January 20, 2014

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

Re: ENSC 305 Project Proposal for the BikeSmart System

Dear Dr. Rawicz:

The following attachment is our outlines for the ENSC 305 project, *Proposal for the **BikeSmart System**,* a smart bike safety system. Our goal of this project is to equip the bicycle with blinking signal lights, allowing riders to control using the voice recognition system on their helmet; in addition, some other features will be added to the bicycle accordingly.

The company details, design considerations, benefits, funding, budget, and milestones of our project have been summarized in this proposal. DreamRide Corporation consists of five talented fourth year engineers: Stan Yang, Nadia Tehranchi, Jason Coo, Paul Chen, and Conrad Wang.

Please feel free to contact our CCO via phone: 778-889-2677 or email: ntehranc@sfu.ca. We are very eager to hear your feedbacks of our products.

Sincerely,

Jason Coo

Jason Coo
President and CEO
DreamRide Corporation

Enclosure: *Proposal of BikeSmart System*

Proposal for the BikeSmart System

A smart and safe bicycle system

PROJECT TEAM

Stan Yang
Nadia Tehranchi
Jason Coo
Paul Chen
Conrad Wang

CONTACT PERSON

Nadia Tehranchi (CCO)
ntehranc@sfu.ca

SUBMITTED TO

Dr. Andrew Rawicz – ENSC 440W
Steve Whitmore – ENSC 305W
School of Engineering Science

ISSUED DATE

January 20, 2014

Executive Summary

> *"Thousands of cyclists are injured every year in collisions with motor vehicles in B.C., according to the Insurance Corp. of B.C. Between 2006 and 2010 - the latest year for which annual statistics have been collected - some 2,157 cyclists were injured in Vancouver alone, more than five times as many as in Victoria and Surrey, which recorded 413 and 410 collisions respectively. Five cyclists were killed in that same five-year period."* [3]

> *"In Vancouver, which collects data on cyclists through electronic counters on its bike routes, city officials estimate at least 60,000 trips a day are now made by bicycle - up from 20,000 in 1990 - with more than 3,500 cyclists commuting to work downtown every morning."* [3]

> "David Hay, a Vancouver bicycle accident lawyer, said some of his clients are suffering from brain damage and quadriplegia from a bicycle crash, but it's up to them to prove negligence against the driver in a car/bike crash. This is often tricky, he added, because the cyclists may not have the resources or may not recall what happened because of head trauma or post-trauma amnesia." [3]

The headline news, "Cyclist fully at fault for collision following careless lane change" or "Cyclist 75% at fault for intersection crash for riding with no reflection" is all around the world [1]. According to Insurance Corporation of British Columbia (ICBC), In the Lower Mainland, on average, 600 cyclists are injured and four killed from May to October every year [2]. When it comes to cyclist's safety, visibility is the key. To become visible to other driver at road, you might decide to wear a bright jacket, but is that surely enough? Have you ever thought about what is going to happen on a rainy night when you are making turns? Do you think the car behind you be are aware of your next movement?

A group of five talented engineers with background in electronics, systems, computer, and biomedical engineering gathered together to develop a device that will interface old method of hand signaling for cyclists. The DreamRide Corporation (DRC) established on January 6, 2014 by these students from Simon Fraser University in Canada. DRC members are consists of well trained engineers in medical devices, programming, operating systems, and CAD designers who decided to develop a new device for cyclists.

This document proposes an idea of wireless bicycle turn signal, the BikeSmart System**,** which designed to increase not only the riders' safety but also other road users' safety. This system will help to alert cyclists and other motorists behind of you to be aware of your next movement. While hand signaling might put cyclists at risk of losing their controls of the bicycle, it is especially danger on rainy days and on slippery roads.
By adding a wireless microphone on the helmet, it will allow more users, such as one handed people, to use the bicycle and communicate with other road users using the BikeSmart system. Furthermore, the team decided, according to the time frame of this project, to add more features such as slope detection system, calories and heart rate count, and so on to record the cyclists' exercise details while they are biking.

The project will span a 13-week of challenging work and the final design, with its specific features will be ready for demo on April 1, 2014. According to our estimation, the entire project budget is

about $700, which is expected to be funded by the ESSEF and other sources available at SFU. We prepare our company to the new challenges in future, and our goal is to educate and benefit our society especially motorists and cyclists to be more safely while driving or riding. We believe that **"Visibility is the Key".**

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Introduction

"Share the road safely". Sounds good in theory. The reality is that there is an average of 19,000 cyclists seriously injured or died in reported road accidents over the year [4]. Terrifying enough, though, these figures only include road accidents that were reported to the police, mean there are still an amount of unreported cyclist involved accidents. One of the most common contributory factors is "fail to see properly" by the riding or the motorist which usually result in cyclist riding into the path of a motor vehicle [4]. Our company spotted the problem and realize this problem is not unsolvable.

The DreamRide Cooperation believes that "Visibility is the key". Being as visible as possible to other road user is critical. While attaching fluorescent flag onto the bicycle could increase cyclists' visibility, this is not exactly ideal for solving the lack of communication between cyclists' and other road users.

The BikeSmart system is a signaling light device developed to allow better communication between cyclists and other road users, meanwhile removing the risk of the cyclists losing their balance when hand signaling. While there are similar products existing in the market, the BikeSmart system has a reliable voice recognition system, allowing users to control the signal lights simply by speaking to the microphone integrated in the helmet. If, however, users prefer the traditional way of controlling their signal lights, there is always the slide switch controller mounted on the bicycle handle. The BikeSmart system does not only provide the benefit of better communication, it also encourages users to exercises as it computes the calories burnt, and monitor the users' heart rate.

This document presents the proposal project of creating the BikeSmart system, providing an overview of the product, outlining the system, risks and benefits, company details, cost and funding, and the project scheduling and milestone. Alternative solutions and existing forms of the BikeSmart system are discussed and critiqued in the market and competition section. The BikeSmart system is the collection of existing features with the enhancements of a voice control system, and various unique functions.

System Overview

The BikeSmart system will be consisted of two primary features which will be designed to control the LED signal signs installed under the bicycle saddle. The first primary function is the voice recognition system that picks up keywords such as “left” and “right” from the cyclists. These analog inputs are converted into digital inputs allowing the microcontroller to send the correct signal to the LED panel. The second primary feature will be the push button control system, which results the same as the first primary feature but functions differently. Instead of detecting keywords from cyclists’, the second primary feature is consisted a switch mounted on the handlebar, such that the cyclists’ will be able to select the corresponding LED signal lights by simply sliding the switch. In addition to the primary features, the BikeSmart will have a monitoring system which is used to display information like calories, slope, and heart rate to the cyclists. Combining the primary and secondary features, the BikeSmart will provide cyclists a safe and functional riding condition.

The following open loop flow chart shows how the BikeSmart system will respond to the cyclist.

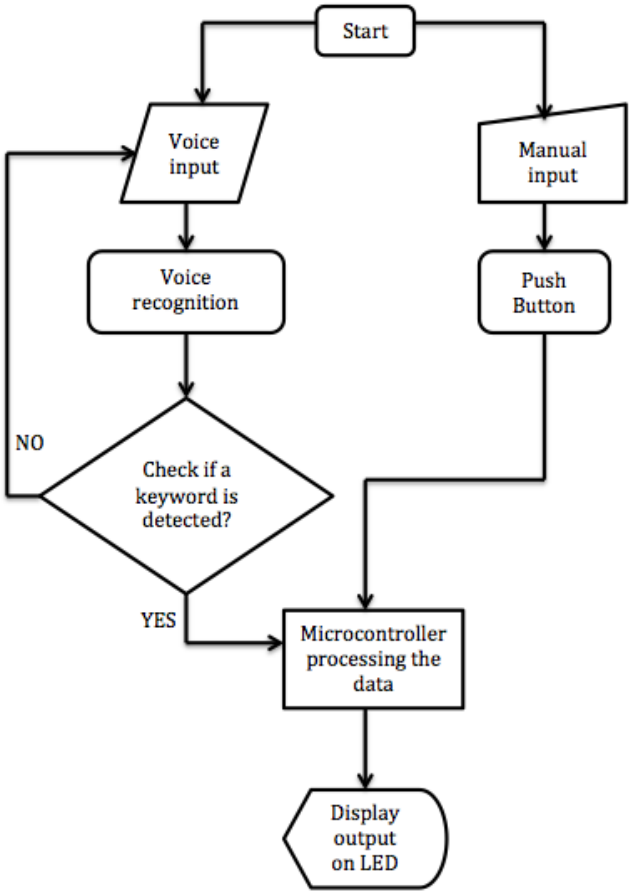

Figure 1- Flowchart of the BikeSmart System

Existing Solutions

In British Columbia, cyclists are required to use hand signals before turning. While making the signal gestures, cyclists will only have one of their hands on the handlebar. Under this condition, it would be challenging for cyclists to maintain a straight line, which might lead to accidents. According to Statistics Canada, approximately 15,751 cyclists are seriously injured every year [4]. Some of the injured cyclists used the wrong hand signals, while some are injured making hand signals and suddenly losing their control of the bicycle due to the strong airflow caused by the passing vehicles.

Smartphone applications are now very popular among the cyclists' communities. Applications help them to see the information on the Smartphone mounted on the handlebar. However, the small displays on the phone screen and the reflection of sunlight make cyclists extremely difficult to see properly while riding. They would have to stare at the screen for three to five seconds before they can see clearly. Although, a few seconds is not particularly long, it is still critical for avoiding accidents.

Proposed Design Solution

With our voice recognition system, cyclists will have full control of their bicycle while making their signal signs just by saying keywords to the wireless microphone attached on their helmet. Another option would be our slide switch system, by selecting the corresponding LED light on the handlebar by a simple hand sliding motion, result as the same as the voice recognition system. If the sliding switch fails, the voice recognition system could be used as a backup for the cyclists, and vice versa. Since the LED displays on the handlebar are brighter than the Smartphone screen, cyclists will no longer struggle to see the information they need while riding their bicycles. BikeSmart will provide a highly safe and fully functional condition to cyclists around the globe. The final product will also be reliable, durable and most importantly, affordable.

Design Overview

There is a LED signal board mounted underneath the seat. By sliding the switch to the right, the right signal light will turn on and same for the left. When the bicycle finishes the turn, user can simply slide the switch to the middle and then the signals will stop.

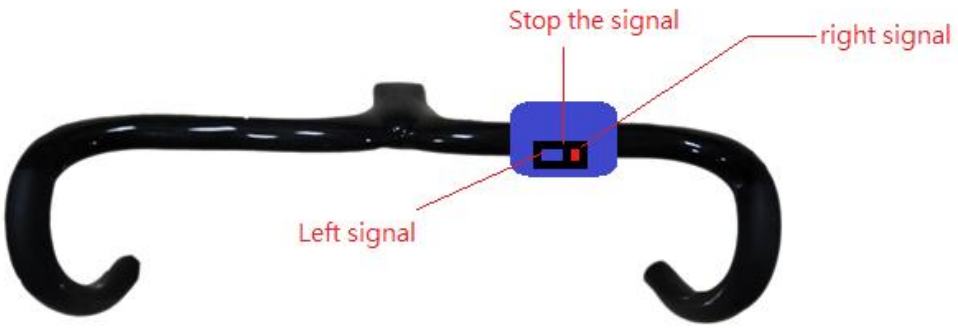

Figure 2- Design of the handlebar

Figure 3- Display of the right turn signal

Figure 4- Display of the left turn signal

The BikeSmart is able to sense when the cyclists attempt to stop. As the cyclists slow down, the LED matrix will show a “STOP” signal or a red signal light to warn other road users.

Figure 5- Display of the stop signal

A voice control system is designed to allow cyclists to simply equip the wireless microphone in the helmet. If the system is successfully built within the given time frame, additional functions, such as heart rate monitoring system, slope detection system, and the calories counter can be developed. By connecting with the voice control system, users can speak to the microphone to receive the information on the LED display mounted on the handlebar.

There are already several products existing in the market to resolve the common problems of hand signaling. However, DreamRide Corp. will put the cyclists' safety and health as our first priority.

Market and Competition

Features of Some Existing Products:

1. Manual wireless controller with a signal panel

Cyclists are required to mount the controller onto the handlebar and place the signal panel underneath the seat. Pressing the buttons on the controller will change the sign of the signal panel. However, some panels only contain limited LEDs, which might not be clear enough from a distance. Moreover, some other related products need 3 AAA batteries to operate which could result in battery issues.

2. Blinking red light

A blinking light is installed under the seat are used to alert other road users. Although this type of product has the advantage on its low price, it lacks the turn signal lights to warn other road users.

By comparing our product to the current existing product, the BikeSmart system has many more advantages. Firstly, the system has a proper size of the signal light to provide better visibility. Secondly, BikeSmart offers a voice control system allowing cyclists to command the signal lights, which is especially useful for one handed users. Furthermore, the DRC even plan to add more functions such as a heart rate monitor and a calories counter to let cyclists enjoy the fun of exercising.

Team Organization

DreamRide Corp. is assembled with five talented and ambitious engineering students: Jason Coo, Nadia Tehranchi, Stan Yang, Conrad Wang, and Paul Chen. These enthusiastic individuals have specialized expertise from Computer to Electronics to Biomedical engineering. The diverse in background and talents will allow each person to bring different dynamics to the company.

The company structure places equal responsibility for every member. Each person is assigned to a role based on his/her skills and personality. Jason (CEO) will provide leadership and make the most critical decisions for the company. Nadia (CCO) will be the voice of the company as she will communicate with professors, teaching assistants, and people outside of the company. Stan (COO) will make sure that the project schedule is on track on a daily basis as well as ensuring that the company operates in an efficient and effective manner. Conrad (CTO) will focus on the specifications of the project and give input on how the project can be optimally designed. Paul (CFO) will be responsible for estimating the cost of the project, such as material budget and labour hours.

The company will hold at least 3 in-person or online meetings weekly to focus on the progress and issues of the project. To ensure maximum productivity, the discussed issues will be resolved either during the meeting or at the beginning of the next meeting.

Company Profile

Jason Coo – Chief Executive Officer

Jason is a fourth year Computer Engineering Student at Simon Fraser University. The courses that Jason has taken equip him with both hardware and software skills. He has programming experience in C/C++, JAVA, and Assembly language as well as having adequate understanding of Arduino C and Matlab to assist the company in successfully building the project. He believes that his involvement as an event planner and communication coordinator for the International Students' Group in Simon Fraser Student Society will be a huge asset for the company. Jason has unquestioned leadership as he is the unanimous pick for the CEO position.

Nadia Tehranchi – Chief Communication Officer

Nadia is a fourth year Biomedical Engineering student with concentration in Electronics at Simon Fraser University. Nadia has been taking programming courses such as C++ and Matlab that allow her to gain familiarity with programming as well as Linux and windows system operations. She has previous co-op experience in working as a Test Engineer with PLC and most recently working as Research Assistant at Micro

Instrumentation Laboratory. She also has much expertise in 3D software such as OpenSCAD, Blender, Wings 3D and SketchUp for designing micro-components. Furthermore, Nadia has shown great social involvements when she volunteered at Vancouver General Hospital for one year. With her qualifications, Nadia is the excellent choice for the CCO position.

Stan Yang – Chief Operating Officer

Stan is a fourth year Computer Engineering student at Simon Fraser University. Stan has intermediate programming experience in C++, Java and Assembly language. He also has strong background in Arduino UNO R3 board as he planned, designed, and programmed a Bluetooth wireless auto lock which can be controlled by an android application that was also designed by him. Stan's well-rounded project background and planning skill make him the best candidate for the COO position.

Conrad Wang – Chief Technology Officer

Conrad is a fourth year Electronics Engineering student at Simon Fraser University. Over the years, Conrad has been a part of many programming projects that allowed him to be comfortable with writing code in C/C++ and VHDL. He studied at BCIT and has a diploma in Electrical Engineering Technology as his practical background will greatly benefit the company. He also worked as a co-op in two different software departments. As a person who has experienced the technology industry, Conrad is the perfect person for the CTO position.

Paul Chen – Chief Financial Officer

Paul is a senior Electronics Engineering student at Simon Fraser University. From his one year international co-op experience, Paul has acquired several technical skills like Assembly language, CNC machine programming, CAD drawing, cost control and quality control. Additionally, he also has experience programming with C++ and Arduino programming language. The industry experience and skills he has obtained oversea give him great knowledge of the technology economy. Paul will undoubtedly be well suited for the CFO position.

Project Planning

A key to successful time management is planning ahead and always staying ahead of schedule. The project is scheduled to be completed within a 4 month period. As shown in figure 6 below, our schedule is very well balanced, meanwhile, allowing us to have extra time to finish each task.

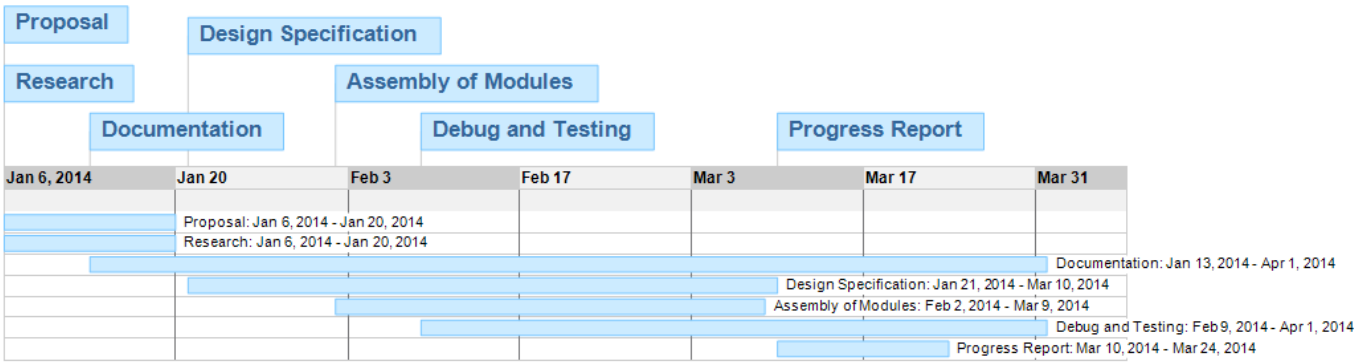

Figure 6 - Gantt Chart

Displayed in figure 7 is the milestone chart which highlights the project schedule.

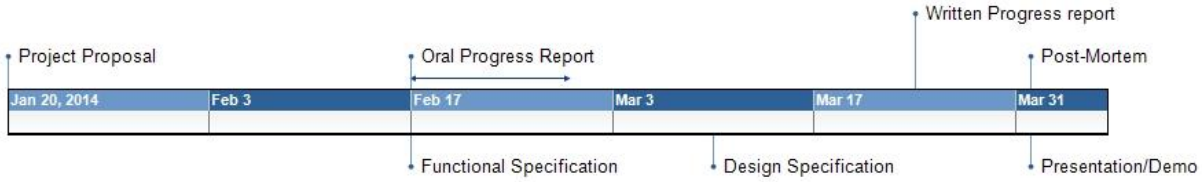

Figure 7 - Milestone Chart

Budget & Funding

The following table is the estimation of cost breakdown for our first BikeSmart. Most components listed below can be purchased locally. The prices of components ordered oversea can vary depending on a few different factors including shipping method, customs, and currency.

Equipment List	Estimated Cost (CAD)
Arduino Uno *2	$80
RGB LED Matrix 60mm *2	$60
Red/Green LED Matrix 60mm	$10
Red/Green LED Matrix 20mm	$5
Sensor (Speed)	$16
Sensor (Slope)	$20
Sensor (Heartrate)	$30
Breadboards	$30
Bicycle glove	$30
Xbee wireless sender	$30

Xbee wireless receiver *2	$50
Accelerometer 3 AXIS ANAG	$16.8
Slice switch DPDT OFF 1A	$1.45
Pocker DPDT 15A ON-OFF-ON	$12.67
Battery	$50
Microphone	$11.5
Helmet	$30
Bicycle	$120
Handlebar mount	$10
Model material	$30
Jumpers	$20
Voice Recognition Shield	$70
Total	$733.42

Table 1 - Equipment List and the Estimated Cost

Funding

A proposal is being examined by Engineering Science Student Endowment Fund (ESSEF). Since it is less likely to get full funded form the ESSEF, once the funding is approved by the end of January, DreamRide will have a meeting to discuss the need for applying Wighton Fund. If the actual cost of the final product is much higher than the estimated cost listed above, and the ESSEF and Wighton Fund could not covered, the exceeded cost will be divided up between members of DreamRide Corporation.

Conclusion

DreamRide Corporation cares about the cyclists' safety as the company is very excited and eager to produce BikeSmart to improve biking experience and reduce accident rate. The company uses existing biking utility products as motivation to design an even better product in BikeSmart.

The DreamRide team is determined and committed. With a firm Gantt chart and milestone list, the team is confident that the project will be completed within the time given. If time permits, the team will add more features to the project.

Thank you for taking the time to review this proposal. Please contact ntehranc@sfu.ca if you would like further information about the project.

References

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