# From a design idea to a finished project



Beginning of a brainstorming session

# You are telling a story



#### 2 How It Works

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# It's the process you're developing



# Not quite ready for prime time



# Keep the fire extinguisher handy!



# Messy first, second or third prototype



# Lets shoot for this.







# Or possibly this.



# Planning for completion

- Time management (everything takes longer)
- Get from paper to real world
- Ask questions, feedback & share
- Stuff you didn't learn in class
- Develop new skills you never needed

#### Schematic (accurate & complete)



#### **PCB (not complete)**



### PCB (accurate & complete)



# Bill of Materials (accurate & complete)

iRobot LC	D PCB	Revised: Friday, Augus	st 08, 2008					
080612_iRobot_LCD Revision:								
Bill Of Ma	aterials	August 31,2010	14:16:51					
Item	Qty.	Ref.			Cost	Part	Supplier	Supplier#
1	1	DSP1		\$	24.00	NHD-0420H1Z-FSW-GBW	Mouser	763-NHD0420H1ZFSWGBW
2	6	D4,D5,D6,D7,D8,D9		\$	0.35	LED	Digi-Key	L71505CT-ND
3	1	ENC1		\$	21.00	EC11B2024305	Mouser	688-EC11B2024305
4	1	J18		\$	2.50	CON20AP	Digi-Key	MHB20K-ND
5	12	R8,R9,R10,R11,R12,R	13,	\$	0.10	220	DIGI-KEY	P220ACT-ND
		R14,R15,R18,R20,R2	1,R22					
6	3	R16,R17,R19		\$	0.10	1K	DIGI-KEY	P1.0KACT-ND
7	6	SW1,SW2,SW3,SW4,	SW5,SW6	\$	0.15	SW PB	Digi-Key	CKN9071-ND
8	1	VRES1		\$	2.75	10K	Digi-Key	3214J-103CT-ND

# Planning for completion

- Where will it live?
- Component selection
- Associated technologies
- Budget
- Testing, testing, testing
- Documentation (you'll thank yourself later)

### Surface Mount Components

![](_page_16_Picture_1.jpeg)

![](_page_16_Figure_2.jpeg)

### Through Hole Components

### Large PCB and Chassis Mount Components

![](_page_17_Picture_1.jpeg)

#### **Part Selection for 10K Resistor**

![](_page_18_Figure_1.jpeg)

![](_page_19_Picture_0.jpeg)

![](_page_19_Picture_1.jpeg)

#### **Coil Cells**

#### **Alkaline Cells**

![](_page_19_Picture_4.jpeg)

### **Re-chargeable Batteries**

### Audio, Video & Computer Connectors

![](_page_20_Figure_1.jpeg)

![](_page_20_Picture_2.jpeg)

#### RF Connectors

## **Enclosure Examples**

![](_page_21_Picture_1.jpeg)

![](_page_21_Picture_2.jpeg)

![](_page_21_Picture_3.jpeg)

**Colorful hand-held** 

#### See through

Heavy duty chassis

![](_page_21_Picture_7.jpeg)

![](_page_21_Picture_8.jpeg)

![](_page_21_Picture_9.jpeg)

**Steel chassis** 

**Benchtop instrument** 

Weather-proof

## **Customized Enclosures**

#### Laser cut acrylic panel

![](_page_22_Picture_2.jpeg)

### Laser or CNC cut enclosures

![](_page_22_Picture_4.jpeg)

# How to get there

• Create an accurate model with Inventor or Solidworks or other CAD software.

![](_page_23_Picture_2.jpeg)

- Use the files created for the model with CNC tools.
- Plastics and thin wood can be cut and etched with a laser cutter.
- Metals, plastics and wood can be cut with a CNC mill or waterjet cutter.

![](_page_24_Picture_3.jpeg)

# Results you can achieve with planning and some effort.

![](_page_25_Picture_1.jpeg)

![](_page_25_Picture_2.jpeg)

![](_page_26_Picture_1.jpeg)

#### **Laser Cutter**

![](_page_27_Picture_1.jpeg)

#### **CNC Milling Machine**

![](_page_28_Picture_1.jpeg)

#### Waterjet Cutter

![](_page_29_Picture_1.jpeg)

#### **3D Printer**

# **Final Thoughts**

• Documentation (you'll thank yourself later)

• Create a user's manual that anyone could use.

# Electronics, mechanics, fluids, mixology and psychology.

![](_page_31_Picture_1.jpeg)

## Resources

#### Parts Distributors

\*Digikey.com \*Grainger.com \*Newark.com Mouser.com Jameco.com MPJA.com McMastercarr.com Sparkfun.com \*These are ISU contract suppliers.

#### Shops on campus

1301 Coover (hand tools)
1316 Coover (hand tools & power tools)
1331 Coover ETG (parts, parts ordering & project advice)
1260 Hoover Boyd Lab (power tools & 3D printer)
426 Design (laser cutters & 3D printer)
1209 Sukup (waterjet cutting)

# **Contact Information**

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