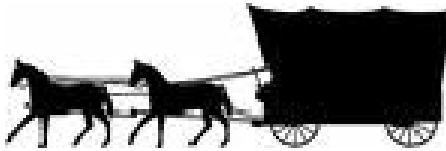


# ENSC 305 / 440 Project

Team 12

*Pioneer Solutions*



*Pioneering the Future*

## **Pioneer Solutions Presents the “Pet Care System”**

A revolutionary approach to take care of your pet.

# Schedule of Presentation

- ▶ What is the Pet Care System
- ▶ Why is the Pet Care System Useful
- ▶ System Overview
- ▶ High Level System Design
- ▶ Bottom Line (\$)
- ▶ Project Specifics
- ▶ Conclusion
- ▶ References
- ▶ Acknowledgments
- ▶ Q&A
- ▶ Low level design with demo to follow



# What is the Pet Care System?

- ▶ Software, hardware, and mechanical solution
- ▶ Prototype for dogs and cats
- ▶ Flexible design for various pets

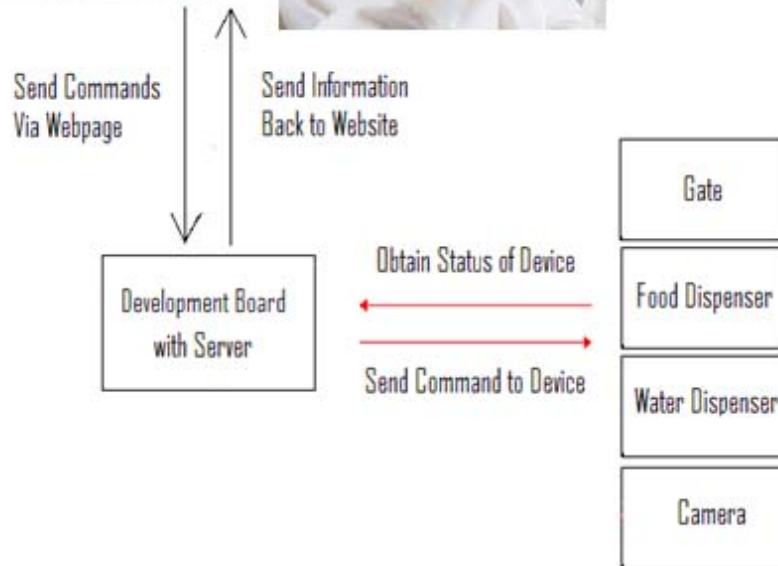
# Why is the Pet Care System Useful?



# Introducing the Team

- ▶ Kyron Winkelmeier – Project Manager/Mechanical Engineer
- ▶ David Chin – Software Engineer
- ▶ Rusty Clarkson – Software Engineer
- ▶ Ricky Chau – Hardware Engineer
- ▶ Alan Lau – Mechanical Engineer

# System Overview



[1][2][3]





# High Level System Design: Webpage and Server

Pet Caring System - Windows Internet Explorer  
http://192.168.1.101:8080/index.html

McAfee SiteAdvisor

Pet Caring System

Auto Mode Manual Mode

Welcome to the Pet Caring System

PetCare System

Water Level:  
Food Level:  
Dog Location:

**Pioneer**  
Manual Mode

**Command**

- ▶ Gate
- ▶ Food Dispenser
- ▶ Video Camera

**Status**

- ▶ Gate
- ▶ Food Dispenser
- ▶ Water Dispenser

Alert

File not found.



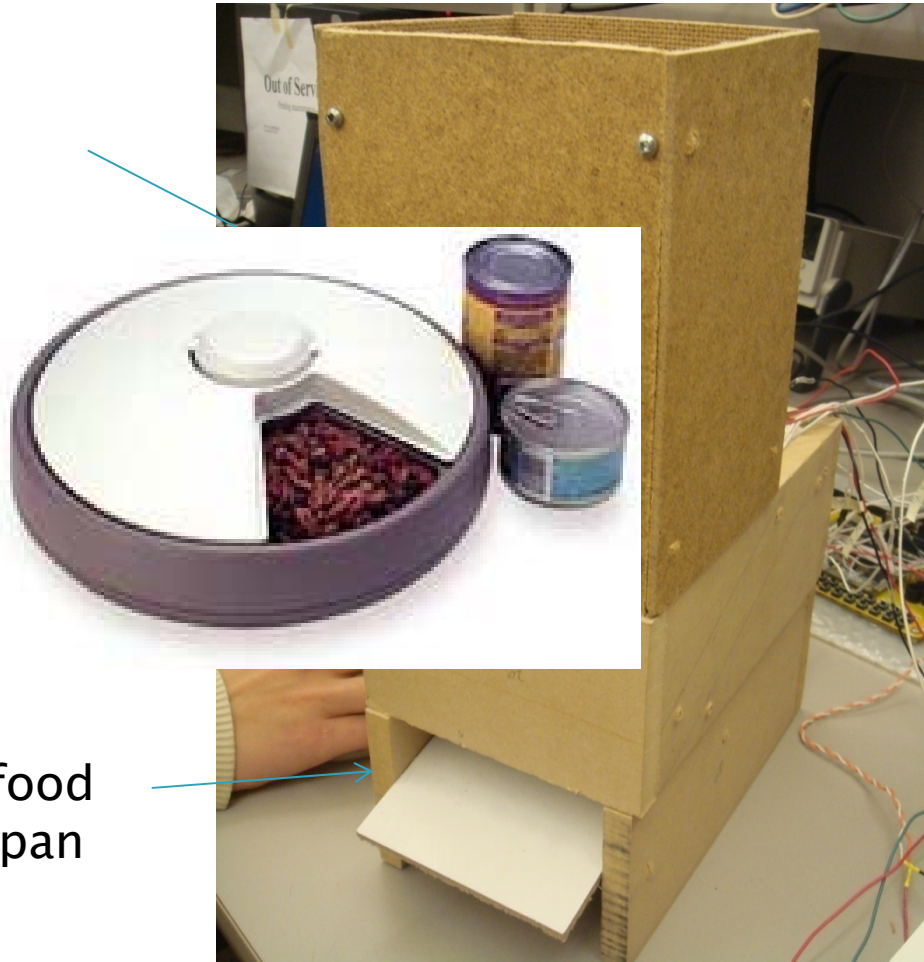


# High Level System Design: Food Dispenser

Top – Food storage

Middle – dispenses food from food storage.

Bottom – dispatches food to the food pan



# High Level System Design: Water Dispenser

## Alternative Design Purpose

- Use a team of the design water dispenser and modify it
- Hydrate the Pet

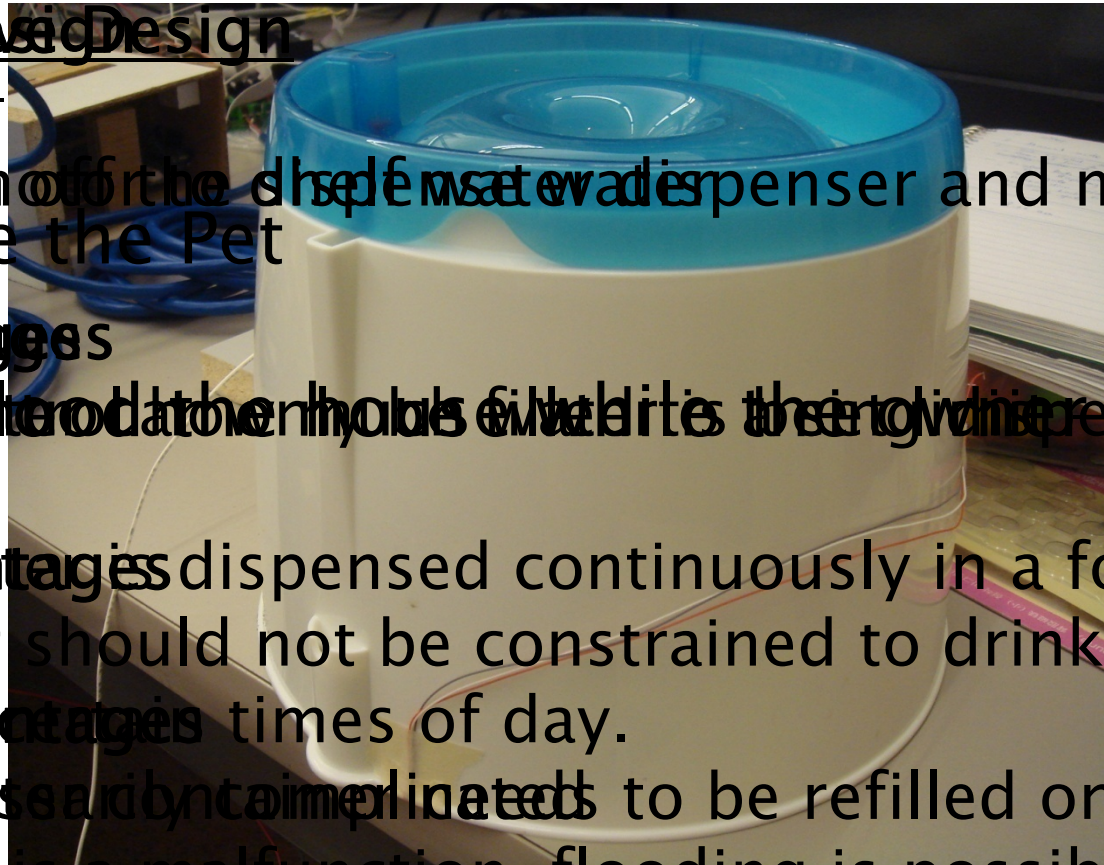
## Advantages

- Don't worry about the holes in the dispenser won't flood  
always!

## Disadvantages

- The water is dispensed continuously in a fountain
- The pet should not be constrained to drinking  
water at certain times of day.

- The water is not filtered
- The water is not filtered to be refilled on a continuous  
basis
- If there is a malfunction, flooding is possible



# High Level System Design: Gate

## Alternative Design

Swing design - a good imitation of most dog doors out in the market

▶ Provide freedom for the dog to go outside

- Disadvantage: Needs power locking mechanism

## Target - the dog will

▶ Walk itself

▶ Do body waste

- Advantage: Do not need motor
- Disadvantage: Occupy too much space
- provide feedback
- Sound command (technical problem)



# Bottom Line: Market

- ▶ Over 50% dog share
- ▶ Owners spend more on pet food alone
- ▶ Pet industry revenue in 2004, grew to \$19.4 billion [5]
- ▶ Current market size for pet care systems is \$4 billion [8]



**Precise Portion  
Pet Feeder**

\$79.95

★★★★☆

5 reviews

[more info](#)

the cat or

and cat

194 and  
4 billion [5]

the Pet

[8]



# Bottom Line: Cost (per system)

- ▶ Software = \$0
- ▶ Hardware = \$40
- ▶ Mechanical = \$20
  
- ▶ Total Cost of Production = \$60
- ▶ Remarks

# Bottom Line: Profit (per system)

- ▶ Price = \$200
- ▶ Profit = \$140
- ▶ ROI = 233%

# Project Specifics: Budget

## Budgeted Expenses

<u>Item</u>	<u>Price (\$)</u>
Hall effect sensor x 4	25
Optical switch x 2	10
6 pin on/off switch	5
24V DC adapter	30
2.5mm 6 ft DC power cable	5
PCB terminal connector	10
9V regulator	5
Motor driver	10
Hinges x 2	5
Motor mount	5
Photo sensor x 2	20
<b>Total</b>	<b>130</b>

## Actual Expenses

<u>Item</u>	<u>Price (\$)</u>
Hall effect sensor x 4	11.8
Optical switch x 2	9
6 pin on/off switch	2
24V DC adapter	33.1
2.5mm 6 ft DC power cable	2.3
PCB terminal connector	9.8
9V regulator 7809	1.25
Motor driver IC L298	6.5
WD40	4.42
Hinges x 2	2.95
Motor mount	1.25
Superglue	6.71
Photo sensor x 2	33.6
<b>Total</b>	<b>124.68</b>





# Project Specifics: Estimated Schedule

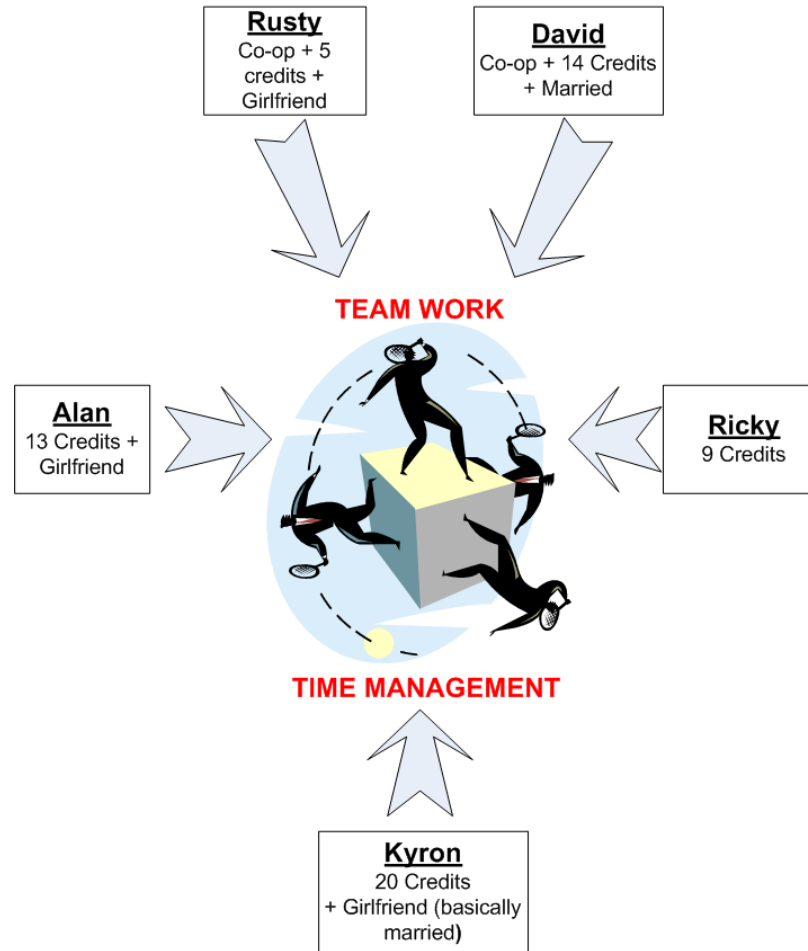
ID	Task Name	Start	Finish	Duration	Feb 2009					Mar 2009				Apr 2009		
					25/1	1/2	8/2	15/2	22/2	1/3	8/3	15/3	22/3	29/3	5/4	
1	Project Start	1/26/2009	1/26/2009	0d	●											
2	Design Overall System and Alternatives	1/26/2009	2/3/2009	7d	■											
3	Build a Linux Platform on the Board	2/4/2009	2/17/2009	10d			■									
4	Create a Working Program on the Board	2/18/2009	2/20/2009	3d			■									
5	Establish a Server on the Board	2/18/2009	3/3/2009	10d			■									
6	Enable Video Streaming through Internet	3/4/2009	3/12/2009	7d					■							
7	Build Gate	2/4/2009	2/17/2009	10d	■											
8	Build Food Dispenser	2/18/2009	2/24/2009	5d			■									
9	Build Water Dispenser	2/25/2009	3/3/2009	5d					■							
10	Create Program to Control Motors	3/4/2009	3/10/2009	5d					■							
11	Create Main Software	3/13/2009	4/1/2009	14d							■					
12	Debug and Test	4/2/2009	4/13/2009	8d									■			
13	Project Finish	4/14/2009	4/14/2009	0d												



# Project Specifics: Actual Schedule

ID	Task Name	Start	Finish	Duration	Feb 2009					Mar 2009				Apr 2009		
					25/1	1/2	8/2	15/2	22/2	1/3	8/3	15/3	22/3	29/3	5/4	
1	Project Start	1/26/2009	1/26/2009	0d												
2	Design Overall System and Alternatives	1/26/2009	2/3/2009	7d												
3	Build a Linux Platform on the Board	2/4/2009	2/18/2009	14d												
4	Create a Working Program on the Board	2/24/2009	2/29/2009	5d												
5	Establish a Server on the Board	2/24/2009	3/13/2009	14d												
6	Enable Video Streaming through Internet	3/16/2009	3/18/2009	2d												
7	Build Gate	2/4/2009	2/17/2009	13d												
8	Build Food Dispenser	2/18/2009	2/26/2009	8d												
9	Build Water Dispenser	2/27/2009	3/2/2009	2d												
10	Create Program to Control Motors	3/3/2009	3/6/2009	4d												
11	Create Main Software	3/19/2009	4/8/2009	15d												
12	Debug and Test	4/9/2009	4/14/2009	4d												
13	Project Finish	4/15/2009	4/15/2009	0d												

# Project Specifics: Team Work



# Conclusion

- ▶ Team Work
- ▶ Time Management
- ▶ New Software, Hardware, and Documentation Skills

# Acknowledgements

- ▶ Patrick Leung
- ▶ Steve Whitmore
- ▶ Jamie Westell & Jason Lee
- ▶ SFU Engineering Department

THANK YOU!



# References

1. Woman on Computer, [Online picture – cited April 12, 2009], Available: [www.myfrontline.info/woman-laptop-horiz.jpg](http://www.myfrontline.info/woman-laptop-horiz.jpg)
2. Man Using Cell Phone, [Online picture – cited April 12, 2009], Available: [http://www.delivery.superstock.com/WI/223/1804/PreviewComp/SuperStock\\_1804R-12045.jpg](http://www.delivery.superstock.com/WI/223/1804/PreviewComp/SuperStock_1804R-12045.jpg)
3. Happy Dog, [Online picture – cited April 12, 2009], Available: [carolynbremer.com/wordpress/images/HappyDog.jpg](http://carolynbremer.com/wordpress/images/HappyDog.jpg)
4. Pet Food Institute, “Pet Population Data”, 2009 [Online]. Available: [http://www.petfoodinstitute.org/reference\\_pet\\_data.cfm](http://www.petfoodinstitute.org/reference_pet_data.cfm). [Accessed: April 12, 2009].
5. USA Today, “Pet spending at all-time high”, 2004 [Online]. Available: <http://www.articlearchives.com/consumer-products/food-beverage-products-animal-foods-pet/253042-1.html> [Accessed: April 12, 2009].
6. Microsoft Office Clip-Art, unless otherwise specified
7. Dog Doors and Pet Doors, “Easy Pet Door”, 2000 [Online]. Available: [http://www.gundogghousedoor.com/easy\\_pet\\_door.htm](http://www.gundogghousedoor.com/easy_pet_door.htm) [Accessed: April 15, 2009].
8. Sky Mall, “Feeder & Bowls”, 2009 [Online]. Available: <http://www.skymall.com/shopping/subdept.htm?c=10712> [Accessed: April 15, 2009].
9. D. Clark and M. Owings, “Motor Control 101, The Basics,” in Building Robot Drive Trains, The New York: McGraw-Hill Companies, Inc, 2003, pp. 218-220.
10. D. Clark and M. Owings, “Using Stepper Motors,” in Building Robot Drive Trains, The New York: McGraw-Hill Companies, Inc, 2003, pp. 142-171.
11. Micropac Industries Inc, Sensors, 2009 [Online]. Available: <http://www.micropac.com/images/3pinceramic.jpg> [Accessed: April 15, 2009].
12. Datasheet Catalog, ULN2004, 2009 [Online]. Available: [http://www.datasheetcatalog.com/datasheets\\_pdf/U/L/N/2/ULN2004.shtml](http://www.datasheetcatalog.com/datasheets_pdf/U/L/N/2/ULN2004.shtml) [Accessed: April 15, 2009].
13. REUK, Examining a Stepper Motor, 2009 [Online]. Available: <http://www.reuk.co.uk/Examining-a-Stepper-Motor.htm> [Accessed: April 15, 2009].



# Q&A





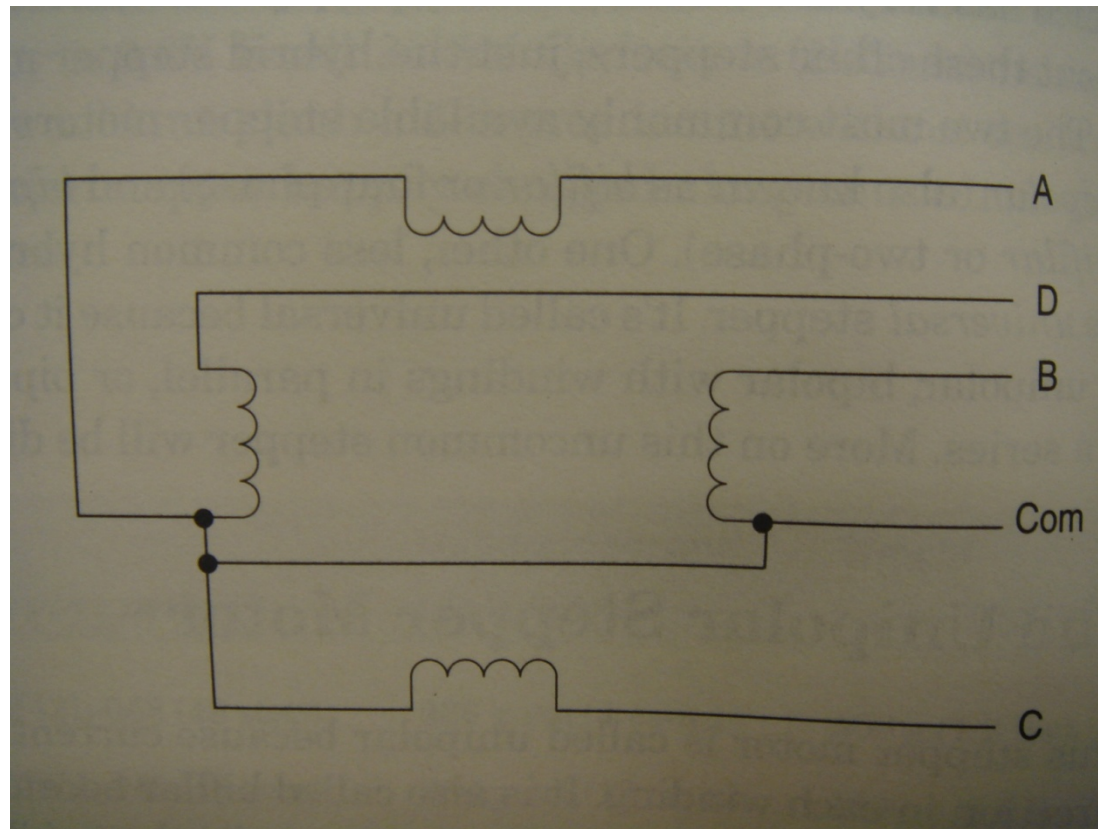
# Stepper Motor – Phyique



[13]



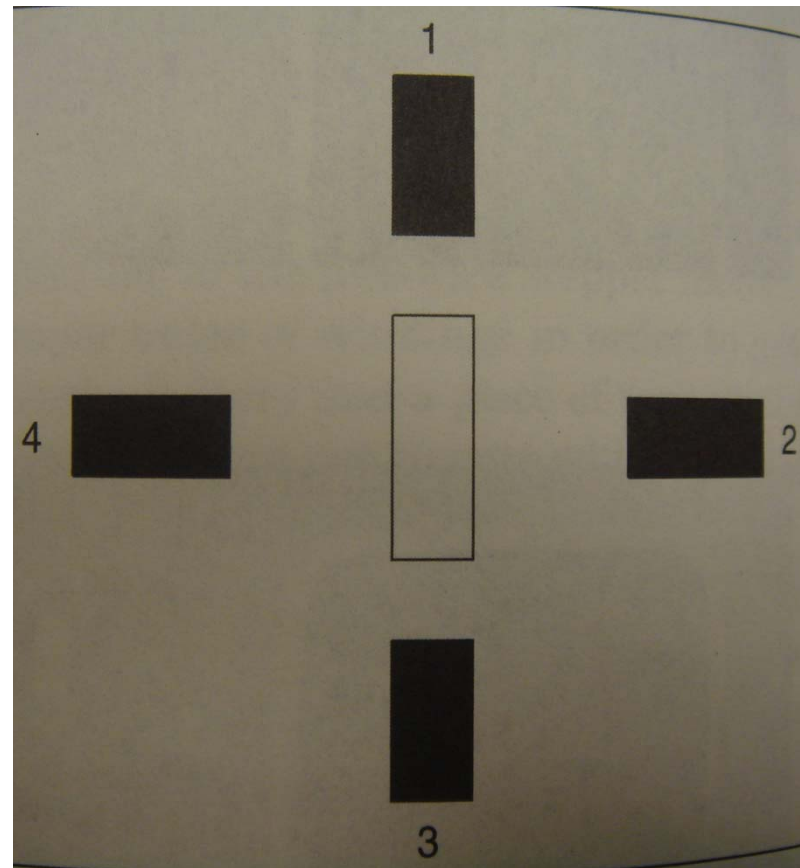
# Stepper Motor – Internal Wiring



[9]



# Stepper Motor – Pairings



[9]



# Stepper Motor – Two phase step patterns

Parings / Phase	A	B	C	D
1	on	on		
2		on	on	
3			on	on
4	on			on

[9]

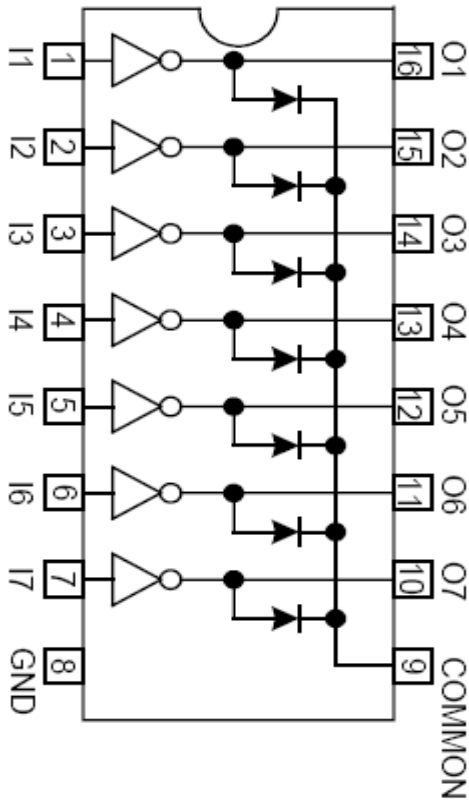


# Stepper Motor – Driver

From Stepper controller

Phase A  
Phase B  
Phase C  
Phase D

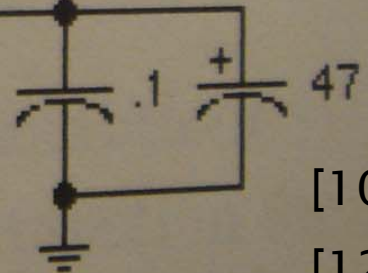
## ULN2004



+28V

A  
B  
C  
D  
Stepper Motor

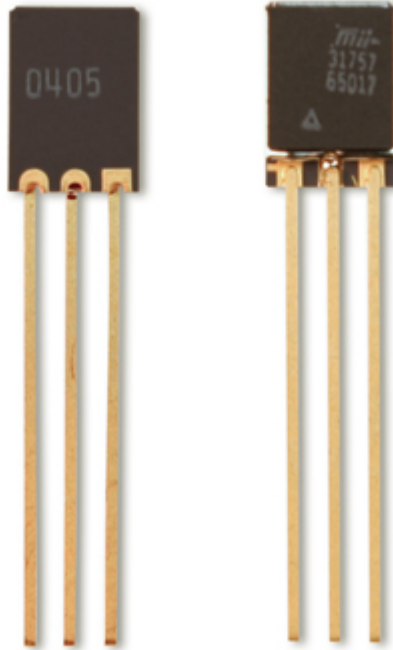
15V



[10]  
[12]



# Hall Effect Sensor



[11]