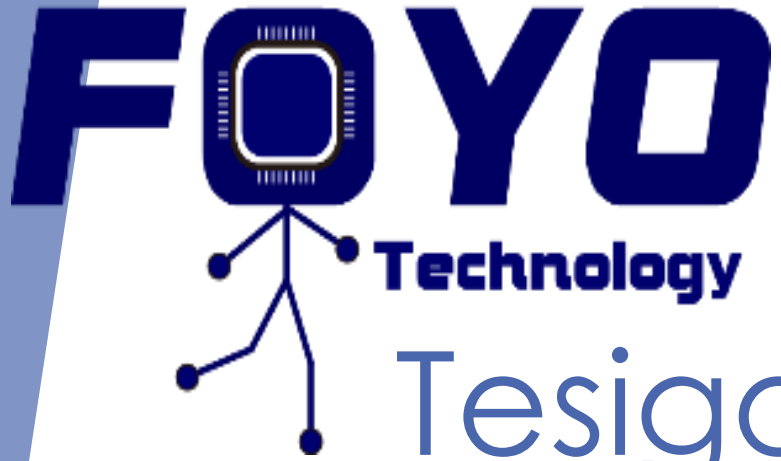


Tesigo Demonstration

ENSC 305W/440W

Instructor: Andrew Rawicz

Stephen Whitmore

Simon Fraser University

December 8, 2015

Team Members:

Worawee (Fai) Janpongsri - CEO

Mengyao (Lily) Li - VPO

Yizhang (Michael) Xu - VPM

Zheng (Matt) Chang - CFO

Jose Arboleda - CTO

Outline

- Introduction
  - FOYO's Staffs
  - Background & Motivation
- Business Case
  - Market
  - Competition
- Mechanical
  - Motor
  - Battery
  - Transmission System
  - Mounting & Wiring
- Hardware
  - Arduino
  - Bluetooth
  - Motor Driver & Distance Sensor
- Software
  - Android App
  - Kinect Sensor
- Finance
- Schedule
- Conclusion
  - Learning Experiences
  - Future Plans
- Reference
- Questions

FOYO Technology

Introduction

FOYO Technology

FOYO's Staffs

Name	Position	Main Responsibility
Worawee (Fai) Janpongsri	CEO	Software - Android, Hardware
Jose Arboleda	CTO	Software - Kinect Sensor
Yizhang (Michael) Xu	VPM	Hardware, Mechanical
Zheng (Matt) Chang	CFO	Mechanical, Purchasing
Mengyao (Lily) Li	VPO	Mechanical, Purchasing

FOYO Technology

Background & Motivation

Motivation:

- We are trying to build a product that involves people's daily life.
- Our staffs are optimistic about the robots' market in the future.

Background:

- Initially designed for disabled person.
- Later on we found it is a good idea to apply more wildly.
- There is no such robot in Vancouver's public area.

FOYO Technology

Business Case

Market

Target People:

- Everyone
- Elder
- People carrying stuffs and no hand to push the cart
- Retailers
  - ✓ Grocery Stores
  - ✓ Shopping Malls
  - ✓ Airports
  - ✓ Libraries

Apply Area:

- Grocery Stores
- Shopping Malls
- Airports
- Libraries

Actual Cost	$800
Expect Cost for Mass Production	$300
Selling Price	$450
Profit	$150
Expected Time for Reproducing the Prototype	12 Hours

FOYO Technology

Competition

- There is no such kind of robot cart in today's market
- Existing Solutions:

- Manual Control Only
- No Electrical Motor Assistance
- Heavy (Compare with *Tesigo*)
- Price: $120-$160 （Cheap）

Fig. 1: Current Shopping Cart in Market [1]

FOYO Technology

Mechanical

Mechanical
- Motor

- Use Belt
- Powerful
- High Torque
- Efficient
- Varies Operation Voltage

Fig. 2: AmpFlow M27-150-P Brush Electric Motor [2]

FOYO Technology

Mechanical
- Batteries

- Rechargeable
- 12V 2.7Ah for Kinect
- 12V 5Ah for Motors

Fig. 3:12V 5Ah Rechargeable Battery [3]

Fig. 4:12V 2.7Ah Rechargeable Battery [4]

FOYO Technology

Mechanical
- Cart frame

Advantage:

- Light
- Strong
- Easy to Re-design

Fig. 5: Original Cart Frame from Peg-Perego [5]

Mechanical
- Transmission System

- Reduce Speed
- Increase Torque
- Easy to Assemble

Fig. 6: Top View for Transmission System

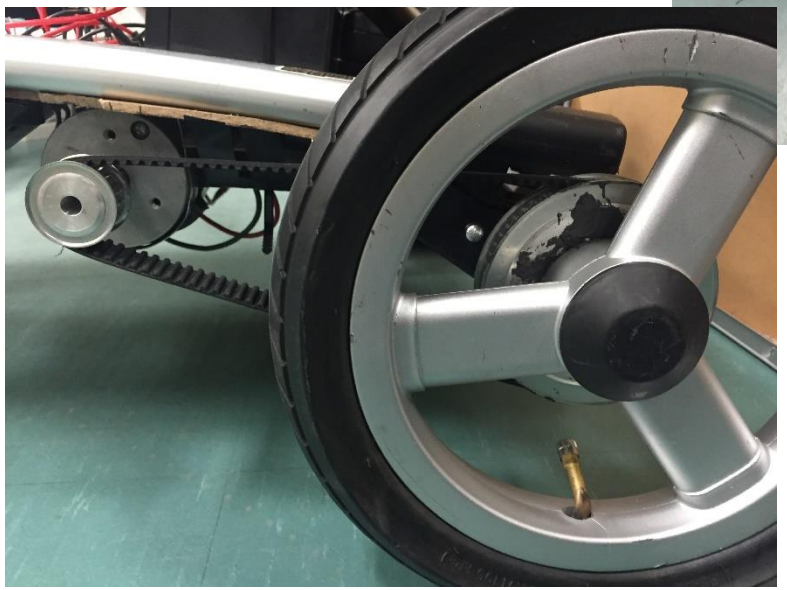


Fig. 7: Side View for Transmission System

Mechanical
- Mounting & Wiring

Fig. 8: Motor Set Up

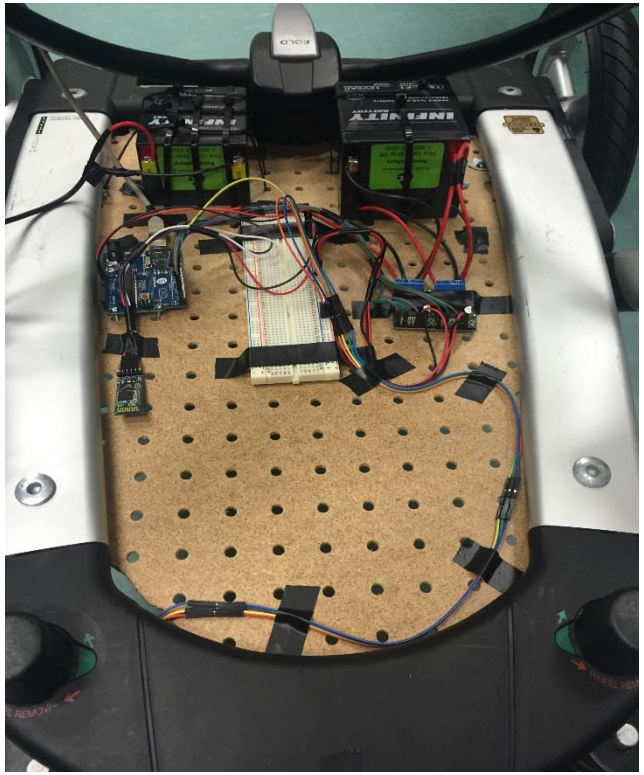


Fig. 9: Wiring Set Up

Fig. 10: Kinect Sensor Set Up

FOYO Technology

Hardware

Hardware
- Arduino UNO

- Easy to control the peripherals
  - Bluetooth
  - Motor Drivers
  - Sensor
- Communicate with Computer via Serial Port

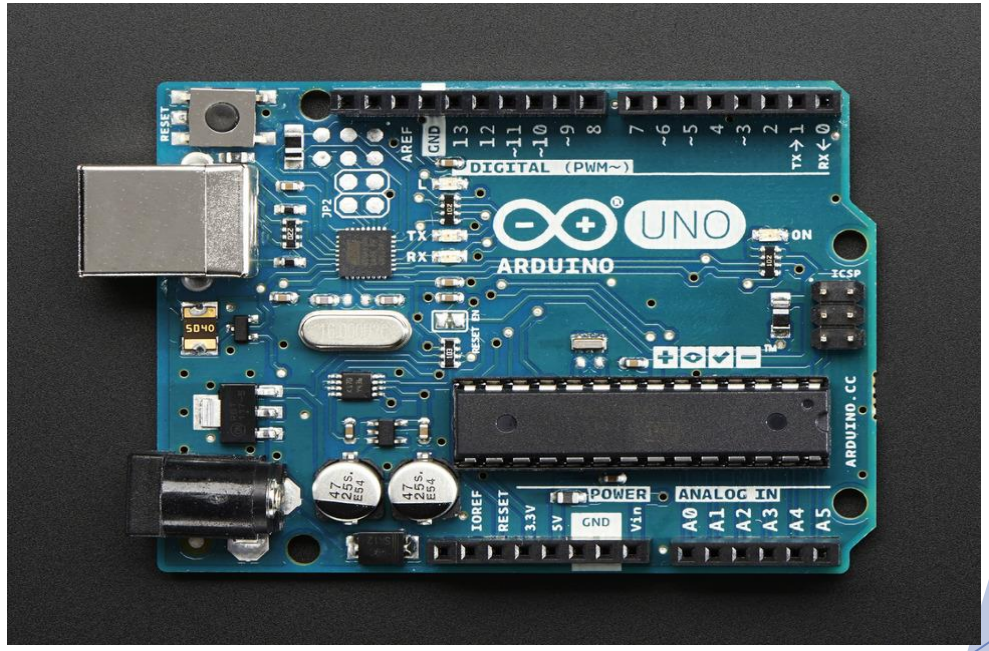


Fig. 11: Arduino UNO [6]

Hardware
- Bluetooth

- Behave as Master and Slave
  - RX (Receiving End)
  - TX (Transmitting End)
- Use Serial communication with Arduino UNO

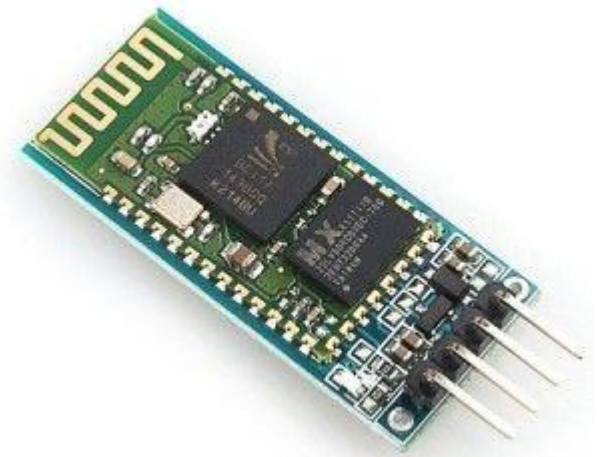


Fig. 12: HC-05 Bluetooth [7]

FOYO Technology

Hardware
- Motor Driver & Distance Sensor

- **VHN5019**
  - Support 12V motors
  - Support Arduino UNO

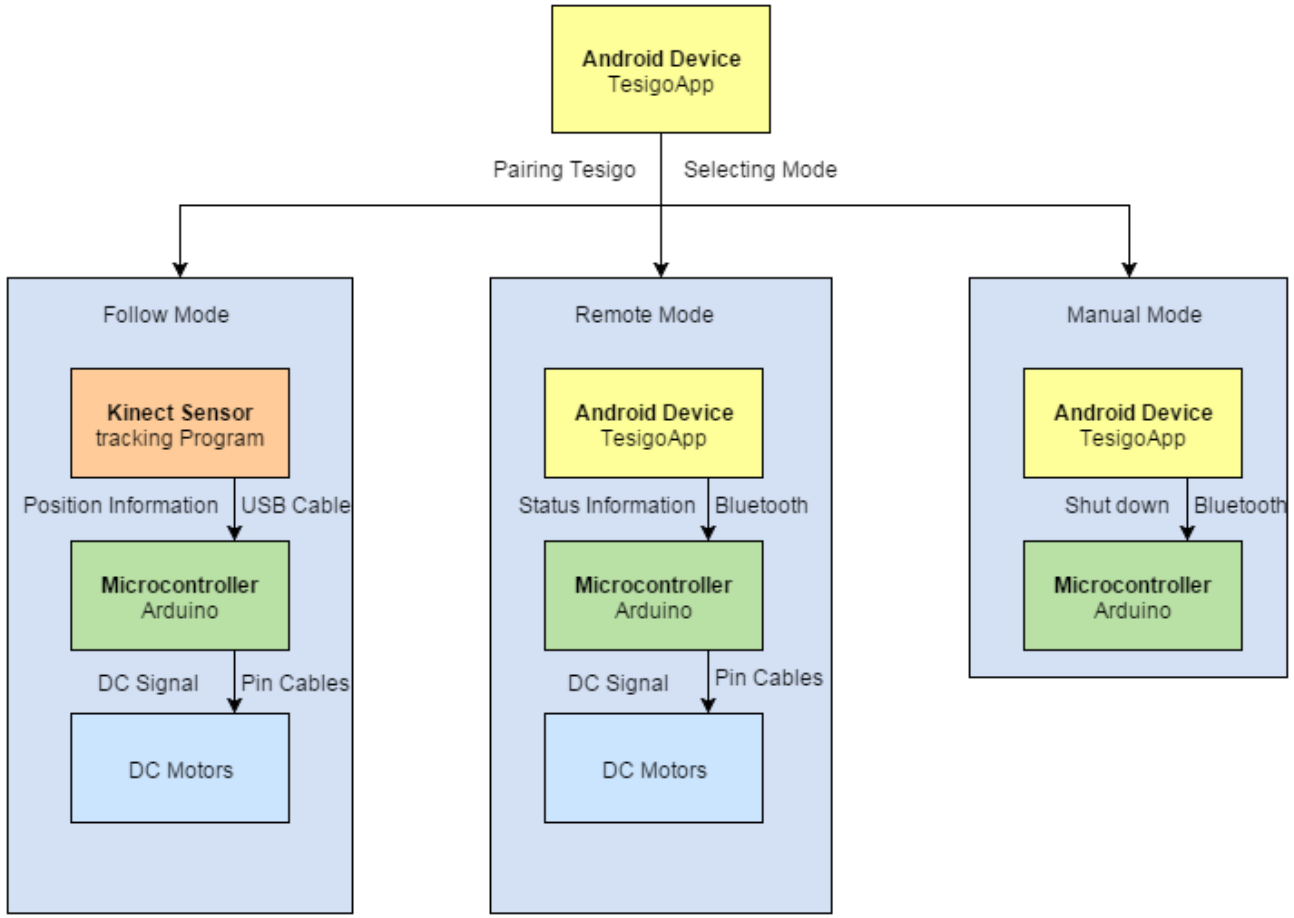
Fig. 13: Motor Driver [8]

- **HC-SR04 Ultrasonic Sensor**
  - Sense the object like PIR sensor
  - Sense and relay the distance to the object

Fig. 14: Ultrasonic Sensor [9]

Software

Software
- Android Application



Software
- *Tesigo* App

The main screen:

- **When *Tesigo* is not connected**

Connection Status:

- "Selected *Tesigo* Disconnected" in red

Direction Control Panel:

- Buttons disabled

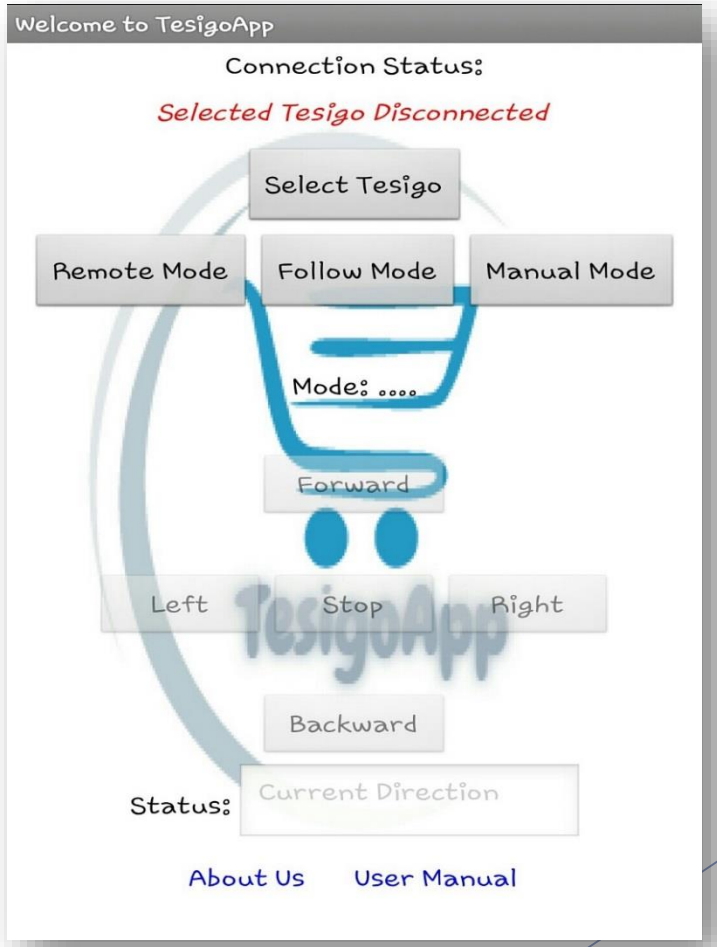


Fig. 15: Main Screen (*Tesigo* Disconnected)

Software
- *Tesigo* App

The main screen:

- **When *Tesigo* is connected**
- **Remote Mode**

Connection Status:

- "Selected *Tesigo* is Connected" in green

Mode:

- Remote Mode

Direction Control Panel:

- Button is enabled

Status:

- "Forward", "Left", "Right", "Backward" or "Stop"

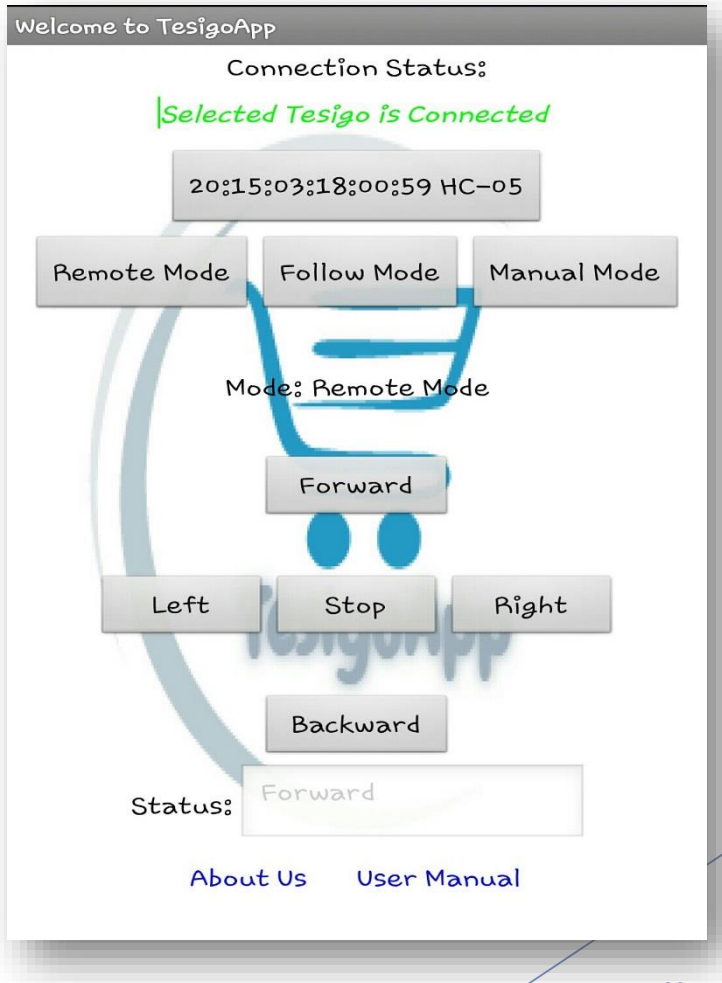


Fig. 16: Remote Mode Screen

Software
- *Tesigo* App

The main screen:

- **When *Tesigo* is not connected**
- **Follow Mode**

Connection Status:

- "Selected *Tesigo* Disconnected" in red

Mode:

- Follow Mode

Direction Control Panel:

- Buttons are disabled

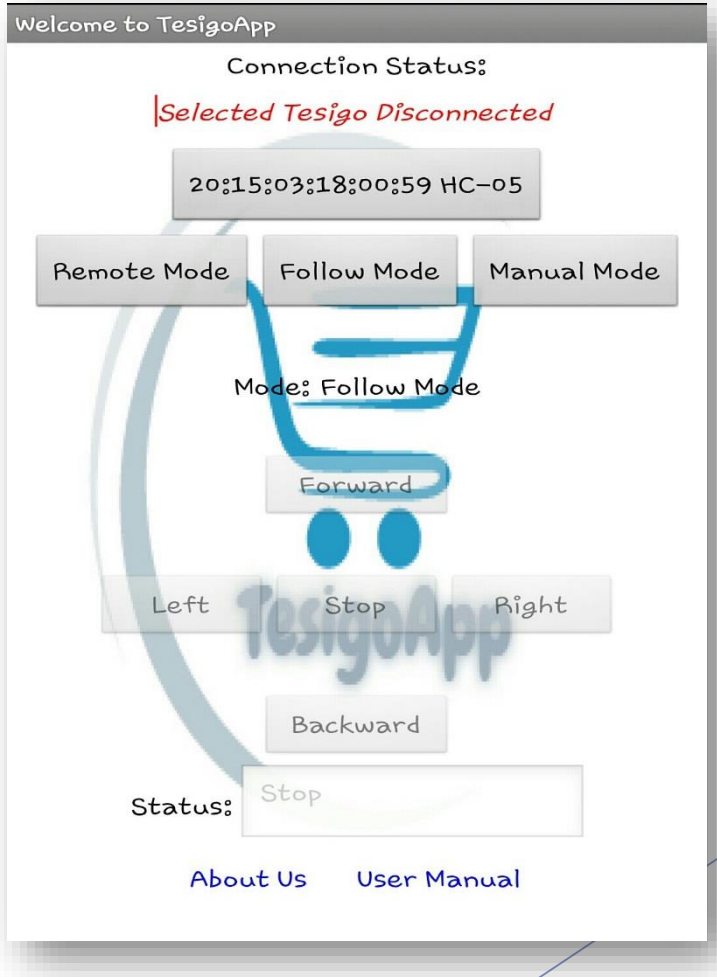


Fig. 17: Follow Mode Screen

Software
- *Tesigo* App

The main screen:

- **When *Tesigo* is not connected**
- **Manual Mode**

Connection Status:

- "Selected *Tesigo* is Connected" in green

Mode:

- Manual Mode

Direction Control Panel:

- Buttons are disabled

Status:

- Stop

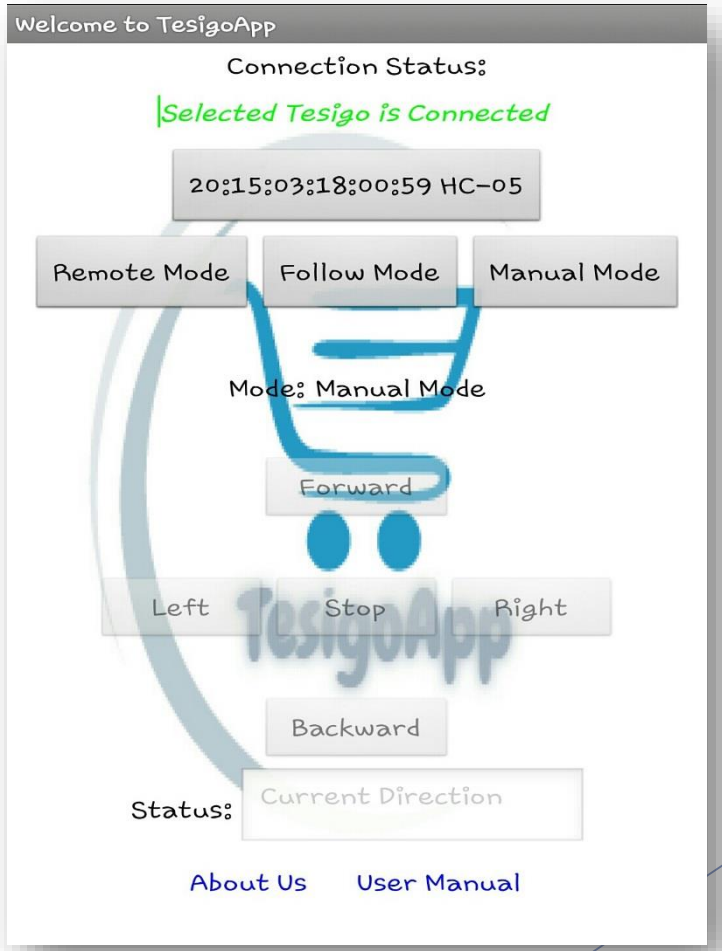


Fig. 18: Manual Mode Screen

Software
- *Tesigo* App

"About Us" screen:

- Information about *Tesigo*
- Information about the team

Fig. 19: About Us Screen

Software
- *Tesigo* App

"User Manual" screen:

- Information about *Tesigo*
- Information about the team

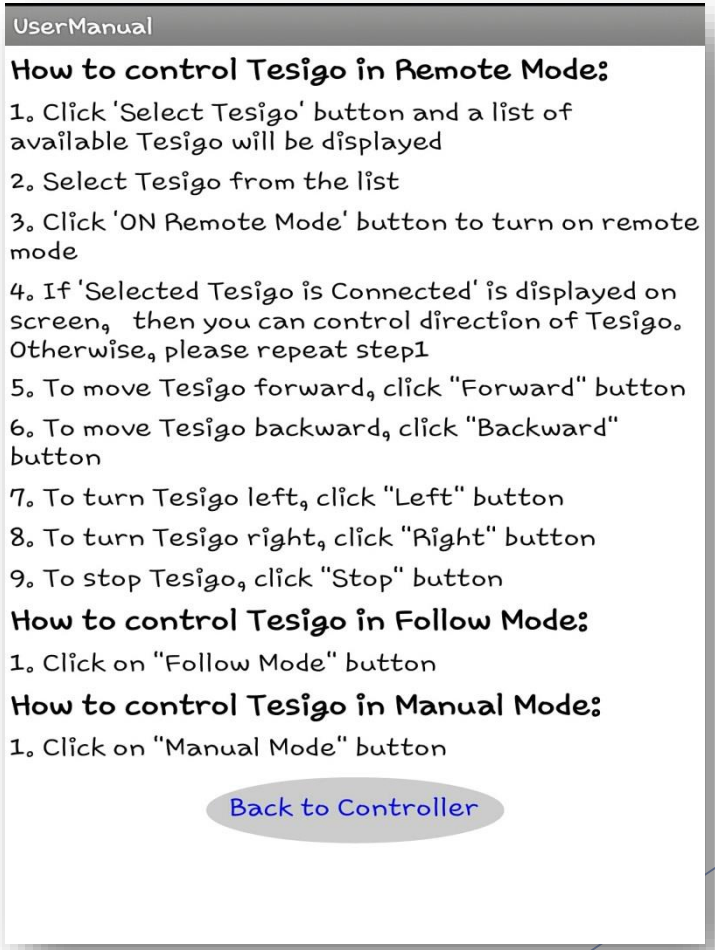


Fig. 20: User Manual Screen

Software
- Kinect Sensor

- Motion Sensing Device
- Depth Sensor
- Tracking System
- Practical use for Developers

Fig. 21: Kinect Version 2 [10]

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Software
- Kinect Sensor

Field of View:

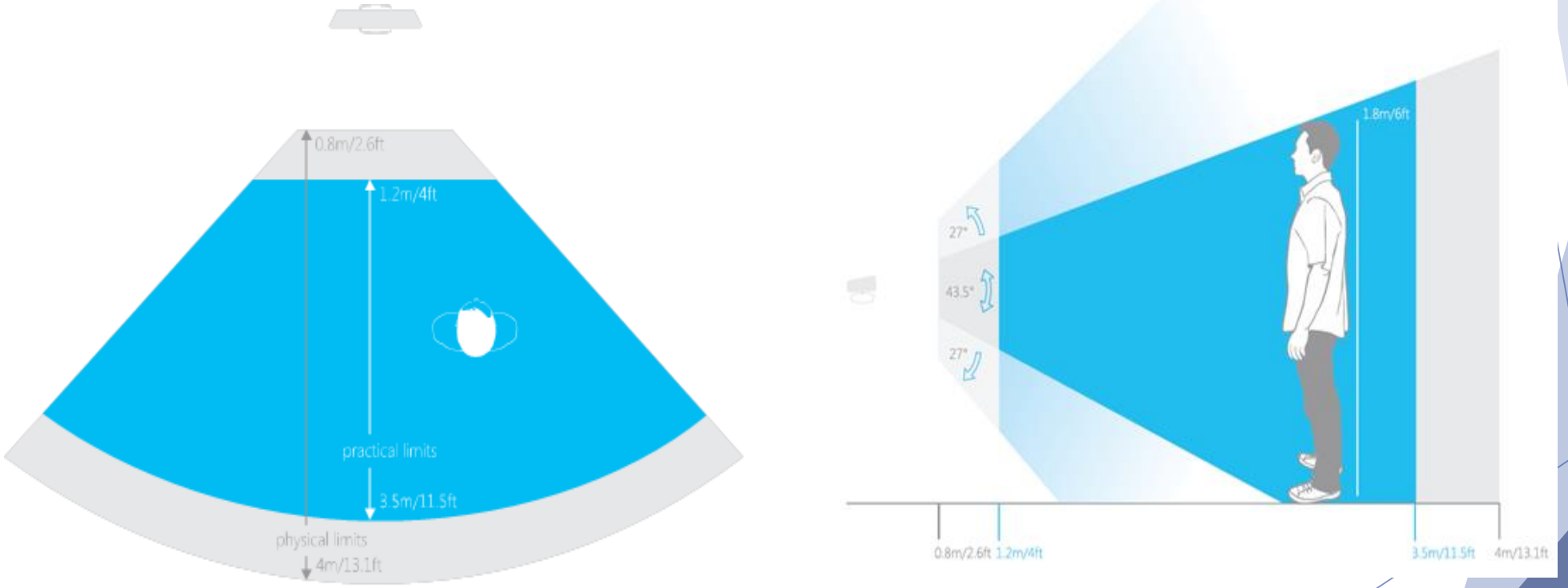

Fig. 22: Kinect Sensor Horizontal and Vertical Field of View [11]

Software
- Kinect Sensor

Tracking Function:

- The Kinect tracks the user's skeleton, providing information (distance and motion) about each joint located in the skeleton
- Each skeleton captured by the Kinect has a tracking ID which allows him to differentiate between people

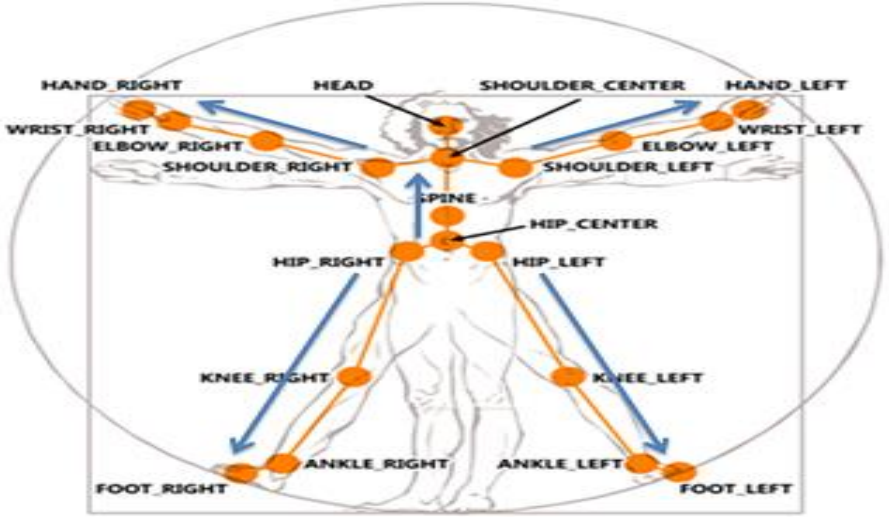

Fig. 23: Kinect Skeleton Joints [12]

Software
- Kinect Sensor

Tracking Strategy:

- "First Person Gets Control" is the strategy being used
- The first person seen by the Kinect will be the target user

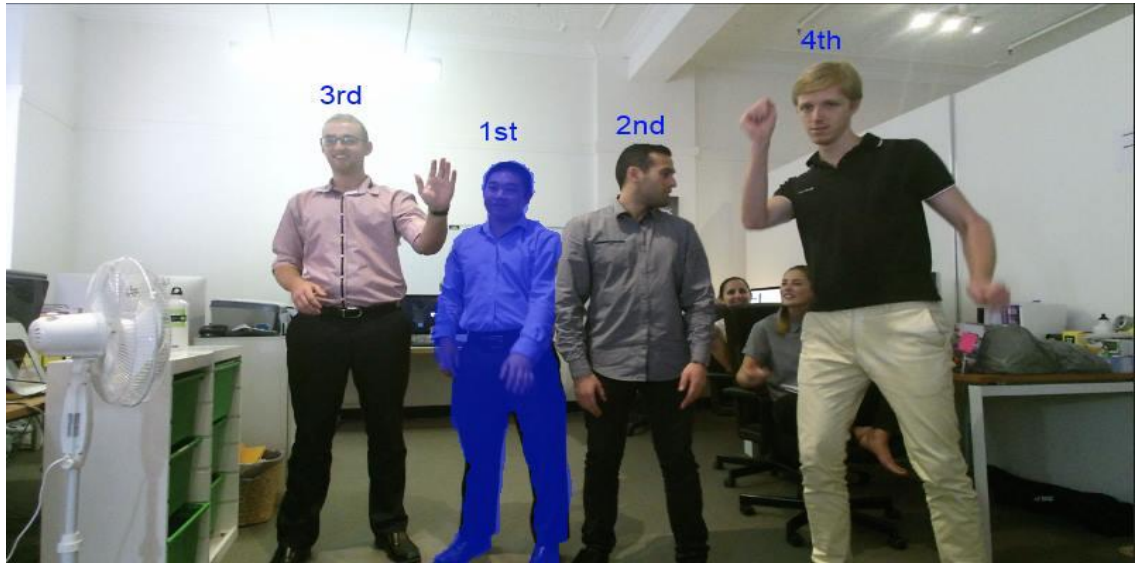

Fig. 24: First person get control [13]

Software
- Kinect Sensor

Kinect's Perspective:

- It tells the position of the user according to her/his hip joint
- It perceives a maximum of six people in tracking mode
- It loses the targeted user if it's view of the target is completely obstructed

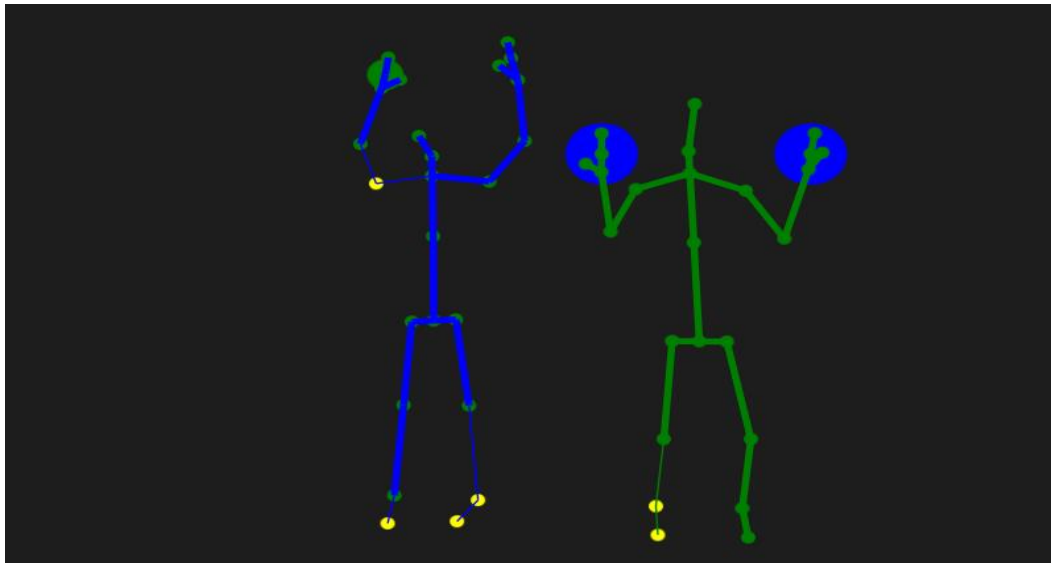

Fig. 25: Body Skeletons

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Finance

Item	Estimated Amount	Estimated Cost ($)	Actual Amount	Actual Cost ($)	Notes
Raspberry Pi	1	60	1	69.44	Not used Raspberry Pi
Arduino Board *	N/A	N/A	2	126.84	Arduino instead of Raspberry Pi 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
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
Rechargeable Battery	2	120	2	103.54	
AmpFlow M27-150 24V DC Motor	2	100	2	132.73	Didn't expect an import tax plus high shipping cost of $36.59
Motor Driver *	N/A	N/A	2	60	Not included in proposal document
Pulley, Belt *	N/A	N/A	2	70.57	Change Design
Other Components:	N/A	20	N/A	63.69	Bought in Canada instead of China
Total	624.99		791.63		Excess budget by $166.64

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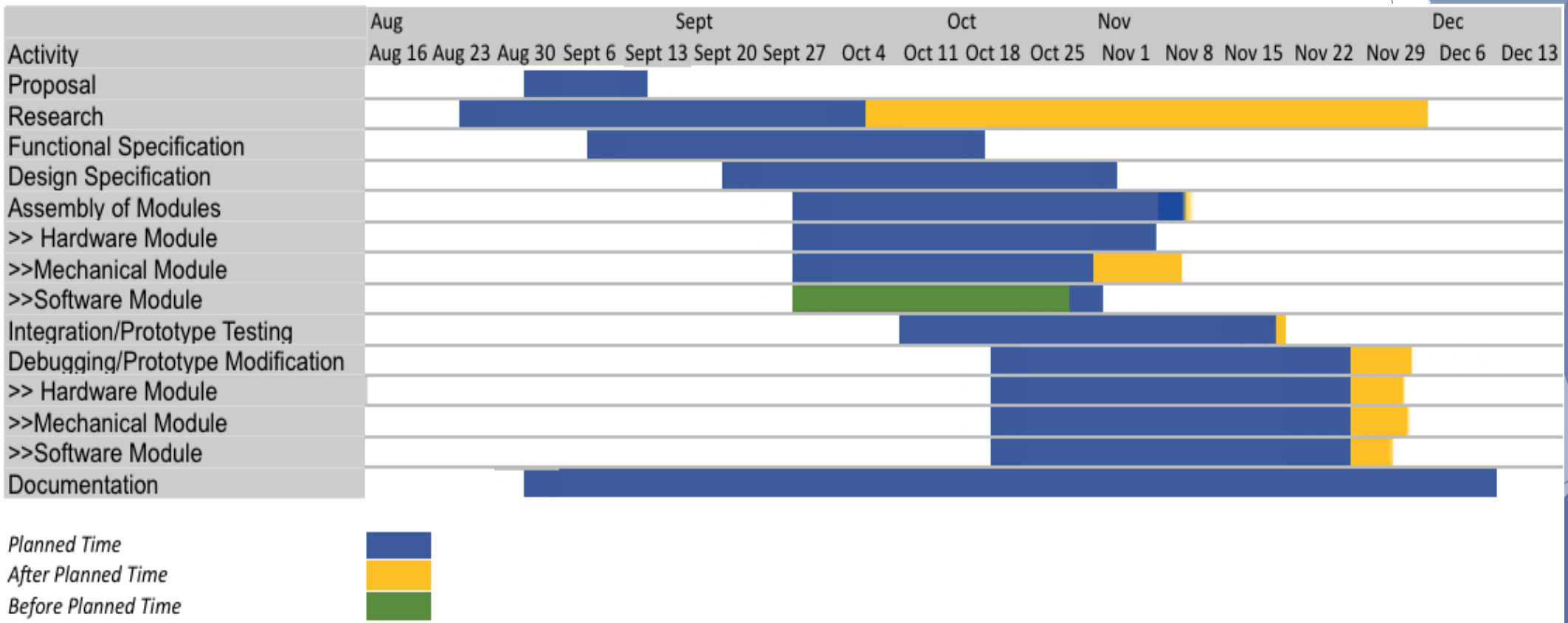
Schedule


Aug
Sept
Oct
Nov
Dec
Activity
Aug 16 Aug 23 Aug 30 Sept 6 Sept 13 Sept 20 Sept 27 Oct 4 Oct 11 Oct 18 Oct 25 Nov 1 Nov 8 Nov 15 Nov 22 Nov 29 Dec 6 Dec 13
Proposal
Research
Functional Specification
Design Specification
Assembly of Modules
>> Hardware Module
>>Mechanical Module
>>Software Module
Integration/Prototype Testing
Debugging/Prototype Modification
>> Hardware Module
>>Mechanical Module
>>Software Module
Documentation
Planned Time
After Planned Time
Before Planned Time

Conclusion

FOYO Technology

Learning Experiences

- **Hardware & Mechanical**
  - Arduino Usage
  - Hardware Welding
  - Mechanical Design and Assemble
- **Software**
  - Android App Development
  - Image Processing Application
- **Others**
  - Design and manufacture process
  - Team Work

Fig. 26: Knowledge related to our project

FOYO Technology

Future Plans

- **Improve the system:**
  i. Add a strong feedback system
  ii. Rebuild the wheel system
  iii. Add wireless recharge kit

- **Reduce the cost:**
  i. Design and build Microcomputer
  ii. Use cheaper camera
  iii. Manufacture our own cart frame

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Acknowledgement

- Dr. Andrew Rawicz
- Prof. Steve Whitmore
- TA: Lukas-Karim Merhi
- Shop Assistants in Lee's Electronics
- Bob Xu – Manager of T&T Supermarket
- Peiyong Lin - Mechanical Engineer
- Our Dear Parents

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Question?