Post Mortem for a Smart Cart

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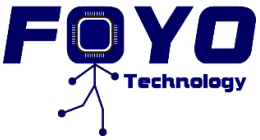

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1. Introduction

FOYO Technology Inc. aims to build a product that provides people have convenient lifestyle. Tesigo provides users a hand-free experience for controlling a shopping cart. So far, there is no such kind of robot working in any public area in Vancouver. Our engineers are optimistic about the robots' market and we think it is a good chance to introduce our product to retailers and other companies. *Tesigo* can be wildly used in multi areas such as shopping mall, airport, library, and hospital.

Tesigo has three operating modes: "Follow" mode, "Remote" mode, and "Manual" mode. Users can choose *Tesigo* to automatically follow them, control *Tesigo* via an Android Application or take fully manual control. *FOYO Technologies Inc.* also introduces an Android Application called "*TesigoApp*" for switching/selecting the modes of *Tesigo* and is used to control *Tesigo* in "Remote" mode.

This document provides a high-level description of main function and project modules for the final prototype of *Tesigo*. A comparison table between estimated and actual costs and a schedule will be provides in this report. Furthermore, major challenges, solutions, group dynamic, and individual reflections on the project will be also covered in this document.

2. System Overview

Figure 1 includes the main functions and different modes of the final product.

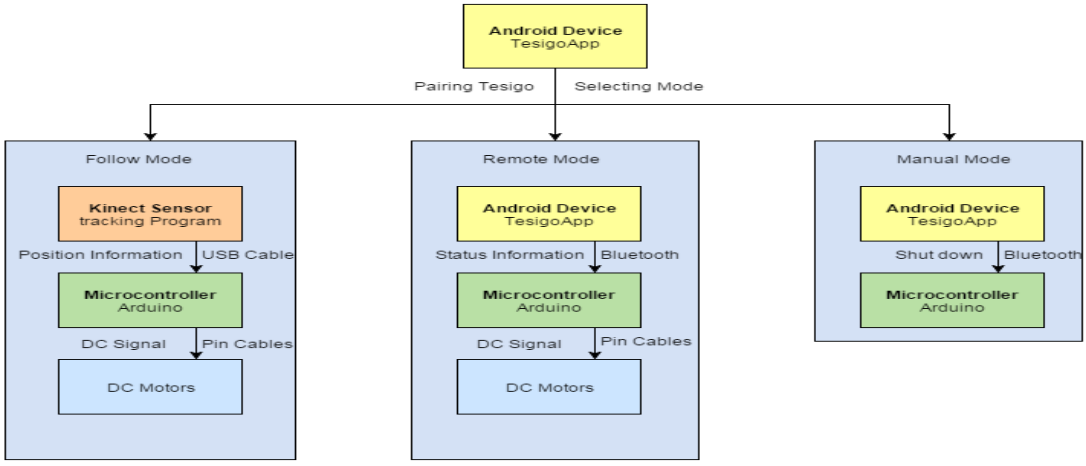


Figure 1: The High-Level Overview of *Tesigo*

Tesigo has three different modes, which are “Follow Mode”, “Remote Mode”, and “Manual Mode” which the user can control *Tesigo* by using Kinect sensor, Android device, and hands respectively. In the ‘Follow Mode’, *Tesigo* will follow the user and avoid other objects automatically; in the ‘Remote Mode’, user can use Android device to control *Tesigo*; in the ‘Manual Mode’, user can use *Tesigo* as a normal shopping cart. The whole system can be divided into three parts: mechanical part, hardware part and software part. Group Dynamics section in this document will discuss about the team organization based on these three parts.

3. Material & Cost

The actual cost of our project is $791.63, which exceed our expected cost of $624.99 by $166.63. During our design process, some unforeseen things happened, so there were some unnecessary expenses. For example, we changed our board from Raspberry Pi to Arduino UNO after we purchased Raspberry Pi, and the previous Arduino board was damaged during our first testing.

Secondly, in order to save time, we bought some electronic and mechanical components in Canada instead of ordering them from China which results in more cost of this project. In addition, the shipping costs and taxes applied when we ordered stuffs from U.S. and Canada.

The next reason was that we added some design details which we did not include in our estimated cost table in proposal document. For example, we added Bluetooth to *Tesigo* for communicating between Bluetooth and *Tesigo,* and we also used timing pulley and timing belt for the mechanical part of *Tesigo* so that we do not need to change original wheels of the cart. The source of funding for our project is provided by each team members of *FOYO Technologies Inc*, Thus, we will split the cost of our project evenly among each group member. Since the total cost is $791.63, everyone in our group need to contribute $158.35. The table below shows the different of estimated cost and actual cost of our product.

Post Mortem for Smart Cart

Item	Estimated Amount	Estimated Cost (CAD)	Actual Amount	Actual Cost (CAD)	Notes
Raspberry Pi	1	60	1	69.44	Not used Raspberry Pi
Arduino Board *	N/A	N/A	2	126.84	1. Used Arduino board instead of Raspberry Pi 2. Burned one Arduino board in testing
Kinect Sensor	1	159.99	1	0	Group member contributed
Kinect Adapter	N/A	N/A	1	60	Didn't expect to use adapter in estimated cost
Ultrasonic Sensor	5	80	2	30	
Glass Fuse	4	20	0	0	Not used Glass Fuse
Fuse Holder Cap	1	5	0	0	Not used Fuse Holder Cap
Bluetooth	N/A	N/A	1	34.82	Didn't include this in proposal document
Cart Frame	1	60	1	40	Got a used one from craigslist
12 V 5Ah and 12V 2.7Ah Rechargeable Battery	1	120	1	103.54	
AmpFlow M27-150 24V DC Motor	2	100	2	132.73	Ordered from Amazon, Didn't expect an import tax plus high shipping cost of $36.59
Motor Driver	N/A	N/A	2	60	Didn't include these in proposal document
Pulley, Belt	N/A	N/A	2	70.57	Didn't expect to use pulley and belt in estimated cost
Other Electronic /Mechanical Components: Wires, USB cable, Screws, Wood, Steel Straps, Tape Glue, basket, etc.	N/A	20	N/A	63.69	Due to the time constrain, we bought these things in Canada instead of ordered in China
Total	624.99		791.63		Excess budget by $166.64

Table 1: Estimated vs Actual Cost

4. Schedule

The Figure below is the comparison between the planned schedule previously submitted in the proposal document of *Tesigo* and the realistic schedule. According to this realistic schedule, for the Research section, we keep researching until now since the performance of this project needs to be improved. For Assembly of Modules, we were delayed by almost one week since we had to wait for the motors to be imported from U.S. which also caused a delayed in the Integration/Prototype Testing module. Moreover in Debugging/Prototype Modification section, we have debugged the main components and applied the corresponding modifications. However, we still working on some minor changes that may cause a delayed of one week. Overall, we are not too far from the original schedule and we believe that we can complete this project before the demo date.

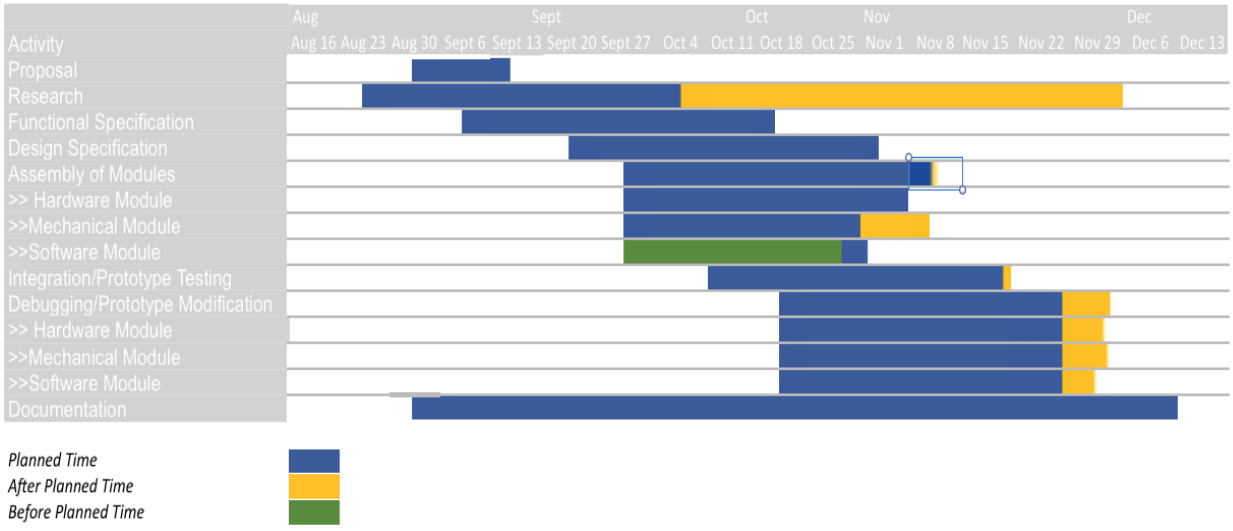


Figure 2: Schedule

5. Problems and Challenges

At the very beginning, we tried to design a remote toy car, which can be remoted by mobile devices in several methods, but later on we denied this topic because it was not useful enough. After that, we decided to increase the size of the car, so that it could carry some loads, and we added a main function to the car that was it can follow the user automatically.

For the hardware part, we considered to use Raspberry Pi in the beginning. However, after we did some research, we found that Raspberry Pi is not powerful enough to do

image processing for a Kinect sensor. So we decided to use a laptop in our prototype and use Arduino UNO instead of Raspberry Pi to control the peripherals.

5.1 Mechanical design for the wheels and motors connection

Since we are lack of tools for mechanic development, we designed many methods to install the high power DC motors. However, we could not find the corresponding mechanic parts in most of the electronics shops around Vancouver. The final decision is to use belts and pulley system since we can order the right size kits from U.S. and it is possible for us to install them using the limit tools we have.

5.2 Android App Design

Firstly, we tried to design our own application by using QT. However, we analyzed that the risks and the time cost of developing the application and we found it was too risky to develop an Android App start from scratch. After doing some research, we found a good software called "MIT App Inventor 2", which helps us building the frames and functions of our Android App easily.

5.3 Kinect Sensor Data Transfer

After we successfully implemented the code for tracking person, we found that it was a challenge to transmit data from the C++ code to Arduino UNO. First, we decided to use a text file, which is used for recording the output data from tracking program then Arduino UNO keeps reading that text file. Unfortunately, there were some errors due to the conflict about two processes accessing one file at the same time. Later on, we found the method that let the tracking program allow Arduino UNO to receive the data directly.

6. Group Dynamic

FOYO Technologies Inc. team is a group of engineering students organized to work together cooperatively and interdependently in order to successfully complete *Tesigo: A Smart Cart.* Our team is meant for the long term interaction; therefore, the positive relationships are necessary. In order to keep the positive relationships for our team to work well, we keep four main aspects in our mind: constructive, productive, mutual understanding and self-corrective. We have trust and mutual understanding for a constructive relationship. Next, a productive relationship allows us to focus on the main issues. Mutual understanding encourages us to understand the other's point of view. Last is self-corrective which allows us to improve relationships. Moreover, we spilt the tasks

equally according to our specialization in different fields. Each module will be assigned to at least two members in order to have an easier team communication and understanding. Furthermore, we decided to schedule our weekly meeting and used a group chat for daily communication. We also provide feedback and discuss the progress as well as the major problems of the project in order to keep track of the project progress and to solve issues quickly. In addition, we assigned roles at the beginning of this project in order to have the most efficiency and efficacy of the project: Chief Executive Officer who keeps the team focused and solve the conflicts and problems among the members, Vice President of Marketing who is in charge of doing the research of possible target markets, Chief Financial Officer is responsible for financial planning and budget management, Vice President of Operations who solves technical issues appeared during the project and Chief Technology Officer who is in charge of research and development of the project and technical support. However, every member should participate in brain storming, problem solving and voting when the issues arise. Overall, *FOYO Technologies Inc.* team has trust and gives a full respect among ourselves.

7. Workload Distribution and Reflection

Due to the different technical and proficient fields, each member is assigned equally with the tasks they are expertise and interested in which allow us to focus and work in a specific part of the project efficiently. The following table summarizes the work distribution of this project.

Tasks	Worawee	Mengyao	Yizhang	Zheng	Jose
Documentation	x	x	x	x	x
Administrative Tasks	x				
Parts Purchasing	x	x	xx	xx	x
Financials				x	
Material Research	x	x	x	x	x
Mechanical Implementation		xx	x	xxx	
Firmware Implementation	x		xx		
Android Implementation	x				
Kinect Implementation					x
System Testing	x	xx	xx	xx	x
System Integration	x	x	x	x	x

Table 2 : Work Distribution

The following section provides the individual reflections of team members for this project.

8. Individual Learning

Worawee (Fai) Janpongsri - CEO

We formed a team of five which consists of three Computer, one Electrical and one Biomedical Engineering students before the class started. We had come up with many good ideas and we also discussed these projects with Dr. Andrew. Finally, we decided to design a smart shopping cart which has not been out on the market and this project would definitely help many shoppers including pregnancy women as well as disabled in carrying heavy loads. At beginning of the project, honestly I did not have much confident that our team would complete this project on time because most of us had no idea how to start the project. Although, we are engineering students, we never did any mechanical project before.

As a Chief Executive Officer, I decided to talk to all my team members discussing which project modules they are interested in and preferred to do. At the beginning, I was worried about the mechanical parts since we had gone through many troubles such as we could not find the powerful motors to move our cart with heavy loads in electronics stores, could not find the right size of wheels that fit the cart's frame and the shipping time was so long which caused a delay in our schedule.

Besides mechanical parts, I am responsible for an Android Application and Firmware Modules which I had not done these before. I began to do research about the technical specs of both microcontroller and microprocessor, and software used to create an Android Application. At first, we used Raspberry Pi for this project because we thought that it can support Kinect Sensor but unfortunately we found out that Kinect Sensor needs an X64 microprocessor which Raspberry Pi is just 16 bits microprocessor. Moreover, if we still kept using Raspberry Pi, it would overkill our project, so we switched to microcontroller and use a very light laptop to process Kinect Sensor.

For this Capstone Project Course, I have learned how to apply my knowledge in the real world such as learning how to design Android Application and make it communicate with microcontroller to control the hardware. Not only technical skills that I learned from this course, but I also learned to manage the team, keep the team focused on the project, solve the conflicts and problems among the members, and trust other members. There were many times that our opinions disagreed which caused some misunderstanding, but

we tried to solve by talking, understanding and trust others in order to complete this project as well as to keep our relationships in a good condition. Every member was also ready to help when someone went through troubles but at the same time we trust each other in completing their works on time.

In conclusion, I would say that I am lucky to have such wonderful team members and I would like to thank them for their hardworking for this project though most of us took five courses in this semester. Furthermore, this course was a challenge for me and it gave an opportunity for me to gain more technical and entrepreneurial skills which I can use them in the future as an engineer.

Mengyao (Lily) Li - VPO

As a fourth year student major in Biomedical Engineering, and taking three courses besides ENSC 305W/440W, I believe ENSC 305W/440W were the most challenging courses among other courses. Before starting the project, I was expected to apply my knowledge that I gained from the last three years on this project but I was wrong since we were expected to learn everything by ourselves. Through this project, I have gained some awesome knowledge not only technically but also interpersonally.

At the very beginning, we planned to build a remote car with a camera on it and do some image processing program, but I realized this project was meaningless and could not improve our life quality. Inspired by an advertisement of Volkswagen, I came up with a new idea – auto-following baby stroller. After discussing with my teammates and professor, we realized that the safety of the baby stroller was the most important thing we needed to consider, which is hard to be consummated by us in the four months. Therefore, we decided to build an auto-following shopping cart. I learned that making a decision is a step by step process which cannot be done in a day.

In this project, I was responsible for designing and mounting the mechanical system with another team member, Matt. Even though I am not a mechatronic student, and I am not familiar with mechanics so I tried my best to solve our mechanical problems. In the beginning, I had no idea how to build the cart, what materials we needed to buy, and where we could find those materials. After I did some research and was inspired by my pervious coop's coworker, I decided to use pulley to build the transmission system. My teammate and I searched almost every local mechanical store but we could not find the suitable pulley and belt for our cart. Finally we bought them from U.S. since purchasing suitable materials is definitely not an easy job in Canada. We felt so disappointed at that time. After we got the pulleys, another problem came up. We did not know how to fit the

pulley with the wheel of the cart. We thought we could not finish the frame of the cart on time but fortunately we did it. Moreover, we also did many tests and modifications to make the pulley with the wheel to fit the cart better.

Throughout this semester I have gained a lot of knowledge in mechanics. I have learned different types of motors and pulleys. I also learned how to install the pulley onto the wheel of the cart.

Finally, I would like to thank each of my intelligent and hardworking people in our team. It was my pleasure to have such a great team and have this awesome experience with them. I am extremely proud about our project, and I hope our product will be on the market in the future.

Yizhang (Michael) Xu – VPM

First of all, I would like to say thank you to four of my hardworking groupmates whom I never worked with before. We formed the group at the beginning of the summer holiday. We made meetings and appointments with Dr. Andrew in the summer. We got many good ideas and I enjoyed sharing opinion about the project during the meeting. From that time, I knew this could be a great learning experience.

As a group project, the first thing I would like to talk is about organization. I learned that it is important to know which technical part is the most interesting for me because every part was hard to do when I stepped in, and only the passion for learning can carry me to go through the problems I will meet. So the first thing is to know who has passion for which part. The second thing is about communication. It does not matter whether it is a two people development team or a person development team, the members always need to talk among themselves to exchange their experiences, help each other, or talk about their normal life. A good relationship can increase the efficiency of corporate working significantly.

This is my first time to do a real world project which starts from designing to manufacture. The whole process is very different from what I expected at the beginning. First thing I would like to mention is about flexibility. Our expectation is always over than what we actually can do. For example, we tried to use a strong iron cart at the beginning but we found it was too heavy to push a cart like that based on the DC motors we could find in the market. We redesigned the whole framework of the cart, although it did not look like what we expected at the beginning. Therefore, we have to be more flexibility based on the real situation we have. The second thing is about adjustable. Due

to the limitation of our knowledge, all the outcomes of the plan were unpredictable and everything we did should have alternative strategies. For example, at the beginning, we planned to use Raspberry Pi as the brain of our robot because we wanted to do image processing. At that time, we knew that we can use Arduino UNO as alternative choice, so we bought the sensors, the drivers that can be applied on both Pi and UNO, in case if we switch the type of microcontroller later. Later on, we found that the Pi is not powerful enough to run the Kinect program so we added a laptop and switched from Pi to UNO for decreasing the technical risky, and other parts would not be effected due to our adjustable decision.

For my specific responsibility in this project, I learned to use UNO to control the peripherals, and obtain data from other PCs. I learned how to install and use a Bluetooth. I got the skills of soldering the motor driver intelligent circuit. It was my first shopping experience in the electronic shops. My self-learning skills is now increase by one more.

After this project, I found I became more interested in engineering science, especially the software part. I concluded myself in this project that I needed to practice more about different programming language and learn more about the popular software and hardware which we can use in the real world.

Jose Arboleda - CTO

First of all, I learned how to create and implement Windows 8.1 applications and Windows Presentation Foundations (WPF), which allowed me to create a proper user interface for this project. Since we were using a camera (Kinect) for the tracking system, it was a fundamental to understand how the camera sees and identifies the target, this was one of the main reasons which made me understand how important is to have a good user interface (Application) to control a hardware device.

Moreover, I learned about communication between processes and system permissions due to that initially in the project I was creating a Windows App to control the Kinect. Windows Apps work in isolated space; this means that they can only output data inside of this isolated space, which just allows the access to the app. This brought three problems:

1. I needed to create another application that reads the output from the Windows app (located in the isolated space) and inputs it in the Arduino.

2. I needed to give permission to the application to access in the isolated space

3. I needed to synchronize two processes (Windows App and application) accessing the same file at the same time.

In order to solve these problems I learned about system privileges and file sharing. Finally, I learned about tracking strategies that were a fundamental part of our project, since we needed to come up with a way to choose a target to be followed and to differentiate with the chosen target and other possible targets.

For the interpersonal learning, I learned that having a schedule and follow it, is primordial for large-scale project like this, which needs to be separated in different parts and all these parts need to be completed on time so the project does not suffer delays. Also, I understood the importance of trusting on the teammates' work and that everyone has a different opinion that needs to be respected.

In conclusion, I think that this kind of projects have a lot of things to learn since it is a project that is self-learning, which requires attention from everyone in the group and self-sacrifice.

Zheng (Matt) Chang - CFO

During the past four months, designing and building the unique product gave me an unforgettable adventure. Before I took capstone course, I expected this course was about applying the knowledge I have learned before into this design. However, it is a process that I learned new concepts, new stuffs and new knowledge.

As a CFO in *FOYO Technologies Inc*, I was mainly responsible for the finance part throughout the project. Thus, my job was to keep our expenditure as close as the budget. In addition, I also needed to buy and order components, made sure all the electronic components ordered online would arrive on time so it would not affect the schedule. Moreover, I am also responsible for the mechanical system design. Before this capstone course, I did not have any experience with mechanics but throughout the mechanical system design, I have gained some mechanical knowledge such as knowing the characteristics of different types of motor, setting up motors that are controlled in our system, and choosing timing pulley and suitable batteries. Besides, I also gained some experience with ultrasonic sensors, Arduino UNO board by helping other group members. At last, what I learned from this course not only technical skills but also the time management, team work and effectively communication. Throughout the semester, things will not always go as we planned and there are always some challenges popped up. Our group did a great planning, we always planed ahead and flexible. During the design

process, lots of ideas came up from everyone's brain, even though we had some arguments, we shared our ideas together and communicated to each other. During the implementation process, it required everyone to work together to get the project done. The teamwork was great and efficiently, so we finished the project earlier than we expected.

The project would not be successful without my four genius teammates which I would like to personally thank them for their excellent performances in the group. Everyone in our group well knows his/her part and they did their job perfectly according to the schedule. It is a great honor for me to join this fantastic group. Everything works smoothly, even though we had only arguments related to the project during the semester. This experience was very useful for me in the future study and work.

9. Conclusions

Our final product already met most of the requirements we designed. However, since we do not have a strong feedback system, our first prototype cannot follow the user perfectly. For example, *Tesigo* may deflect slight to the right or to the left when it is moving forward, and the turning angle is not adjustable when a user tries to make a 180 degrees turning and standing still. So for the next step, we will try to add a feedback system into our product which can adjust its' motion depends on the environment automatically. The cost is the most challenging problem for our product. We need to balance the intelligence and development cost of our product, we also need to design our own microcontroller and reconsider about the camera we use to reduce the cost of our product in the future.

Appendix

AGENDA

Time: September 12, 2015 at 10:00 - 12:00

Location: Library

Purpose of Meeting: To Discuss project topic

Points for Discussion:

- Potential Project Topic

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu

Absent: None

Purpose of Meeting: To Discuss project topic

Minutes:

Worawee Janpongsri called the meeting at 10:00 in Bennett Library.

A. What's the topic of the project?

Should we still do automatic baby cart or doing something else?

Discussion: Worawee Janpongsri mentioned the safety issue about baby cart. Menyao Li mentioned a new idea-Eye Glass Mouse for disable people. But Zheng Chang did not like it. Yizhang Xu mentioned that we should use same idea, an automatic moving cart with other purpose. Menyao Li mentioned we could do an automatic shopping cart.

Action: Everyone does some research about automatic moving shopping cart

B. Business Arising.

Should we continue to perform the future meetings every Saturday?

Discussion: Menyao Li mentioned that she would not be able to attend the meeting on next Saturday so she requested to have the next meeting on Friday.

Action: Worawee Janpongsri will contact the members via a chat group if there is an extra meeting

C. Next Meeting Date

The next meeting was arranged for September 18, 2015 at 10:00-12:00 at Bennett Library.

D. Other Business

None.

AGENDA

Time: September 18, 2015 at 10:00 - 12:00

Location: Library

Purpose of Meeting: To brainstorm about the project specifications

Points for Discussion:

- Is it better to have android application or not?
- Importance of implementing camera and live preview?
- 2/4-wheel cart?
- Size of the cart
- Buying or manufacturing our own cart parts
- Other safety measures
- Passing votes to select the CEO and other representative of the company
- Future plans
- Company Name & logo

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu

Absent: None

Purpose of Meeting: To brainstorm about the project specifications

Minutes:

Worawee Janpongsri called the meeting at 10:00 in Bennett Library.

A. Approval of the agenda and minutes of the September 18, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. Business Arising

How to contact each other every day?

Discussion: Menyao Li mentioned we should create group chat, so we can communicate when we do not have a meeting.

Action: Worawee Janpongsri will create a group chat in Facebook, and use facebook messger to cantact.

C. Is it better to have android application or not?

Discussion: Yizhang Xu mentioned that android application is easier and more efficient than an apple application. Menyao Li suggested that the application can be programming in C++. Worawee Janpongsri recommended that QT software can be used with C++.

Action: Each member would need to do self-studying of QT with C++

D. Importance of implementing camera and live preview?

Discussion: Yizhang Xu and Zheng Chang agreed that the application would not necessary to implement camera

Action: None

E. Is it better to have two or four wheels' cart?

Discussion: Yizhang Xu mentioned that it is sufficient to have two big wheels cart with small four wheels attached to the sides of the cart. Zheng Chang suggested that the two big wheels should be connected together in order to be stable

Action: None

F. Size of the cart

Discussion: Zheng Chang suggested that the cart should not be too big

Action: Each member need to vote for the size in the next meeting

G. Buying or manufacturing our own cart parts

Discussion: Yizhang Xu mentioned it is better to manufacturing our own parts

Action: Each member should do some research about the parts and price

H. Future plans

Discussion: Worawee Janpongsri suggested that the customers should sign up in the application for using the cart and each cart should have a unique id. Menyao Li said that it could be a bar code. Worawee Janpongsri mentioned that once the cart is out of the certain area, it should be locked

Action: None

I. Company name and logo

Discussion: Canguro is the company name, which means kangaroo in Spanish. It refers to our automatic cart. A muscular kangaroo will be on logo.

Action: Matt will design the logo in the following days.

K. Next Meeting Date

The next meeting was arranged for September 23, 2015 at 12:00-14:00 at Bennett Library.

E. Other Business

None

AGENDA

Time: September 23, 2015 at 12:00 - 14:00

Location: Library

Purpose of Meeting: To brainstorm about the project specifications

Points for Discussion:

- Is it better to use Arduino and Raspberry pi?
- Which sensors are suitable for the project?
- Cart size
- Should we buy or make the cart?
- What is the maximum weight the cart can hold?
- How many wheels the cart should have?
- Which battery is suitable for the cart?
- Company name and logo
- What are the parts needed to be ordered?
- Do we need any program?

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: To discuss the cart's components before start ordering them

Minutes:

Worawee Janpongsri called the meeting at 13:00 in Bennett Library.

A. Approval of the agenda and minutes of the September 18, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval
- Action: Jose Arboleda is introduced to the team as CTO

B. Business Arising

Apply for the Engineering Science Student Endowment Fund (ESSEF)

Discussion: If we apply ESSEF funding, the product is no longer ourselves. So, everyone voted to No to apply funding.

Action: We do not apply any funding; everyone contributes equal amount.

C. Is it better to use Arduino and Raspberry pi?

Discussion: Arduino is suitable for controlling hardware while Raspberry Pi is suitable for image-processing.

Action: Order both Arduino and Raspberry Pi (pi 2 B) for different purpose.

D. Which sensors are suitable for the project?

Discussion: Distance sensor is needed to measure the distance between obstacles and cart and 3D Kinect sensor is for detecting person. This project will need at least 2 kinds of these sensors.

Action: Order both distance sensor and 3D Kinect sensor

E. Cart size

Discussion: The cart must be at least 1 meter height in order to detect people and obstacles.

Action: None

F. Company name and logo

Discussion: Zheng Chang came up with a new idea of company name - **"**FOYO". It means For You, Follow You. It refers to our automatic cart.

Action: Zheng Chang will design the logo tonight, and should finish it before September 27.

G. What are the parts needed to be ordered?

Discussion: Motor, battery, raspberry pi, Arduino and sensors are needed to buy within next week.

Action: Everyone goes to Lees Electronics together tomorrow.

H. Next Meeting Date

The next meeting was arranged for September 28, 2015 at 4:30pm at Bennett Library.

I. Other Business

None.

AGENDA

Time: September 28, 2015 at 4:30 - 6:00

Location: Library

Purpose of Meeting: To brainstorm about the project specifications

Purpose of Meeting: To discuss the cart's components before start ordering them

Points for Discussion:

- Use Raspberry Pi, if Raspberry Pi does not work, we add arduino
- The things we need to buy:
    1. Cart
    2. Raspberry Pi
    3. Motor
    4. Battery
    5. Kinect Sensor
    6. USB for Rasperberry Pi
- How many motors we need? Front Wheels or Back Wheels
- Which battery we should buy?
    - Distribute the duty for Project

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: To discuss the cart's components before start ordering them

Minutes:

Worawee Janpongsri called the meeting at 10:00 in Bennett Library.

A. Approval of the agenda and minutes of the September 28, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. Business Arising

How to separate payment when we order compounds online or buy compounds at local store?

Discussion: Zheng Chang said he could pay everything first, and everyone give him equal money at the end of semester

Action: None.

C. Is it better to use Arduino and Raspberry pi?

Discussion: Use Raspberry Pi, if Raspberry Pi does not work, we add Arduino

Action: Buy Raspberry Pi in Lee's electronic store when everyone is free

D. Which cart are we going to buy?

Discussion: A real shopping cart may be too large for the project, we may use a stroller and put a basket on it.

Action: Zheng Chang will search the cart later.

E. Which battery are we going to buy?

Discussion: Yizhang Xu said it depends on motor size

Action: Everyone search for the battery

F. Which sensor are we going to buy?

Discussion: Making cart is too much work so we will ask for a broken one from supermarket in order to reduce project's cost.

Action: Go to supermarket to see the appropriated size and ask the manager if we could get one.

G. What is the maximum weight the cart can hold?

Discussion: 10-15 kgs should be the most suitable but again need to measure once we have the cart.

Action: None

H. How many wheels the cart should have?

Discussion: The cart should have 3 wheels which 2 of them (back) are transmission wheels and one at the front is assistant wheel. (2x3 wheels).

Action: None

I. Which battery is suitable for the cart?

Discussion: Either car or motorcycle battery is needed. It would last for 2 years and it is rechargeable.

Action: None

J. Company name and logo

Discussion: Canguro is the company name, which means kangaroo in Spanish. It refers to our automatic cart. A muscular kangaroo will be on logo.

Action: Start designing the logo.

K. What are the parts needed to be ordered?

Discussion: Motor, battery, Raspberry pi, Arduino and sensors are needed to buy within next week.

Action: Go to the shop and buy the appropriate ones

M. Do we need any program?

Discussion: The program to measure the speed of two transmission wheels

Action: None

N. Duty of each one

Discussion: Fai and Jose: Software; Michaela: Hardware**;** Matt and Lily- Mechanical.

O. Next Meeting Date

The next meeting was arranged for Oct 9, 2015 at 4:30pm at Bennett Library.

P. Other Business

None.

AGENDA

Time: October 9, 2015 at 16:30-18:30

Location: Library

Purpose of Meeting: To discuss the functional specification

Points for Discussion:

- What are the general requirement, user interface requirement, physical requirement, electrical requirement and reliability & durability of the system?
- Distribute the duty for function specification
- What are we going to buy tomorrow?
- Does anyone have problem that cannot solve?

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: To discuss the cart's components before start ordering them

Minutes:

Worawee Janpongsri called the meeting at 4:30 in Bennett Library.

A. Approval of the agenda and minutes of the October 9, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. Business Arising

None

C. What are the general requirement, user interface requirement, physical requirement, electrical requirement and reliability & durability of the system?

Action: Discuss in the group chat later

D. Distribute the duty for function specification

Discussion: Fai is responsible for letter, executive summary and Android application; Lily is responsible for system overview and motor; Michael is responsible for introduction and raspberry Pi; Matt is responsible for cart design and sustainability & safety; Jose is responsible for kinect.

Action: Everyone does their jobs and finish before next meeting

E. What are we going to buy tomorrow?

Time: 2:00 pm.

Discussion:

1. Motor (12W, DC)

2. Speed controller (1. for Raspberry Pi. 2. for DC motors)
3. RyanTeck RPi MCB motor control board.
4. HDMI - VGA Converter cable
5. HDMI cable (not required)

Action: None

F. Does anyone have problem that cannot solve?

Discussion: Zheng Chang asked how to assemble motors to the cart? He suggested using same wheels, dissemble the wheels and install the motors into the wheel. If it does not work, then buy a new wheels or wheels motor system.

Action: None

G. Next Meeting Date

The next meeting was arranged for Oct 23, 2015 at 10:30am at Bennett Library.

H. Other Business

None.

AGENDA

Time: October 23, 2015 at 10:30-12:30

Location: Library

Purpose of Meeting: Progress Update

Points for Discussion:

- Practice Oral presentation
- Things still need to buy

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Progress update

Minutes:

Worawee Janpongsri called the meeting at 10:00 in Bennett Library

A. Approval of the agenda and minutes of October 23, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. Business Arising

None

C. Mechanical System

Discussion: Matt will meet lily on this weekend to start design the cart frame.

Action: None

D. Things we still need to buy?

Discussion: Michael said we needed buy the Bluetooth for connecting with App with the cart. Fai wanted to change Raspberry Pi to Arduino Uno. Jose suggested us to buy a Kinect adaptor for our testing, so we don't need buy DC power right now.

Action: Michael and Fai will go to Lees Electronics to buy the Bluetooth and Arduino Uno. Matt will buy the adapter online.

E. Next Meeting Date

The next meeting was arranged for Oct 27, 2015 at 10:30-12:30 in the Library.

F. Other Business

None.

AGENDA

Time: October 27, 2015 at 10:30-12:30

Location: library

Purpose of Meeting: Progress Update, Distribute work for Design specification report

Items for Discussion:

- Distribute everyone's duty for design paper
- Progress update
- Visit BCIT

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Progress update

Minutes:

Worawee Janpongsri called the meeting at 10:30 in Bennett Library.

A. Approval of the agenda and minutes of the October 27, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. Business Arising

None

C. Visit BCIT

Discussion: Lily said there was a Tutorial about how to make a race car model on this weekend, she wanted to go with matt on Oct 31

Action: Lily and Matt will go to BCIT at 14:30.

D Mechanical

Discussion: Matt suggested putting a wood board onto the cart frame, so we could put everything onto the board and use screw to fix it. He already finished it. Everything is done for cart frame design except pulley part, we ordered pulley belt from amazon, and still not arrived so far.

Action: None.

E. Kinect

Discussion: Jose is doing the Kinect now, he mentioned we should think about how to power the Kinect with DC power, since during the demo, we can't use plug in.

Action: None.

F. Android App, Arduino and Motor driver

Discussion: Fai is almost done for Android App, Fai and Michael are working on motor driver and Bluetooth

Action: None.

D. Next Meeting Date

The next meeting was arranged for November 7, 2015 at 10:00 – 12:00 at TASC Building

E. Other Business

None.

AGENDA

Time: November 7, 2015 at 10:00 – 12:00

Location: TASC Building

Purpose of Meeting: Integrate and test parts

Points for Discussion:

- Set the suitable speed for the cart
- Integrate remote mode with the cart
- Test remote mode for the cart
- Discuss about the power supply for the Kinect Sensor
- Integrate remote mode with follow mode
- Integrate follow mode with the cart

MINUTES

Present: Worawee Janpongsri, Menyao Li, Zheng Chang, Yizhang Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Integrate and test parts

Minutes:

Worawee Janpongsri called the meeting at 10:30 at TASC Building

A. Approval of the agenda and minutes of the November 7, 2015 meeting

Minutes were approved as amended:

- Vote: Unanimous approval

B. How to control the cart?

Discussion: Matt suggested us to use a suitable PWM, maybe using feedback control if have extra time

Action: None

C. Integrate remote mode with the cart

Action: Integrate Android Application with the hardware; the cart

D. Test remote mode for the cart

Discussion: The cart should be able to move forward, backward, left, right and stop when the corresponding buttons are pressed.

Action: Test remote mode for the cart

E. Discuss about the power supply for the Kinect Sensor

Discussion: Need to find the male jack to connect female adapter of the Kinect Sensor for powering. Otherwise, need to cut the wires and connect them manually.

Action: Go to electronic stores, contact Microsoft or cut the wires

F. Integrate remote mode with follow mode

Discussion: Need to have the conditions in Arduino to decide which modes should the cart be operated.

Action: Implement the code

G. Integrate follow mode with the cart

Action: Test the follow mode with the cart if the cart response to the user's movement and direction

H. Next Meeting Date

The next meeting was arranged for November 12 at 1:30 pm at Lab1.

I. Other Business

None.

AGENDA

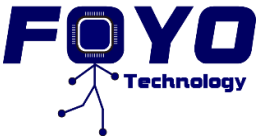
Time: November 12, 2015 at 14:00

Location: TASC Building

Purpose of Meeting: Integrate and test parts

Points for Discussion:

- Integration
- Debugging and Modification



Post Mortem for Smart Cart

MINUTES

Present: Worawee (Fai) Janpongsri, Menyao (Lily) Li, Zheng (Matt) Chang, Yizhang (Michael) Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Integrate and test parts

Minutes:

Worawee Janpongsri called the meeting at 14:00 in TASC Building.

A. Integration

Action: Michael, Lily and Matt have integrated the motors and Arduino into the cart

B. Debugging and Modification

Discussion: Tesigo App was tested and worked successfully. Kinect was tested, however it was not completely successful since the application cannot run for more than one minute. Batteries were tested but still need to be attached to the frame of the cart. Motors worked perfectly but the belt between the motors and the gears is loose, the distance between the motor and gear need to be increased

Action:

A. Attached Kinect to the cart
B. Decrease friction in the wheels
C. Test the velocity of the cart
D. Find a method to power the Kinect using batteries
E. Modify App to select different modes
F. Redefine the direction of the cart

C. Next Meeting:

The next meeting was arranged for November 20, 2015 at 10:00 at Lab 1.

D. Other Business

None.

AGENDA

Time: November 24, 2015 at 10:00

Location: Lab 1 in ASB

Purpose of Meeting: Writing document and integration

Points for Discussion:

- Written Progress Report
- Test Plan
- Final Presentation
- Demon
- Post- Mortem

MINUTES

Present: Worawee (Fai) Janpongsri, Menyao (Lily) Li, Zheng (Matt) Chang, Yizhang (Michael) Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Write document and integration

Minutes:

Worawee Janpongsri called the meeting at 10:00 at Lab 1**.**

A. Written Progress Report

Action:

- Everyone provided their part for the document
- Fai integrated the whole documents
- Everyone did the formatting and grammar checking together for the document

B. Test plan

Action:

- Everyone had discussed about what kind of test will be implemented during demo
- Michael and Lily wrote and formatted the test plan
- Everyone did grammar check together

C. Final Presentation and Demo

Action: Final presentation was divided in different parts between the team members, each group member will be in charge of present that part during the demo

D. Post- Mortem

Action:

- The document was divided and distributed evenly between the group members
- It was decided that the group members will complete their parts for the next meeting
- The work was distributed as follows
    - Lily: Introduction and format for paper

- Michael: Problems and Challenges, high level description, conclusion
- Jose: Schedule, meeting/ agenda
- Matt: Financial, meeting/ agenda
- Fai: Group Dynamics and Load Distribution

E. Integration

Action:

- Solve problem with the movement of the Kinect when it is attached to the cart
- Create power connection for Kinect using the batteries

F. Next Meeting Date

The next meeting was arranged for December 3, 2015 at 19:00 at Robotic Research Lab in ASB.

G. Other Business

None.

AGENDA

Time: December 3, 2015 at 19:00

Location: Robotic Research Lab in ASB

Purpose of Meeting: To prepare the Demo and write post-mortem

Points for Discussion:

- Practice the final presentation
- Prepare the Demo
- Write Post-Mortem

MINTUES

Present: Worawee (Fai) Janpongsri, Menyao (Lily) Li, Zheng (Matt) Chang, Yizhang (Michael) Xu, Jose Arboleda

Absent: None

Purpose of Meeting: Write document and integration

Minutes:

Worawee Janpongsri called the meeting at 19:00 at Robotic Research Lab in ASB**.**

A. Final presentation

Action:

- Everyone finished their assigned part for the final presentation
- Jose integrated and formatted the final document for the presentation

B. Demo

Action: Debugging and testing of demo has been delay for next meeting

C. Post-Mortem

Action:

- Everyone finish their previously assigned part for the Post-Mortem
- Lily integrated and formatted all the parts of the document
- Fai finished grammar checking for the completed document
- Michael formatted the completed document

D. Integration:

Action:

- Solve problem with the movement of the Kinect when it is attached to the cart
- Secure basket and prevent motion
- Create power connection for Kinect using the batteries

E. Other Business

None.