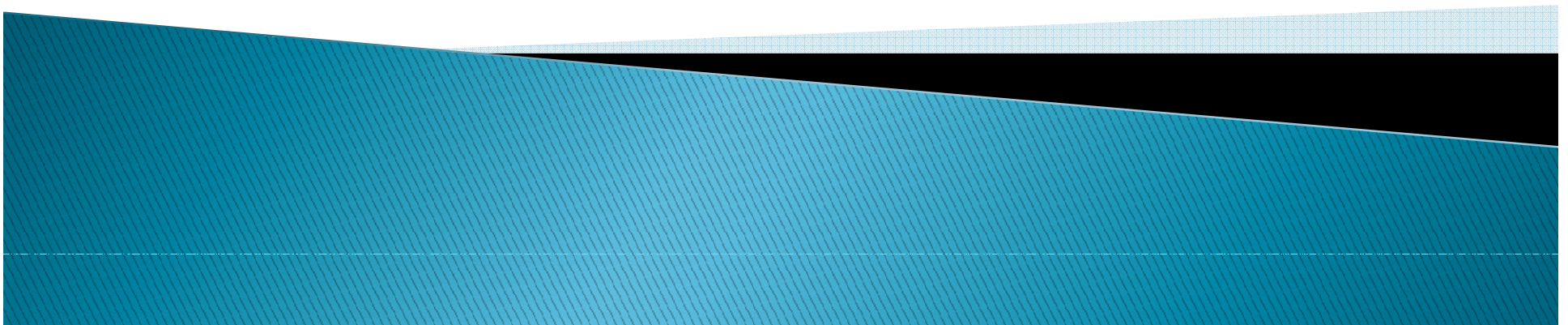ELYSIAN
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Avatar 3G

ENSC 440

Sherman Tse, Anthony DiNicolo, Celestine Poon, Simon Mai, Leo Chan

Elysian Team

- ▶ Sherman Tse, President and Chief Executive Officer (CEO)
  - ◦ Team leader, focused on networking and Arduino board setup.

- ▶ Leo Chan, Chief Information Officer (CIO)
  - ◦ Focused on the camera and speaker, also worked on the Android app.

- ▶ Anthony DiNicolo, Chief Operating Officer (COO)
  - ◦ Focused on the case, battery and mechanical aspects of the design.

- ▶ Celestine Poon, Chief Communication Officer (CCO)
  - ◦ Focused on the sensors and mechanical aspect of the design. She also setup agendas and posted reports for meetings.

- ▶ Simon Weineng Mai, Chief Marketing Officer (CMO)
  - ◦ Focused on the Android app development.

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Our Motivation

▶ Take advantage of 3G to control a robotic device

▶ Allow users to connect with the outside world from inside the home

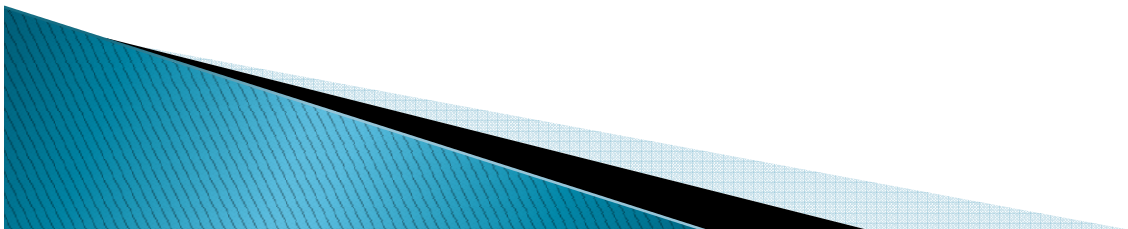▶ Construct an affordable solution to appeal to a wide audience

Copyright: New Generation Hobbies

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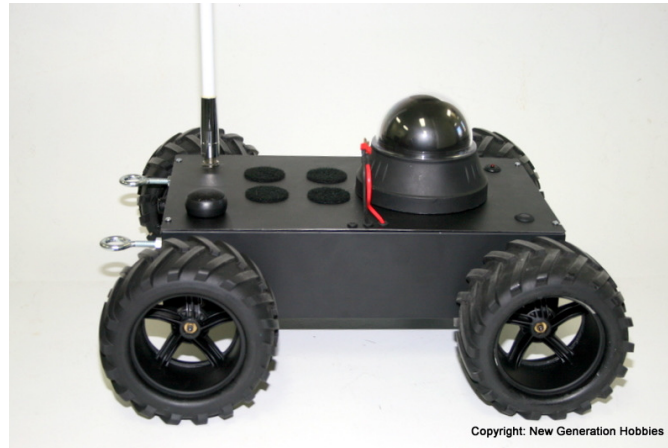
What is the Avatar 3G?

- Telepresence device
- Bring people closer together
- Connectivity anywhere with 3G or Wi-Fi access
- Compact size for easy storage
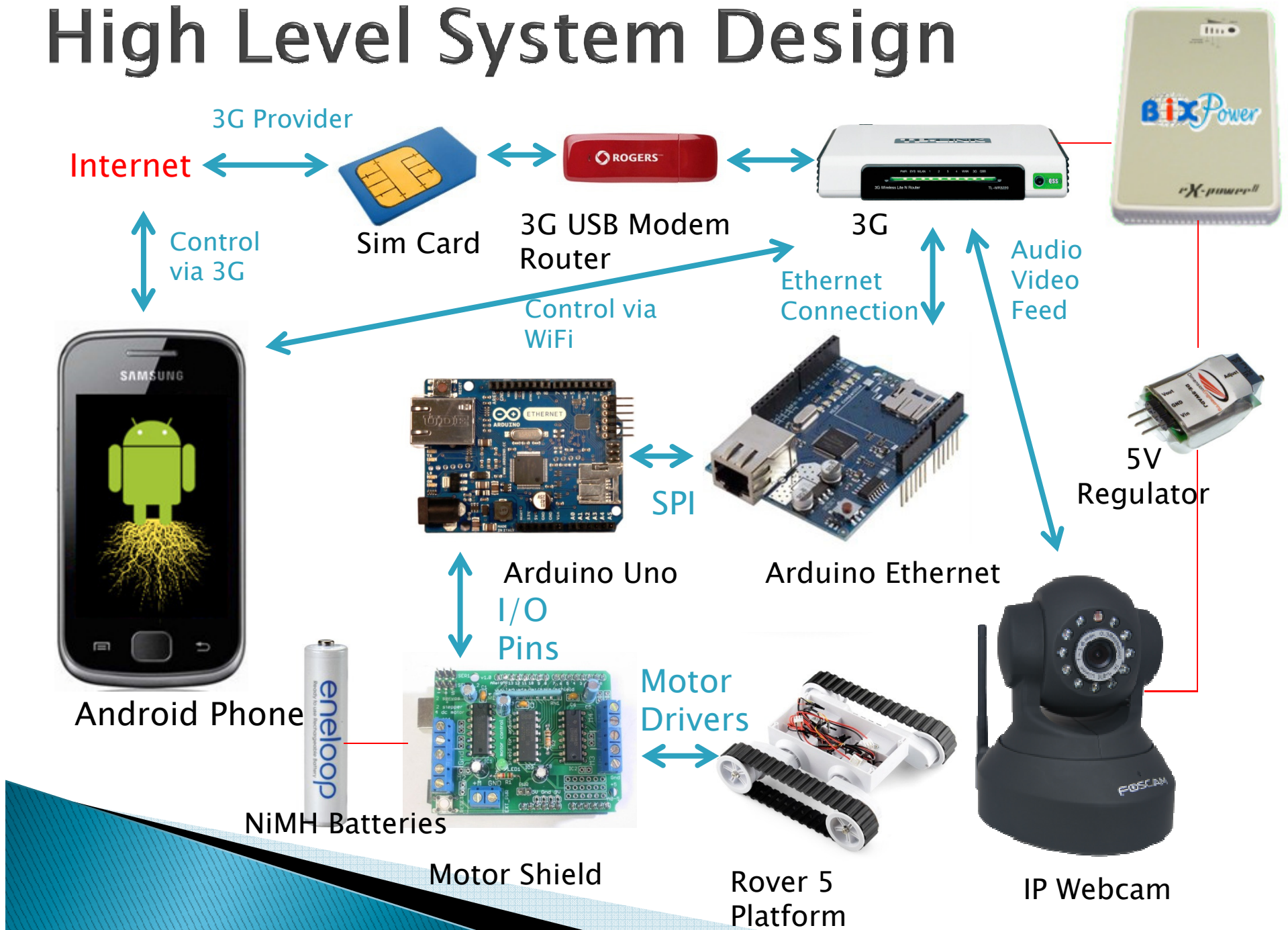- Storage compartment
- Low cost

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Market

- First truly affordable 3G controlled robot.

- Low production costs : $505

- Applications in home assistance, surveillance, telepresence, entertainment, and as an educational development platform.
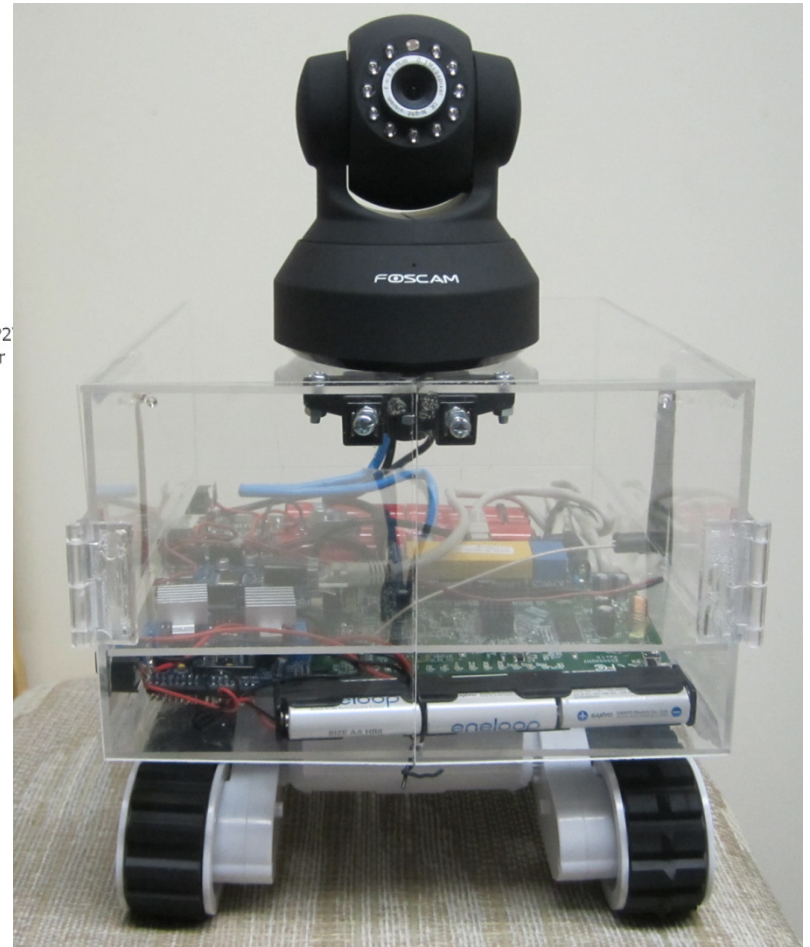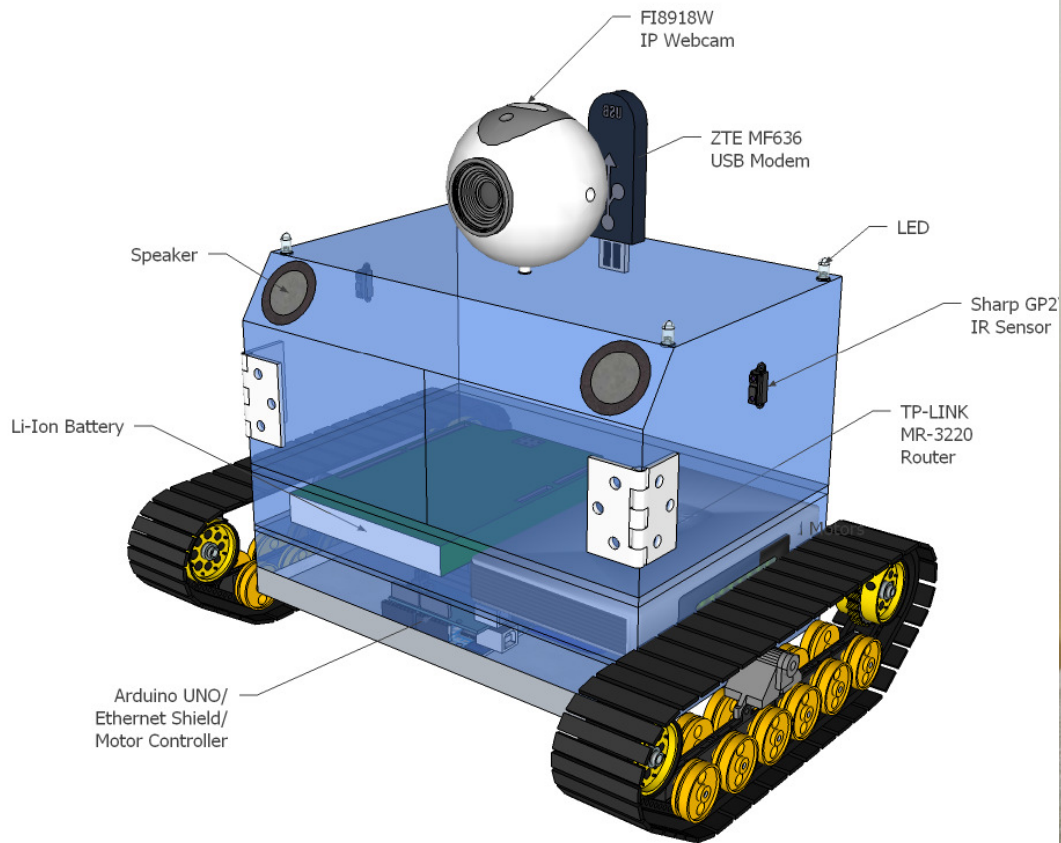
Competition

	Avatar 3G	Telemedix CHAD [4]	3DQ 3G Platform [5]
WiFi Control	Yes	Yes	Yes
3G Control	Yes	No	Yes
Video Feedback	Yes	Yes	Yes
Two-Way Audio	Yes	No (One-Way)	Yes
Speed/Size	Medium Speed, Light Build	Very Slow, Very Large	Fast Speed, Medium Build
Run Time	2 hours	15 minutes	2 hours
Phone OS	Android	iPhone	No
Cost	$505	$1120	$19,499!

High Level System Design

3G Provider

Internet

Control via 3G

Sim Card

3G USB Modem Router

Control via WiFi

3G

Ethernet Connection

Audio Video Feed

BiX Power

5V Regulator

SPI

Arduino Uno

Arduino Ethernet

I/O Pins

Android Phone

NiMH Batteries

Motor Drivers

Motor Shield

Rover 5 Platform

IP Webcam

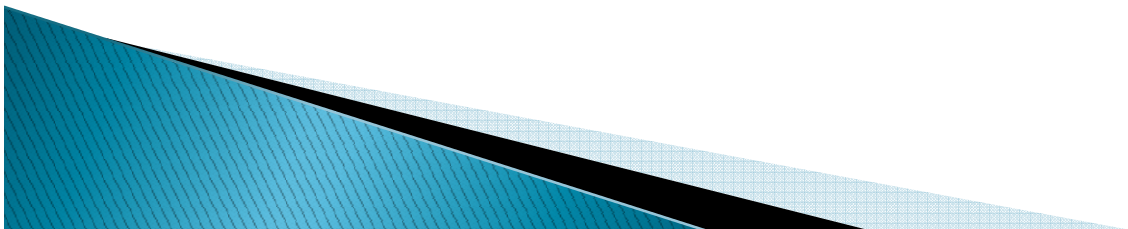# Concept vs Final Design

Wireless Control System

- 3G connection to internet, with public IP
- WiFi connection via LAN
- Both use TCP (Transmission Control Protocol)
- Android sends a control signal every 50ms to Arduino
- Arduino checks for new control signal every 250ms
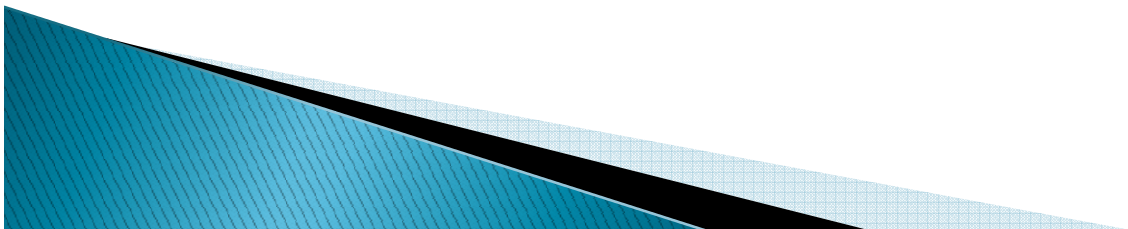- Arduino stops moving until control signal received

Rover 5

- 4 available motors, only using 2 to save power
- Powered by 6 AA batteries
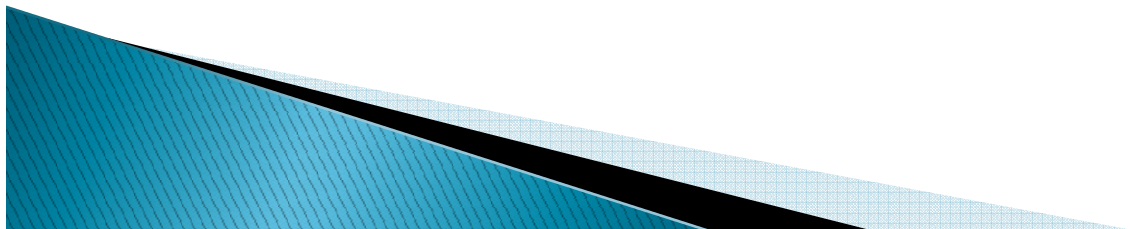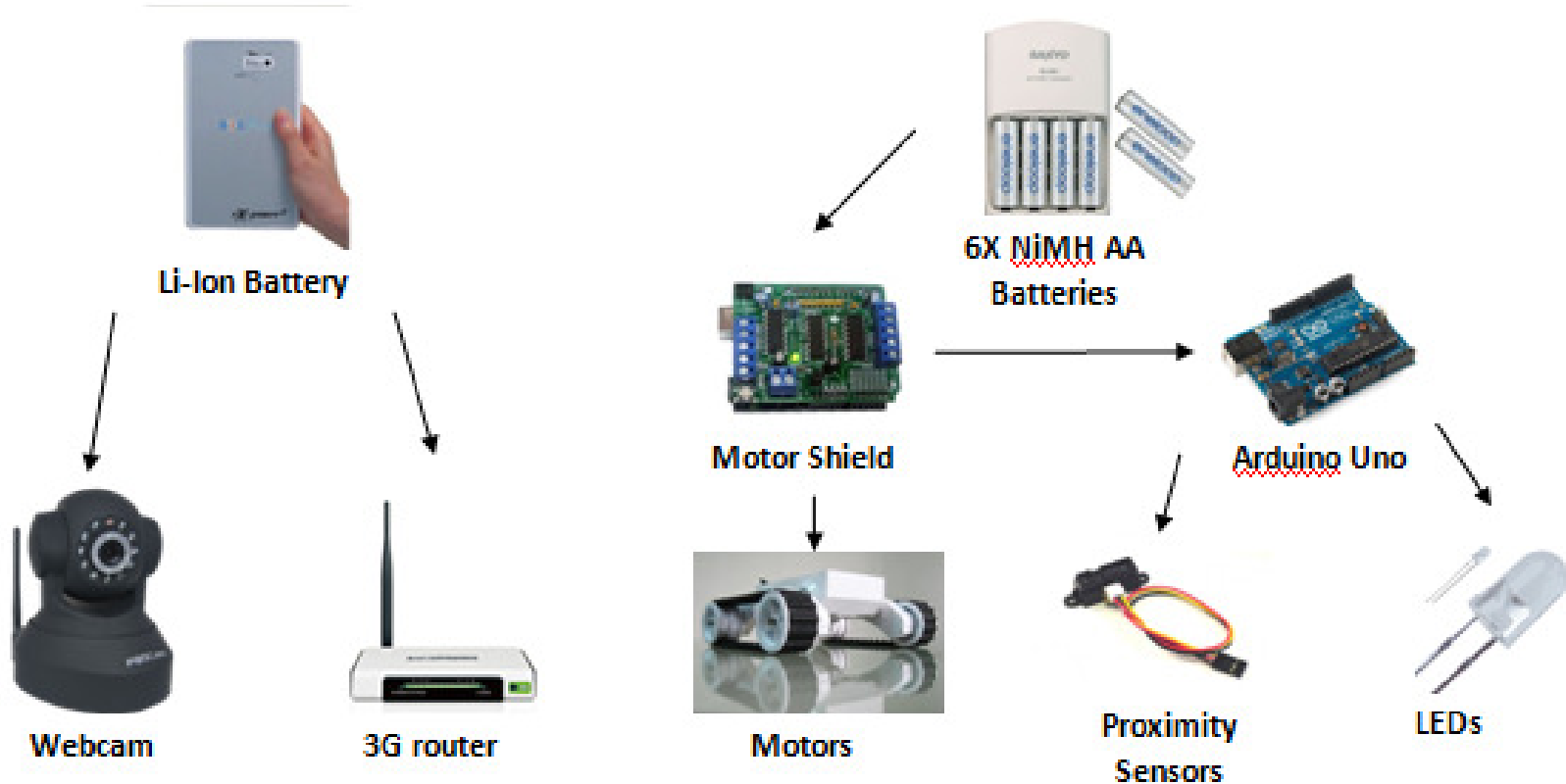- Speed = 1km/hr
- Torque = 10kg/cm

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Power Supply

- BiXNet BP75 Universal External Rechargeable Lithium Ion Battery
  - High capacity battery ensures router and webcam stay functional
- 6 rechargeable AA NiMH batteries
  - Minimal added cost for much greater battery life

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Electrical System Design

Li-Ion Battery

6X NiMH AA Batteries

Motor Shield

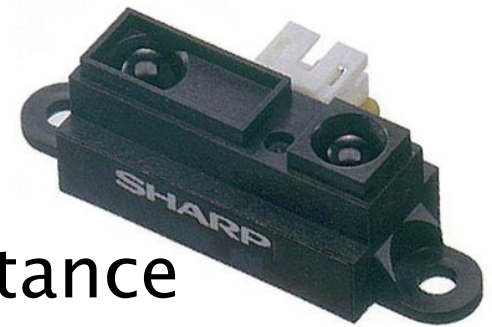Arduino Uno

Webcam

3G router

Motors

Proximity Sensors

LEDs

Camera and Speakers

- FOSCAM FI8918W
- Built-in 2 way audio communication
- Connects to the Android app with wireless connection through the modem with its own static IP
- Powered by the Lithium ion battery
- Able to control pan and tilt via the android app

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Sensors

- Sharp GP2Y0A21YKOF Analog Distance Sensor
- There are two sensors located just above the treads
- Powered by Arduino Uno
- Range: 10cm – 80cm
- Speed is limited with respect to the distance
- Short distances will halt the Avatar
- Manual override of sensors is available

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Why Android?

- Open source
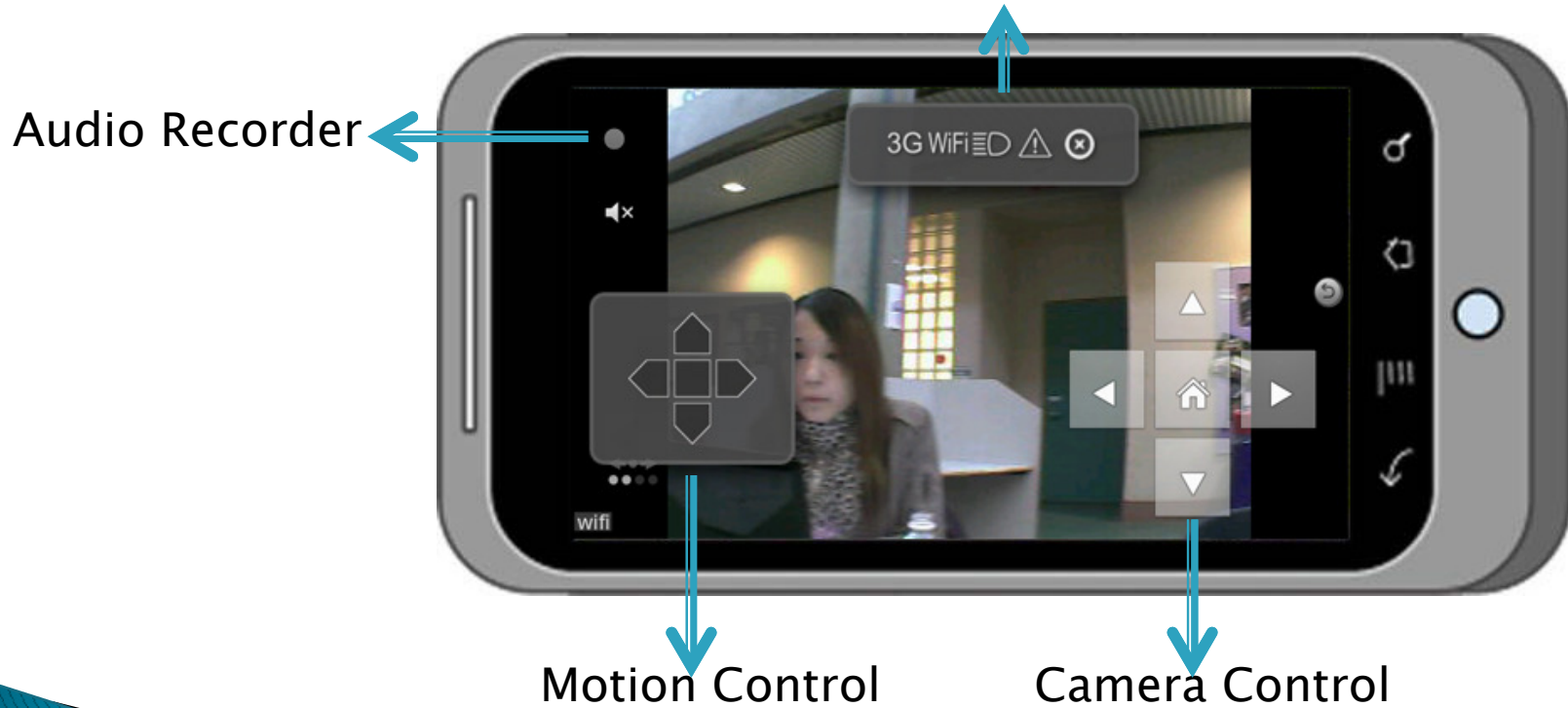- Java based
- Price

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Applet Flowchart
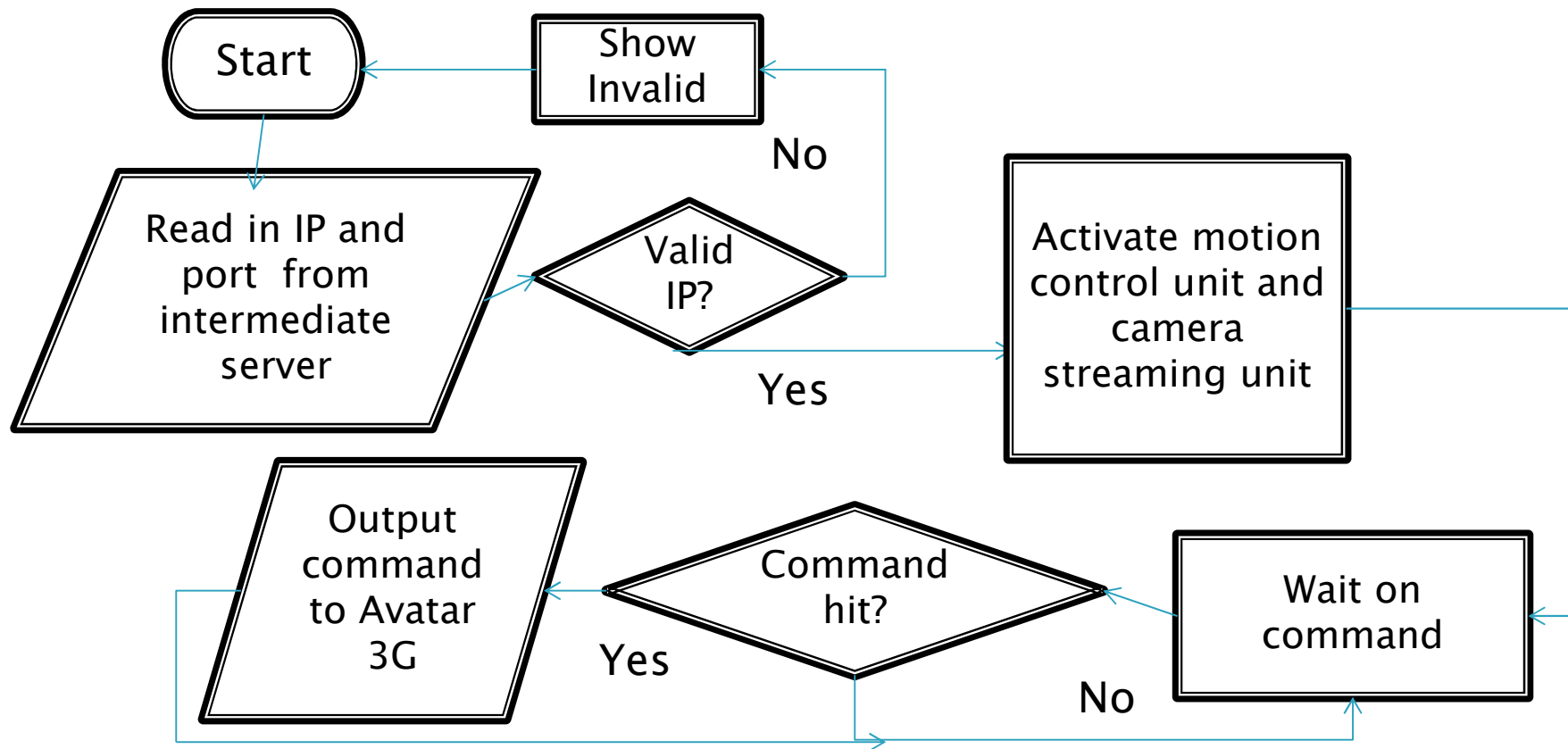
Android Applet

- Tiny Camera   +   Softkey

Network Selection Pad

Audio Recorder

3G WiFi

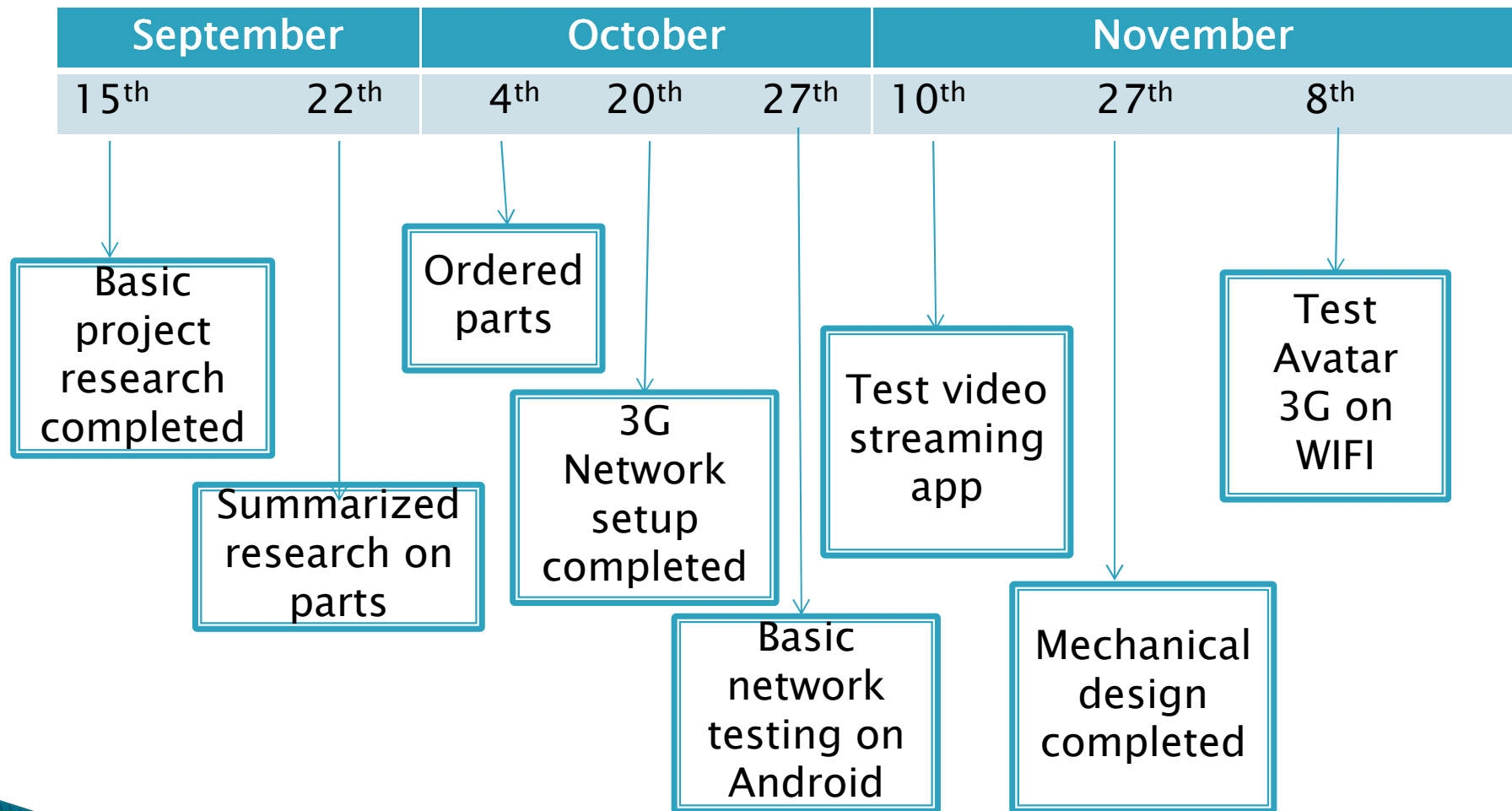Motion Control   Camera Control

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Casing

▸ Constructed from 3mm Perspex
▸ Removable shelf for item storage and easy access to electronics
▸ Provides a sleek, polished design
▸ Weather resistant
▸ Shatterproof

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Project Timeline

September		October			November		
15th	22th	4th	20th	27th	10th	27th	8th

Basic project research completed

Summarized research on parts

Ordered parts

3G Network setup completed

Basic network testing on Android

Test video streaming app

Mechanical design completed

Test Avatar 3G on WIFI

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Project Timeline (cont'd)

December					
1st	4th	5th	6th	8th	12th

Android app design completed

Frame and integrate all hardware components

First test on using app control Avatar3G

Install sensor to Avatar3G

Test Avatar3G using app on 3G network

Final test

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Sources of Funding

- Engineering Student Society Endowment Fund (ESSEF)
- Self Funding

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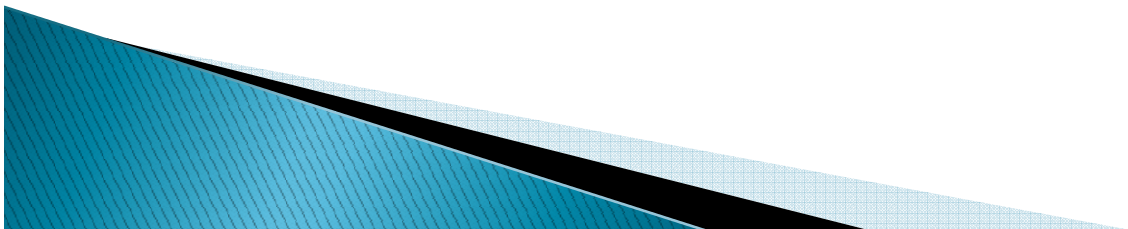
Estimated Budget

Equipment	Estimated Unit Cost
Arduino Ethernet Microcontroller Board	$56.00
3G USB Modem + 3G Router	$95.00
Chassis, Motors, Wheels, Plexiglas Casing	$150.00
Audio Speaker	$10.00
Sim Card	$12.00
IP Webcam	$55.00
Lithium Ion Rechargeable Battery + Charger	$50.00
Android Phone	$112.00
Total Equipment Cost	$540.00
3G Wireless Plan	$60.00
Shipping	$75.00
Total Project Cost	$675.00

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Final Development Costs*

Equipment / Service	Actual Cost
3G Modem	$47.61
Arduino Ethernet + Uno	$89.02
TP-Link Router	$51.61
Motor Shield, Motors, Gear Box	$83.56
IP Webcam	$97.22
LED, Gearbox, Sensors	$65.63
Rogers PAYG Data Plan	$28.00
Rogers Rocket Stick (Used)	$25.00
Li-Ion Battery	$123.94
Rover 5 Platform	$86.46
Backup drivers, switches, jacks, 10w regulator	$64.92
Backup regulator, piezo speaker, resistors	$46.93
Perspex Casing	$36.50
Public IP from Rogers	$6.72
Motor Driver Chips	$24.15
Total	$877.27

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*prices include shipping, spares and tax

Future Production Costs Per Unit*

Equipment	Estimated Unit Cost
Arduino Ethernet Shield	$39.95
Arduino Uno Microcontroller	$28.95
Motor Shield for Arduino	$20.09
Foscam FI8918W	$97.22
2x Super Bright 5mm LED	$1.90
2x Sharp IR Sensor	$23.90
BP 75 Lithium Ion Battery	$123.94
Rover 5 Platform	$62.95
3x Rocker Switch	$2.04
10W Voltage Regulator	$16.08
Perspex Casing	$36.50
TP-Link Router	$51.61
Total	$505.13

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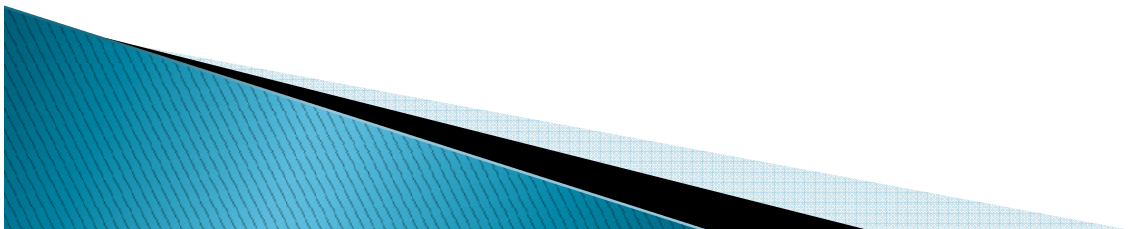*prices exclude shipping, tax, and 3G Modem

What We Learned...

▸ Useful applications of skills learned in class
▸ Mechanical skills not covered in classes
▸ Research is the most time consuming aspect of the design process
▸ When possible, use devices with datasheets
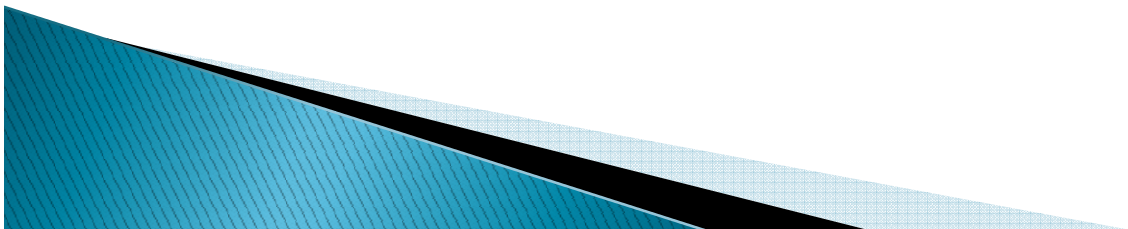▸ Importance of organization and planning

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Future Work

- Higher power motors
- Larger torque chassis
- Rotating sensors
  - Better speed control
- Fully incorporated applet
  - Video and sound without 3rd party apps

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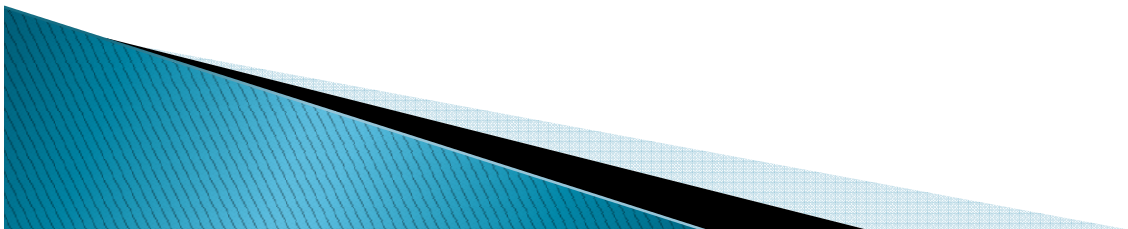
Conclusion

- Recap
- Our love for the Avatar 3G

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Sources

[1] Samsung Galaxy Gio S5660 (2011). Retrieved Sept 20, 2011 from addictivetips.
http://cloud.addictivetips.com/wp-content/uploads/2011/06/Samsung-Galaxy-Gio-root.png

[2]SoftKeys for ROOT USERS (2011). Retrieved Dec 9, 2011 from android market.
https://market.android.com/details?id=net.hoopajoo.android.SoftKeys

[3] tinyCam Monitor PRO (2011). Retrieved Dec 9, 2011 from android market.
https://market.android.com/details?id=com.alexvas.dvr.pro

[4] Post Mortem for a Controlled Home Assistive Device (2011)
http://www2.ensc.sfu.ca/~whitmore/courses/ensc305/projects/2011/8post.pdf

[5] 3DQ Research Robot Development Platform (2011)
http://www.rotoconcept.com/products/3genabledwifirobot/
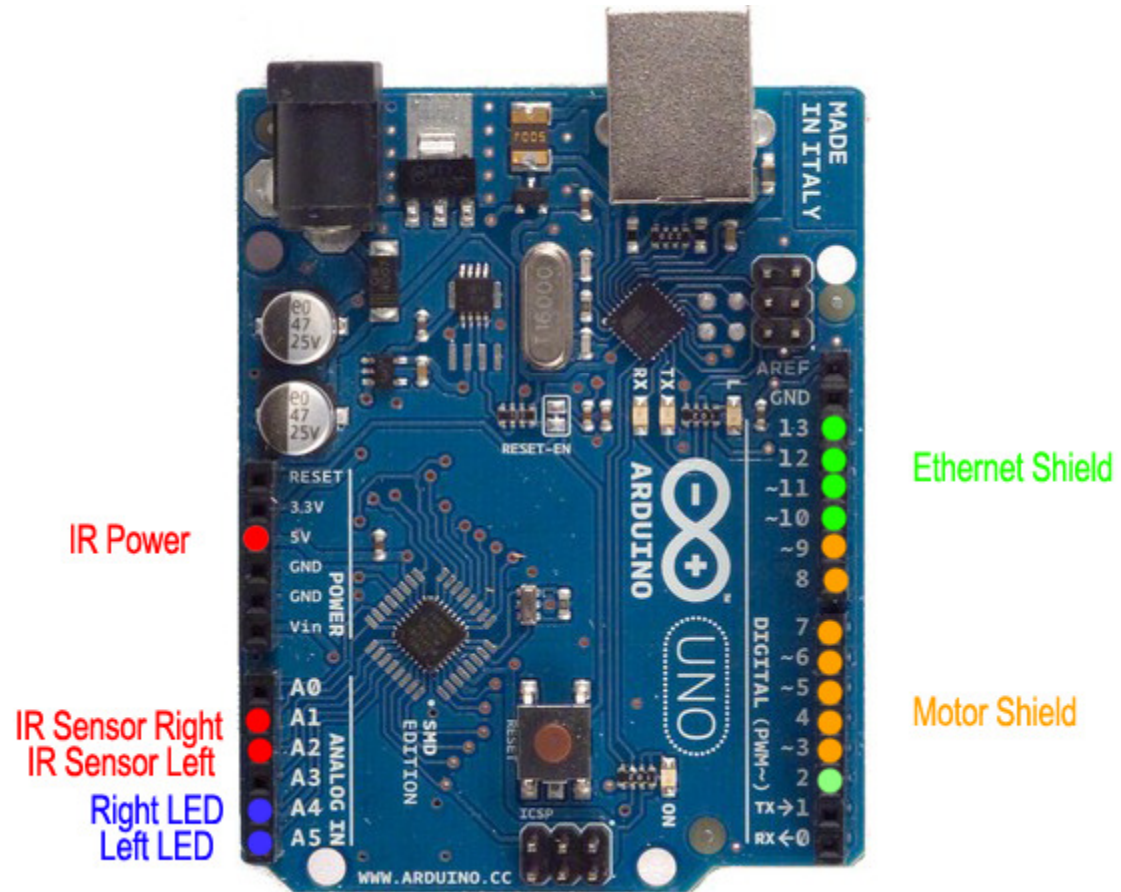
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Acknowledgement

- Anthony's grandfather and his friend for helping us build the casing of the Avatar 3G.
- Professor Andrew and Mike for helping us finalize our idea

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3G Footage and Interviews
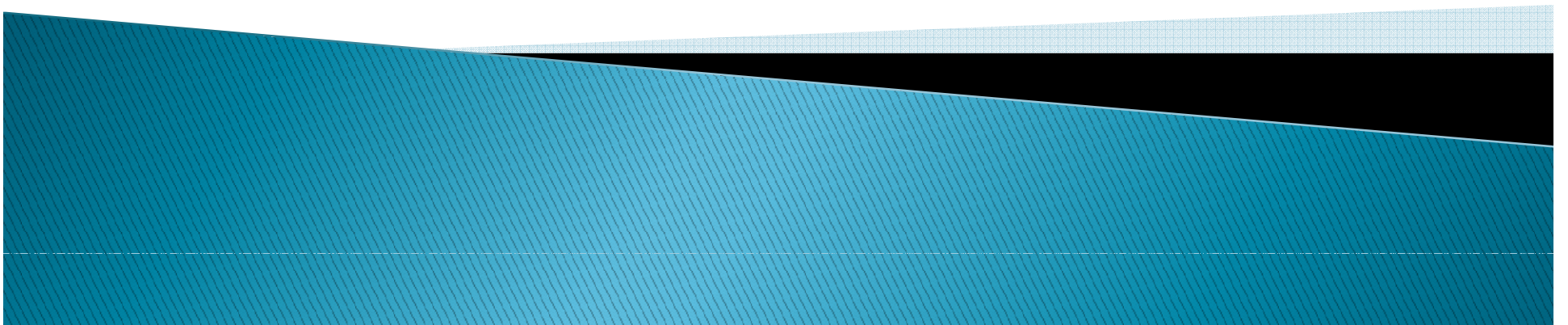
Questions

Arduino Pinout

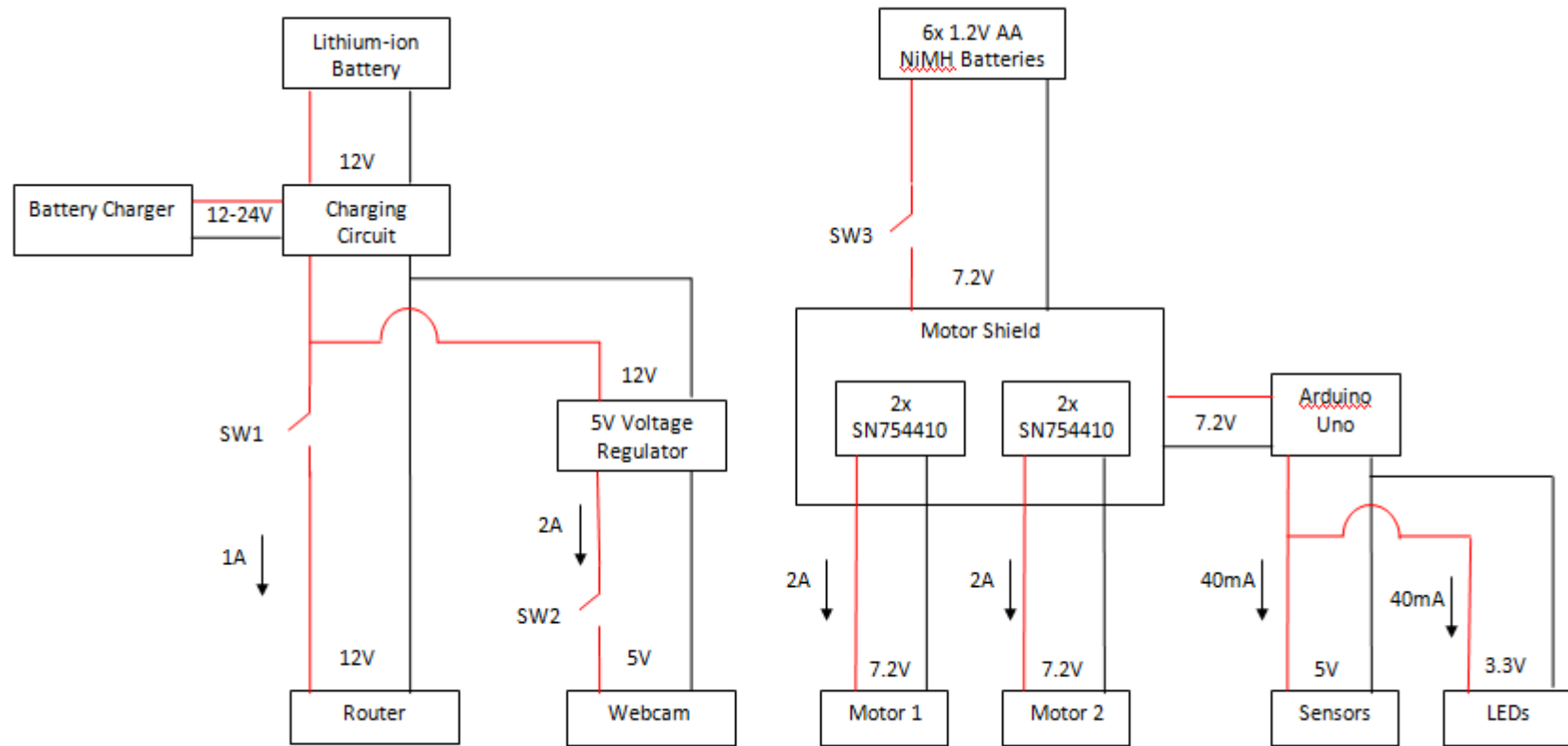# Electrical System

Complete Electrical System for Avatar 3G