



Crown Agriculture Solutions
Farming made simple

School of Engineering Science
Simon Fraser University
Mike_Saad@sfu.ca

July 28, 2019

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 405W Project proposal for a Complete Farming Solution System

Dear Dr. Andrew Rawicz:

The attached document, Proposal for a Complete Farming Solution System, outlines my project for ENSC 405W and ENSC 440. Crown Agriculture Solutions'(CAS) goal is to significantly enhance crop yield at a fraction of the cost by providing pertinent data creating maintenance seamless. CAS' first product is "Costless Node Network" or CNN. CNN is a network of sensors spread throughout the farm providing the farmer necessary data thereby significantly improving crop.

The proposal is to provide an overview, scope, and benefits of the proposed product, outline of design considerations. A detailed project schedule and timeline are also included. Proposed is also innovations set aside for future endeavors due to time constraints.

Crown Agriculture Solutions is operated by an innovative marketing personnel with a broad skill set to design and produce customer focused products. This capstone project proposal is prepared in partial completion of the graduation requirements at the Simon Fraser University in the Engineering Science program. I have exceptional management skills demonstrated on a large-scale of 1000+ guests. Generated strong work ethics from a set of 15 teenagers. I have a proven track record of transforming a simple idea into a viable product and a lucrative corporation.

If you have any questions or concerns regarding my proposal, please feel free to contact me by my direct line at (778) 840.8462 or via email at mike_saad@sfu.ca

Sincerely

Maikel Saad



Crown Agriculture Solutions

Farming made simple

A Farming Solution proposal

Proprietor: Michael Saad
[Mike Saad@sfu.ca](mailto:Mike.Saad@sfu.ca)

Submitted to:

Craig Scratchley (ENSC 405W)
Andrew Rawicz (ENSC 440)
School of Engineering Science
Simon Fraser University

Prepared On July 28, 2019

EXECUTIVE SUMMARY

As the cock screams at the dawn! Jack Bill Jr. feels the stress already and all 1000 hectares of responsibility. As he prepares his breakfast, he thinks about all the money he may be losing every second from the instant the seed was planted until it is time to harvest it. Furthermore, how laborious and tedious everyday life is for him! There is likelihood of loss of investment from every angle during the seed's lifetime and it could all add up very quickly. This problem is so serious to the point that some farmers may lose entire crop to barely breaking even.

This is a serious issue with virtually all farmers worldwide. Farmers are constantly worried about the year's crops, how to maximize yield, and how tedious and laborious everyday life is. They feel stressful about their crops because no matter how hard they try the yield is still, in their eyes, less productive! Farmers cannot keep track of every inch of their fields and hence about the various needs of different areas in the farm. In most cases, they have no option but to spend money on unnecessary major costs including pesticides, fertilizers, seeds planted in vain, dehydration, storage, storage buildings, insurance for everything, farm vehicles, farmers' compensation. My proposal is to capture all information and put farmers in control and suggest action on area in distress from any of the above shortcomings. Timely action on various issues will allow farmers to act quickly and decisively to mitigate certain issues and hence healthier profits.

Crown Agriculture Solutions has formulated a comprehensive solution to solve all the aforementioned problems encountered by farmers. CNN helps farmers generate quality crop from almost every seed planted by empowering the farmer with the tools necessary to do so. Further CNN will cut all costs to only a small fraction. This means healthier crops, higher percentage yield and greater satisfaction.

Crown Agriculture Solutions consists of an innovative marketing with a track record to prove it. Rich expertise in electronic engineering combined with powerful marketing and management skills. Further a strong dedication to customer satisfaction and thereby numerous referrals and strong testimonies from acquired customers. To demonstrate, I have a proven record to be able to turn any problem, no matter the size, into a powerful lucrative corporation. With the aforementioned powerful entrepreneurial skills paired with rich expertise in electronics, I believe I'm an exceptional candidate for this task.

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Introduction/Background

Project goal is to engineer a way to extract information from a farm with an effortless and productive manner. Collected data is intuitively presented to the farmer to enhance their crops. The type of data, volume of data, speed of access, will be the deliverables for this project. Project background stems from the laborious task of farmers to manually and visually judge and collect data and this leads to inefficiency, poor and limited access to data, as the size of the property increases. My goal is to minimize physical efforts to collect data with initial capital cost and maximize productivity for the farmers.

This product is a comprehensive solution to all the challenges faced by farmers across the globe. Farmers suffer from low yielding and increasing costs to the point that most barely breakeven. CNN's primary goals is to reverse this experience by providing high resolution data and take control of the crops and expect healthy yield year after year. Using CNN means deploying a method which leads to a very healthy crop yield at a very low costs. Furthermore, CNN means a significant reduction in tedious labour.

Scope and benefits:

The goal of this section is to deliver an outline, and benefits thereof, for each part of the product deliverables.

Node:

Each node is expected to be robust due to its required depth in soil. All parts of node are below soil surface except antenna making it withstand any damage to hardware. Each node will be equipped with a simple battery. This is sufficient considering a node only uses very little power and any battery will last several years. After such time period the product will surely have many upgrades making the new product lucrative and cost-worthy.

Moisture Sensor:

Sensor's primary purpose is to detect a decrease in soil water level, report to Base, and suggest quantity of water necessary to compensate for aforementioned loss. This sensor

will not only cut farmer's water consumption costs significantly, but it will also ensure no plants will be dehydrated.

Network Properties:

Each node is equipped with an antenna operating in the ISM band, which allows for a longer range and lower power consumption than other networking options and not requiring a license to operate. The range, low power consumption, and the low bandwidth make this communication tool the most suitable for CNN. Each node is to report to Base station any changes in conditions that require action from the farmer. Changes are reported as soon as they occur. The sensor density could be determined by the farmer or as seems best fit for the circumstances. This may differ for each customer. For cost analysis and simplicity, the example of a node every 3m x 3m which is 10m² will be utilized. Most commercial farms are approximately 1000 hectares meaning that there are 400 nodes necessary per acre across the farm.

Base Station:

The Base Station is a key component of this system. It gathers feedback from each node and suggests action to the farmer. It must have the capability to communicate, in real time, with all nodes regardless of the farm size. There is potential of a need for multiple base stations due to the high volume of nodes. The Base Station needs to handle a high volume of reports from nodes as well as determine the location of each report via the node ID. Further, the Base Station must have the capability to intuitively and in real time generate a report to the farmer at convenient times.

Farmer Report Application:

This App must present reports in an intuitive manner such that the farmer fully understands necessary action at first glance. This is what the farmer sees and is possibly the main deciding factor in purchasing the product. Crown Agriculture Solutions' clear aim is to design a User Interface that will make this product as lucrative as possible at first glance.

Further Benefits:

Labor:

In addition to the aforementioned benefits, CNN aids the farmer in cutting labor costs down to a fraction. This is because the system makes farming efficient by only prompting the farmers to act when necessary.

Machines:

Less effort necessary brings forth major cuts in machine usage costs. This translates into major savings in gasoline, maintenance, depreciation, possible rent, and repair and insurance.

Buildings:

Better crops mean limited need for storage. Storage can incur major costs in building maintenance, depreciation, and repairs.

Insurance:

A healthy harvest means minimal need for crop insurance and storage insurance.

User Interface:

CAS has developed a User Interface, which is a powerful yet intuitive tool that even a novice user can understand. Thereby creating a lucrative image for CNN at first glance. CNN boasts a 1-click Interface creating a simple environment for the farmer. Thereby empowering the farmer to control his entire commercial asset with complete simplicity

RISKS:

There are two major risks. Hardware failure and software failure.

Node Hardware Failure:

Hardware failure occurs mainly at the nodes. Sensors might become less accurate and might malfunction in the worst case. Such failure might occur due to a power surge. Power issues may arise due to voltage levels not within tolerable boundaries. Since sensor is a capacitive sensor, accuracy of data acquired may decrease with years.

Node Firmware Failure:

Firmware crashes are common in almost any system that does not update its firmware. Therefore, firmware updates will be sent to the nodes frequently. However, if the node firmware is corrupt, a clean firmware version can be sent via Base Station.

Report Failure:

Before reporting a change in conditions to Base Station, A node will sample two times within a short interval between samples to ensure correct data reported. This will be achieved by a change greater than the sensor threshold. Furthermore, report is sent twice for verification purposes.

Base Station Hardware Failure:

To ensure that the Base Station is functioning according to design parameters, redundancy is used once again by adding a second base station. The second Station is constantly checking for errors in the main Station. Once the Main Station is corrupt the secondary Station will act instead thereof and request action from the farmer.

Further Failures:

The base station Software as well as the farmer App software is constantly updated via WIFI. In the case of hardware failure, with farmer's permission, Crown Agriculture Solutions will deliver necessary hardware to farmer with expedited shipment. Further Crown Agriculture Solutions will perform a diagnostic check to discover any anticipated failures in near future.

MARKET AND COMPETITION:

Although this is a profitable topic, there are many hurdles facing engineers around the globe including distance-range, power consumption, a maximum of one, rarely two, sensors per node, node density, difficult User Interface, complex technology and algorithms, Wi-Fi-based, unnecessary high bandwidth, unnecessary parts, research-based rather than Market-based and of course security.

Furthermore, all competition is purely research-based, and the very latest thereof was published more than a decade ago. Although there are many predecessors in this field, they are purely research-based and such technology is clearly outdated making Crown Agriculture Solutions, by far, the market Pioneer.

Crown Agriculture Solutions has a clear advantage in many aspects including an unparalleled intuitive user interface, minimal engineering hours, a stand-alone system via continuous error checks, low-bandwidth network.

An unparalleled user interface is not only intuitive but presents tasks in minimal effort format. Although all systems are error-prone, we provide built-in recovery system from most issues.. Comprising of hardware redundancies, frequent software checks, regular firmware checks, simpler and cleaner code translates into minimal engineering hours. Finally, minimal components used incurs wiser use of engineering hours towards new sensors and innovative upgrades to the system making newer versions much more lucrative and cost-worthy.

COMPANY DETAILS

Crown Agriculture Solutions was founded in March 2019. The Company name, logo, and the product name are carefully chosen. Crown was chosen to represent the superiority of the company in every aspect. "Farming made Simple" was chosen to attract the farmer at first glance. CNN represents the speed and accuracy of the product. My goal is to design and produce a comprehensive solution that will aid the farmer in producing a nearly perfect crop yield at a fraction of the cost with minimal effort.



Crown Agriculture Solutions

Farming made simple

Owner Profile

As a senior engineering student, I have been involved in many projects including video compression using MATLAB, programming an LCD display on FPGA in assembler and VHDL. designed a miniature version of Facebook in C++, as well as solutions using java. My goal is to produce clean reusable code in combination with code runtime optimization and minimum memory usage. Languages I have used include Assembler, Java, VHDL, MATLAB, C++, HTML, and Python.

Milestones

Alpha Stage: Proof of Concept

Initially, a communication via ISM antenna between two PIC microcontrollers is required. Communication is tested by sending data from one SPI port in the microcontroller and confirming receipt of data sent.

Several sensor data acquisitions by microcontroller are conducted. Initially a moisture sensor is inserted in a dry pot and voltage is recorded. Following, the pot is hydrated and data is acquired. Voltage from moist acquisition should be less than dry acquisition as this is the nature of the sensor.

Beta Stage: Prototype

Beta stage includes numerous optimizations to the Alpha stage. Initial goal is to minimize power consumption using power switches to power down antenna and sensor. Further only power utilized is to maintain timer in PIC while in sleep mode. Once timer reaches end of time period sensor data is acquired and, if at threshold, data is sent via antenna to central node. Central nodes are utilized to compensate for antenna limits. Further breadboards and wires will be eliminated. An android Application will also be included in this stage.

Gamma Stage: Production

Gamma stage is entirely focused upon cutting costs. Options include one-time programmable microcontrollers in conjunction with a much simpler antenna. Goal is to eliminate SPI thereby significantly cutting costs.

Proof of Concept Costs

Item	Quantity	Unit Price(USD)	Total (USD)
Raspberry Pi zero W package	2	35	70
Kit	2	20	40
HDMI screen	1	75	75

Keyboard & mouse combo	2	20	40
Moisture Sensor	5	10	50
Plants	5	10	50
Sd card	2	10	20
PIC16F18875	5	2	10
Development board for PIC	2	55	110
Antennas	6	5	45
batteries	12	1	15
Pvc pipe and cover	1	20	20
Total			545

Product cost:

The strength of this product is that a complete node as described above can be purchased with a price under one American dollar. A typical commercial farm size is 1000 hectares and therefore needs 400 nodes per acre for a typical vineyard. The total cost of my system per acre in bulk quantities is approximately \$40 USD per acre at a cost of \$0.1 USD per node. The total cost of CNN for a 1000 hectare vineyard is approximately \$100000. Farmers are generally expected to be able to afford this system and when paired with a dream system that cuts costs significantly, makes life much easier, as well as produces a much higher crop yield. I therefore believe that my system will provide a dependable and reliable approach to farmers at an affordable cost. This is considered a negligible cost to the farmer simply because it will return the cost of deployment very quickly.

CONCLUSION

Farmers have been faced with many hurdles since the beginning of civilization. Such hurdles are surprisingly contradictory. Farmers at times dispense much larger volumes of water than is needed by plants and thereby incurring needless costs. On the contrary, a considerable issue is the drying of plants.

Crown Agriculture Solutions' first, of many, innovation, CNN, addresses such issues by informing the farmer of the amount of water necessary in the area surrounding each node thereby cutting hydration costs as well as ensuring plants will not be dehydrated.

CNN is the first existing solution in the market with such a powerful package to ensure a rich crop yield paired with cutting down unnecessary costs. CNN is a combination of low power nodes enhanced with low bandwidth technology requiring minimal Engineering hours combined with a powerfully intuitive User Interface making CNN a lucrative solution to the farmer at first glance. Crown Agriculture Solutions aims to continue to innovate CNN and to tailor it to meet every farmer's needs. Thus, driving CNN into every farmer's hands across the globe!