager - Jim Motta Developer - Siraj Malik Developer - Fares Qeadan
57	Pilot complete	0 d	5/2/2006	5/2/2006	56	
58	Deployment	3.33 d	5/2/2006	5/5/2006		Project manager - Jim Motta
59	Determine final deployment strategy	1 d	5/2/2006	5/3/2006	57	Project manager - Jim Motta
60	Develop deployment methodology	1 d	5/3/2006	5/4/2006	59	Project manager - Jim Motta
61	Secure deployment resources	1 d	5/4/2006	5/5/2006	60	Project manager - Jim Motta
62	Deploy software - Senior Project Demo	0.33 d	5/5/2006	5/5/2006	61	Project manager - Jim Motta Developer - Fares Qeadan Developer - Siraj Malik
63	Deployment complete	0 d	5/5/2006	5/5/2006	62	

Gantt chart



Team Members

Name: Jim Motta

Organization: University of Nevada, Reno (CS426)

Profile: Jim Motta is currently a senior undergraduate student in Computer Science at the University of Nevada, Reno. For the last three years Jim has held a Systems Engineer position with International Game Technology where he supports and maintains the IGT progressive gaming infrastructure. Mr. Motta is a C/C++, QT 4.0.1 programmer with experience in Database management and Network Security. Jim is currently working on the security functions for goSmart and their interfaces into the GUI. As a team member, Jim is the Project Manager and is responsible for the overall product, as well as, maintaining the timeline for the project. His coding contributions to the project so far include working on the database communication, security routines, error checking implementations, Deployment package, and the GUI.

Name: Fares Qeadan

Organization: University of Nevada, Reno (CS426)

Profile: Fares Qeadan is currently a senior undergraduate student in Statistics & Computer Science (dual major) at UNR. Fares holds a Research Assistantship in the Math & Statistics Department, he worked for one year in STATLAB (UNR Statistical Consulting Unit) and is currently doing research with Dr. Anna Panorska. For the last two years Fares has an internship in the Center for Health Data & Research, Nevada State Health Division as a biostatistician and SAS programmer. As an international student Mr. Qeadan was honored to receive the International Student Award for two consecutive years (2003-2004), and during his stay in the United States, Fares has received more than 10 scholarships and awards. Fares is a C/C++, Qt, Scheme and Prolog programmer and has a rich knowledge in programming and modeling using statistical/mathematical software such as Maple, Matlab, SPSS, Minitab and SAS. Fares' contribution and role in the development of goSmart consists of programming the scheduling engine, database communication, networking, real-time and security aspects of the software and their GUI. Fares is currently working on communicating with the motion sensor and his ultimate goal is to implement his own original encryption algorithm which can be used in the goSmart software. As a team member Fares is in charge of reviewing (inspection/testing) all new implementations into the software.

Name: Siraj Malik

Organization: University of Nevada, Reno (CS426)

Profile: Siraj Malik is a senior at the University of Nevada-Reno. He will be graduating in May, 2006. His main interests in computer science involve programming graphical applications using OpenGL. After college, he hopes to pursue a future in the video game industry, writing graphics intensive software. Mr. Malik is also planning to attend graduate school in the field of computer science in the near future. Siraj is presently learning PHP and JAVA programming and web-development. Siraj's main involvement in the goSmart project was developing the graphical user interface and being part of the overall maintainance of the system.

Team Advisors

Name: Sergiu Dascalu, PhD.

Organization: University of Nevada, Reno

Profile: The instructor in charge of our Senior Project course (CS426). Dr. Dascalu is the recipient of the 2005 Lemelson Award for Innovation and Invention in Teaching or Research. He has been involved in software engineering for more than 20 years. The development of goSmart software has received a great deal of support from Dr. Dascalu in terms of motivation and creativity. As a team, Dr. Dascalu helped us build trust and energy in our team relationships.

Name: Fred Harris, PhD.

Organization: University of Nevada, Reno

Profile: Dr. Harris is the overall project mentor for the goSmart software development. He is the 2005 recipient of the F. Donald Tibbitts University Distinguished Teacher Award. Dr. Harris is the author of articles, books, chapters and award winning technical papers. Our senior project has received a great deal of support from Dr. Harris, resources and technical support are provided by him in addition to periodical meeting designated for the development guidance and counseling.

Name: Rasoul Baghal, PhD.

Organization: International Game Technology, Reno, NV

Profile: Dr. Baghal is the director of Gaming Operations and Engineering Support for International Game Technology and is serving as an outside source for input on the project. Dr. Baghal will be conducting an independent test of our software once a working model has been completed. Dr. Baghal will provide feedback to the group based on his interactions with the software and provide any recommendations he feels may help.

Market Potential

We think goSmart software has potential for effective use as a commercial product. In the recent year, wireless communication and home automation held commercial promise in both, the domestic and international market. Traditionally most academics are driven less by commercial promise than by the educational aspects of their accomplishment. However, creativity and technological innovation empowers its progress from the competition game and therefore realizing any academic product its commercial promise is a necessity. Our team is planning to market the goSmart software upon the completion of its final product to interested users.

Evidence of User Interest

Obtaining positive evidence of user interest still awaits further research. However, there are many systems for home automation in the market which is nothing but an indicator for user interest. Some of these systems are X10 based technology and others use different hardware technology like Z-Wave and INSTEON. Among them is HomeSeer control Software v2.0 (Z-Wave tech.) which control

and monitor lighting, appliances, security, HVAC, telephone and home theater all from one central point. Another home automation system is the mControl software which supports both the INSTEON and X10 protocols. Finally an example of the X10 technology is the Firecracker Fuse Timer Software which allows you to add scheduling capability to Firecracker. Turn on the coffee pot, radio and your kids bedroom lights all automatically. Based on such available software, users' interests in home automation systems are then predicted.

Social Impact of the Project

goSmart simplifies life and contributes in fulfilling the growing interest in smart homes. The use of this product is expected to provide better and safer living conditions leading to an improved quality of life and independent living. Luxury and convenience are what most people seek. Going wireless in controlling some devices within the house using the home computer will provide the sense of security and ease of home management. The social impact of this product is very significant to the general public particularly to both elderly and disabled people.

Why goSmart

The novelty of the goSmart solution is placed on its system design and integration of multiple aspects that most other related software don't have:

- goSmart does not require a specific COM port number. The user can specify the COM port available in their machine.
- goSmart software is a multi user system.
- goSmart allows the user to add, delete or schedule devices within different zones in the house.
- goSmart will send an email to the owner upon any security breach detected by the motion sensor.
- goSmart will (in future versions) allow the use of Macros to control several devices at once.

Strategies

We are planning to market the goSmart software via an internet business which does not require any facilities or shipments methods. Buyer will be able to download the goSmart software after they

pay for it. Our main focus will be on the proposed product and what problems customers might have that would necessitate this product. Our advertisement theme will concentrate on explaining how much time and money the system could save customers. Consumers want to save time, money in their day-to-day life, so, our main strategy is to address these concerns, by offering a smart home automation system called goSmart.

Budget and Business Plan

Estimated Project Costs

The following projected costs represent the costs associated with distributing a commercial version of goSmart.

Research Budget Plan				
Category	Estimated Quantity	Estimated Cost per Unit	Estimated Subtotal	Notes
Research Equipment				
Dimmable Lamp Modules	5	\$12.99	\$64.95	Two Prong
Appliance Modules	3	\$13.99	\$41.97	Three Prong
Motion Sensors	2	\$29.99	\$59.98	Eagle Eye wireless sensors
Firecracker	2	\$16.99	\$33.98	Wireless transmitter
RF mini transceiver	8	\$12.99	\$103.92	One transceiver needed per house code
Robo-Dog Security Alarm	1	\$44.99	\$44.99	Simulates the barking of a dog.
Research Costs Total			\$349.79	
Software Costs				
QT 4.1 Desktop Edition	1	\$3,300.00	\$3,300.00	Desktop Edition provides Database and
			\$0.00	Network module needed for this project
			\$0.00	
			\$0.00	
Communications Costs Total			\$3,300.00	
ESTIMATED MARKETING GRAND TOTAL			\$3,649.79	

Business Plan

A long term business plan is currently under development for goSmart.

Glossary

X10 A communications "language" that allows compatible products to talk to each other using the existing electrical wiring in the home
[www.smarthome.com/about_x10.html]

Firecracker Firecracker is really just a wireless transmitter.

Project Related Resources

Problem-Domain Book

1). Gordon Meyer , **Smart Home Hacks**. O'Reilly Media, Inc. First edition. 2004.

Smart Home Hacks offers integrated solutions to enhance safety, comfort, and convenience in a house. The book is built upon tips and tools for automating your house. It illustrates the use of the x10 programming throughout numbered "hacks". Smart Home Hacks was very helpful in illustrating the idea of automation and control by clear and concise examples.

Reference

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