

Self-Sustaining Heated Driveway

Proposal

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Dear Dr Shawki Areibi

Enclosed is our proposal for a *self-sustaining heated driveway* system.

We would like to take this opportunity to thank you for allowing our firm the privilege of designing and implementing this project. We hope that this proposal marks the beginning of both the development of an efficient and productive system and a long and fruitful relationship between Smart Systems and yourself.

This is a formal proposal that covers the main idea of a self-sustaining heated driveway. Enclosed in this package are background information and project phases. It also details a strategic work schedule with deadlines, objectives to be met, and an approximation of the budget needed in order to implement a prototype.

We hope this proposal meets with your approval and we will be contacting your representatives within the next few days to follow up on our offer.

Sincerely Yours

Joshua Gibbs

Ammar Abu Leil

Nicholas Pollard



Executive Summary

Smart Systems Consulting Firm is a business in the market of smart technology solutions. Our company is motivated and innovative with design solutions that are efficient, cost effective and environmentally friendly. Our firm employs brilliant programmers and engineers that work with clients to achieve a solution that is suited for their needs and goals.

Dealing with harsh winters and heavy snowfalls is a common problem amongst most people, especially with the removal of snow. Our company provides a self-sufficient heated driveway solution that will eliminate this common issue, save money, and use sustainable methods to do so. We provide an innovative, smart, self sustaining, and automated system that requires minimal manual input.

The following proposal document will contain the essential information needed to understand the problem at hand, how it is going to be dealt with, and specific deadlines for the solution to be designed. Included in this report are our firm's timeline, budget, explanations of our solution, its benefits to our clients, and background on the technology

The major objectives of the project are as follows:

- Self sustaining green system
- Cost effective
- Decreased manual labour
- Intelligent, mostly automated system

In the end, the main goal of our company is to build a self-sustaining heated driveway that is environmentally friendly, can improve lifestyle, while being self-sustainable and unique from current solutions available. By allowing us to install this design, costs, time, and labour will be reduced. We are happy to be given an opportunity to design this innovative project and we plan to complete the listed objectives above.



Company Profile

Smart Systems Consulting Firm is a newly established firm in the business of promoting and designing innovative solutions. Our business strives in developing sustainable and environmentally friendly design solutions. Our mission is to provide an easier tomorrow with technological systems that are efficient and innovative to make living easier.

We employ bright and innovative engineers and programmers who are dedicated to helping our clients design and implement the most efficient systems to their needs. The staff at Smart Systems Consulting Firm (SSCF) consists of Project Leader, Ammar Abu Leil, Nicholas Pollard, Chief Systems Programmer, and finally, Chief Systems Engineer, Joshua Gibbs.

Smart Systems believes that this team of workers is a great combination for the project at hand. Ammar has great management skills; therefore he will oversee the operation and management of the project. Nicholas Pollard is very knowledgeable in several high and low level languages, thus making him an excellent addition to the team. And finally, Joshua has a vast experience in hardware and simulation, making him a very valuable team member as well.

Smart Systems consulting firm looks to achieve a model system for Dr. Areibi. With our dedicated staff of Engineers and programmers, we look to provide a solution that would better benefit you and future customers.



Proposal Statement

Technological systems are evolving and becoming more attractive to the consumers due to the benefits they provide in improving lifestyle, sustainability, and efficiency. Such markets are smartphones, integrated devices in cars, computers, coffee makers, etc.

Canada is one of several countries that is known for its harsh winters. At times, it may be difficult to shovel the snow due to accumulation, constant snowfall, or finding the time to do so. Smart Systems Consulting Firm is pursuing to deal with this problem by designing intelligent self-sustaining heated driveways.

Smart Systems' design of heated driveways is going to differ from the current solutions available by being an intelligent, self-sustaining system. Meaning, that this solution will be as efficient as possible, and almost entirely automated so that minimal effort is needed to operate or activate the system.

This technology will achieve the above benefits by:

- Continually monitoring the conditions of the driveway by using different types of sensors
- Effectively sensing and melting the accumulation of snow
- Powering the system with solar cells
- Using a microcontroller for this system, as it will provide the appropriate decisions, tasks, scheduling, etc.
- Making the system as automated and efficient as possible

This technology will improve one's lifestyle, time management, and effort, as it will increase safety from slip hazards, and health, due to the time spent shoveling the snow manually.

With the time allocated, Smart Systems Consulting Firm is focused on a design model that targets the major deliverables of the system identified above. Due to the short time period given to design this solution, a working prototype is expected to be constructed, however, it will be a scaled down model. In order to produce this working prototype, Smart Systems estimates the duration of the project to be 74 days: November 23,2012 being the completion date.



Background

Introduction

One common downfall in living in a country that has harsh winters is the amount of snowfall seen and dealing with the removal of it. At times, it may be difficult to allocate time to shovel the snow. The weather can also make it difficult to shovel regardless of the time needed to do so, such as shoveling during a blizzard. One way to deal with this issue is to install a heated driveway. There are currently several different types of solutions available such as an electrically powered grid, a geothermal solution, heated water pipes, or hydronic solar systems [1]. The problem with these current solutions is that they are expensive to maintain and install, and may not be as efficient as can be. One of Smart Systems' goals is to provide the same service as the current solutions while decreasing installation and maintenance costs. Smart System's heated driveway system will provide a solution that will be self-sustaining, automated, and intelligent while decreasing costs.

Smart Systems' self-sustaining heated driveway is efficient because it will be battery and solar powered. Solar panels will be used to charge the battery, while an emergency power supply will be connected in case the battery no longer has power. One of the greatest features that will differ our solution from the current solutions is its intelligence and efficiency. The system will be capable of detecting when the heating grids should be powered, thus contributing to less power consumption. There are two main components to this system that make it unique from current solutions: the heated matrix under the driveway; and the programmed microcontroller.

The heated matrix is an innovated idea that Smart Systems has come up with to better reduce the amount of power consumed by the heating of the driveway. Most current solutions will heat the entire driveway, which consumes a lot of electricity, thus costing more money. Our solution is capable of heating up certain sections of the driveway instead of the whole grid. If, for example, a car was parked on one half of the driveway, then no snow would fall on that section of the driveway, thus only one half of the driveway would need to be heated.

The microcontroller to be chosen for this system will be very efficient in terms of power consumption and speed. The system is capable of features such as a user interface, fully automated functionality as well as manual controls, data mining, and accessing weather information from the internet in order to anticipate what to do.

Constraints and Criteria

In order to construct a functioning prototype that can be implemented and further improved on, the system must meet certain constraints and criteria. These constraints and criteria are outlined as follows:

Table 1: Table listing Constraints and Criteria of the design solution

Constraints	Criteria
Must be able to sense snow	Should be as durable as possible.
Must effectively melt snow	Should be as reliable as possible
Must use solar panels as main source of power	Should be as cost effective as possible
Must be automated	The faster the snow melts, the better
Must eliminate need for shoveling	
Must be safe at all times	
Must have a back-up power source (city electricity)	
Must at least heat a two-car driveway	

The constraints outlined will help in designing the system according to these specifications. The criteria will help in optimizing the system by trying to improve certain aspects as much as possible. Smart Systems will follow these constraints and criteria in designing this system.

Work Plan

Schedule

The project at hand is quite complex when viewed as a whole. But when it is broken down into sub-projects, or phases, the project becomes easier to complete. The following are the different phases and their estimated schedules:

Table 2: A list of the phases along with their scheduled dates in order to complete the project

Phases	Description
PHASE 1 Sept 10/12 – Sept 14/12	
Microcontroller with Battery Supply	Obtain a microcontroller and set it up with an extremely simple program in order to become familiar with the MCU.
PHASE 2 Sept 12/12 – Sept 24/12	
Microcontroller with Solar Cells	Implement solar cells that can charge a battery and also power the microcontroller.
PHASE 3 Sept 20/12 – Oct 2/12	
Main Sensors	Connect main sensors to the microcontroller, such as: temperature sensor and conductivity sensor.
PHASE 4 Sept 25/12 – Oct 4/12	
Heated Wires	Connect the heated wires to the microcontroller using relays (in this case, the heated wires will be represented using LEDs).
PHASE 5 Oct 5/12 – Oct 18/12	
Basic Program	Write a basic program that can fetch data from the sensors and power the heated wires
PHASE 6 Oct 19/12 – Oct 23/12	
Pressure Sensors	Add pressure sensors on the drive way in order to determine if certain parts of the drive way need to be heated or not: depending on if a car is present or not.
PHASE 7 Oct 24/12 – Nov 8/12	
Optimize Program	Improve the program so that the system can be as efficient, smart, and functional as possible. (Ex. Data mining, retrieving weather information from the internet).
PHASE 8 Nov 9/12 – Nov 23/12	
User Interface/Display	Implement a user interface for manual temperature settings, ON/OFF, and display of usage.

Gantt Chart

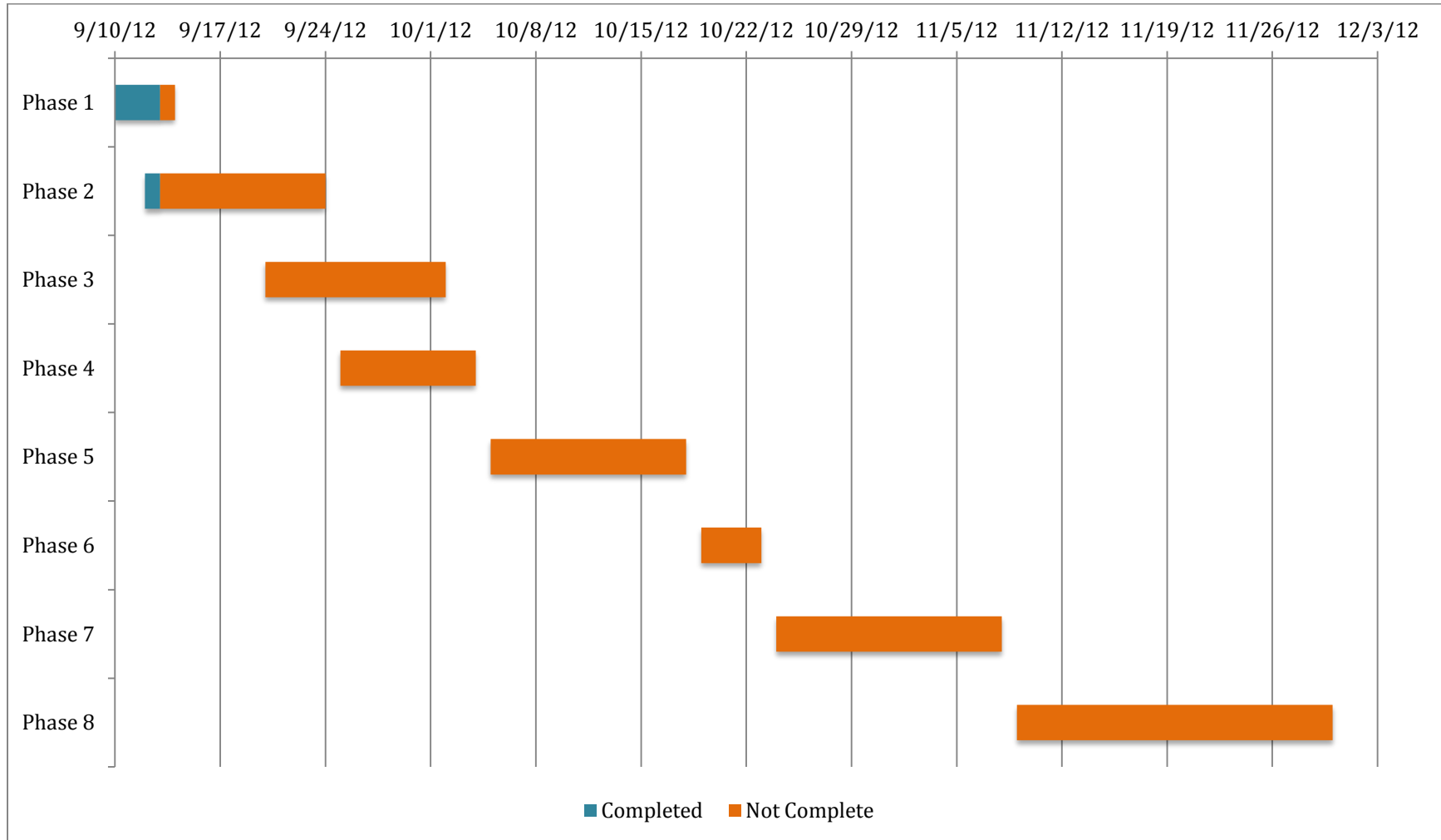


Figure 1: Gantt chart displaying duration and specific parts of phases

Objectives

In order to complete this project, short-term objectives and long-term objectives need to be defined and completed. Short-term objectives will consist of specific deliverables that need to be completed according to the proposed phases, where long-term objectives will be directed to the system as a whole. The following is a list of the objectives that need to be completed for this project:

Short-term Objectives

- Choose cost-efficient and durable equipment (ex. Microcontroller, sensors, solar cells, etc.)
- Complete each phase on time, if not earlier

Long-term Objectives

- Have working prototype
- Make well documented reports and programs so that the project can continue after the allocated time given
- Ensure cost savings

Budget

In order to design and implement a prototype of a self-sustained heated driveway, specific equipment is needed. The following table outlines the equipment that is predicted to be used along with an average price of each component.

Item	Cost	Quantity	Final Cost
Microcontroller [2]	\$70	1	\$70
Solar Panel [3]	\$50	1	\$50
Sensor [4]	\$20	2	\$40
Relay [5]	\$5	2	\$10
Op-Amp [6]	\$5	2	\$10
Battery [7]	\$15	1	\$15
Wire [8]	\$0.10	20	\$2
Total			\$197

References

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