Discover Bot

Members

• Team Members

- Tim Sonnen
- Joe Carter
- Marshall Townsend
- Brian Gift
- Nathan Park
- o Kierra Ryan
- Qinlin Xu
- Advisor
 - $\circ \quad \text{Dr. Joel Perry}$
- Mentor
 - Sarah Willis

Project Goal

To develop a single-user prototype of the telerobotic master/slave setup and validate function and durability

Specifications

- Required
 - Safety
 - Durability
 - Accessibility
 - Intuitive
 - Serviceability
 - Camera
 - Size

• Prefered

- 3D Vision
- Haptic Feedback

Project Learning

Current Status

- Parts ordered
 - Waiting on delivery
- Parts being printed
- Project Learning
 - Looking into control schemes
 - Leap Motion
 - Master/Slave

Robot Arms

- Variety of available kits online (\$300+)
 - RobotShop
 - AliExpress
- Open source designs two significant options
 - BCN3D Moveo
 - 5 DoF
 - 3D Printed
 - Barebones design documentation
 - THOR
 - 7 DoF
 - 3D Printed
 - Extensive design documentation



THOR - Open Source Robot Arm



THOR - Open Source Robot Arm

- 7 DoF arm (6 axis + gripper)
- ~1.4 ft (422 mm) horizontal reach
- Open source hardware and software
- 3D Printable for rapid prototyping



THOR - Open Source Robot Arm



- Current objective is to recreate the arm as designed
 - Order parts motors, electronics, etc
 - Print parts 3D printed body
 - Recreate CAD assembly
 - Build
- Write software for real-time control
- Use to test control methods
- Adjust design to our requirements

THOR - Printed Parts











Controllers

- Current two implementations are Leap Motion and Master/Slave controller setup
- Leap Motion
 - Virtual Reality controller
 - Hands free controller
 - Users seem to enjoy hands free aspect
 - Issues with responsiveness and range
 - Might lack some intuitiveness
 - No haptic feedback



Controllers Continued

- Ultrahaptics
 - Uses a grid of ultrasonic speakers to direct sound waves
 - Allows for the sense of touch in air
 - Works with Leap Motion
 - Meeting setup with company



Controllers Continued

- Master/Slave controller
 - Second arm shaped device used for controller
 - More intuitive than Leap Motion
 - Could more easily implement haptic feedback using this controller
 - Not as durable and safe as Leap Motion
 - Great example of what a finished product could look like in the video from TeleroboticsCAR



3D Vision

- Issue of depth perception arises when streaming video from arm's view with regular camera
- Available options for stereoscopic shutter and polarized 3D but all have high price points
- Possibility of using two webcams to create 3D stream
- Options for creating stereoscopic anaglyphic 3D using two video streams, but not shutter or polarized 3D
- Still researching this issue



Minoru Stereoscopic Anaglyphic 3D Webcam

Project Management

Schedule

- This Semester
 - Finish 3D Printing THOR arm
 - Begin assembly of THOR arm
 - Begin modeling a master controller

• Next Semester

- Finish THOR arm
- Finish control system (either LEAP, or master)
- Redesign arm to fit specifications
- Test design safety and durability
- Begin prototyping 3D vision

Budget

Budget	Total	5000			
		total from site	order one	order two	shipping
Parts	stepper online	136.9	103.59		33.31
	amazon	191.66	89.97	101.69	0
	robot digg	60.26	46.26		14
	Ali	32.23	18.17	10.42	3.64
	mouser	8.58	0.59		7.99
	Pololu	43.55	39.6		3.95
	Seed	26.3	4.9		21.4
control system		1500			
parts for final bot		1000			
Travel	van	126			
	gas	182			
	food	480			
	hotel	390	1 night		
Unallotted funds	-	822 52			
unanotted lunus		022.32			

Ordered Parts

								Rods		6	2	3	2 7	
Stepper Motors				- Charles					Lough (mm)	Disease (mark)				
11	Type	Length	n	from	purchased	here?	cost		Length (mm)	Diameter (mm)				
1	Nema 17	40mm	39.22 N.cm	-2.5550 (2 1 /30)				2	14	4				
				stepper online	-		\$9.98	1	14,5	5			l l'	
3	Nema 17	34mm	121.2 N.cm	stepper online			\$24.51	1	32	5				
								1	102	5				
3	Nema 17	34mm	21.57 N.cm	stepper online			\$6.69	1	128	5			8	
Belts		<u></u>						Bolts					8 - S	
8	Type	Length	Shops					#	Size	Length (mm)				
	512 clored		Construction Construction				1 1	2	M3	10				
2	Belt	208mm (104 teeth)	RobotDigg					6	M3	6				
H				robotdigg		-	\$0.28	46	M3	8		00	8 - P	
1	GT2 Open Belt	lm	RobotDigg, RepRap World	rehebdies			taga	1	M3	10			ų – į	
Pulleys				robotciege	-	<u> </u>	39.00	15	MB	12		2	0	
	2852-25	Second Second	e Azartar			2 2		9	MB	16				
	Туре	Number of Teeth	Shops					4	M3	18				
	GT2 Bulley	10	RobetDian	201 - 102				8	M3	25				
<u></u>	one Publick	20	RODOLDIKN	robotdigg	· · · · ·	1 - 1	\$1.60	8	M3	28		20		S
2	GT2 Pulley	40	RobotDigg					8	M3	30		8	§ - 9	
				robotdigg		-	\$2.20	13	M3	40		<u>i</u>	2 2	
Bearings	Ture	These			1	-	$\left \right $	8	MB	46				
	Type	anops			-	<u> </u>	+	1	M5	18				
	212-22	This shares (30)						Nuts				1		
1	16014zz	printed), Createc3D	6					#	Size			8	\$ - \$	1 3
		53 E.						2	M2					
S	6252Z	Sector Sector	S			2 2		90	M3					
11	Bearing	RobotDigg		robotdigg			\$2.50	1	M5					
2	MF84ZZ							Electronics						
£2	Bearing			amazon			\$11.89	#	Part	Description		2.		1

Ordered Parts Cont.

1	Arduino Mega	2		amazon	x	here		1	MF-R700 Fuse	F1	тнт
1	Micro Endstop	•						169	Male Pins	PM, PS, PT, PA, PDIG	тнт
7	Fans	40 x 40 x 10mm (stepper motor cooling)			x			2	PCB Terminal Block	POWERPIN1, SW1	1x2 TH
			2	amazon	22.05	here	6.98				
ontrol PCB V2 current ersion)								128	Female Pins	U1, U2, U3, U4, U5, U6, U7, U8	-
#	Part	Reference	Description					24	Jumpers	-	-
1	PCB	<u>.</u>	-		-	-		2	Fan	14 D	40mm
8	A4988 Stepper Motor Driver	-	-		pololu			1	Bus Wire 2x36	-	Option
			<i></i>	aliexpress out of stock!!			1.7	Commercial			
8	100uF Capacitor	C1, C2, C3, C4, C5, C6, C7, C8	16V SMD	aliexpress	x		1.85	Opto-Sensors (current			
		R9, R10, R11,			N 82			version)	Part	Description	Shaar
8	100kΩ Resistor	R12, R13, R14, R15, R16	SMD 1206	100000000	×			-	Ontical	Description	snops
	0.32	P1 P2 P3 P4		aliexpress	-	-	0.57	4	Endstop	-	AliExpr
8	10kΩ Resistor	R5, R6, R7, R8	SMD 1206	aliexpress	×		0.98				
3	6200 Resistor	RLED1, RLED2,	SMD 1206		×			filament			
5 .		RLED3		aliexpress	<u> </u>	-	1.58	ASB white with			1
3	LED	DLED1, DLED2, DLED3	SMD 1206		ж			Cartrage ABS white			
2			Same	allexpress			1.33	PLA black			
1	1N4004 Diode	D1	THT	22	x	1		- Dribler			-

1	MF-R700 Fuse	F1	тнт	mouser	x		0.59
169	Male Pins	PM, PS, PT, PA, PDIG	тнт	aliexpress	x	h. 2	0.35
2	PCB Terminal Block	POWERPIN1, SW1	1x2 THT	aliexpress	x		0.94
128	Female Pins	U1, U2, U3, U4, U5, U6, U7, U8	-	aliexpress	x		1.03
24	Jumpers	-	-	aliexpress	x		1.2
2	Fan	2	40mm	aliexpress	x		1.23
1	Bus Wire 2x36		Optional				
ommercial Ipto-Sensors current ersion)							
#	Part	Description	Shops		Ĩ.		
4	Optical Endstop		AliExpress	aliexpress	x		0.66
lament		-		8		1 2 3	
SB white with artrage				amazon	x	here	49.99
BS white	() (x	here	29.99
LA black					x	here	29.99
LA green			3		x	here	29.99
			-				

Gantt Chart

Project Title Interactive Telerobotics Exhibit

	Lead Instructor Dr. Perry					Date 9/12/17																											
						Fall 2017																	Sprina 20	18									
WDC						Snapshot 1 Snapshot 2								Snapshot 3 Design EXPO																			
NUMBER	TASK TITLE	DATE	DUE DATE	(weeks)	COMPLETE	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29	11/5	11/12	11/19	11/26	12/3	1/14	1/21	1/28	2/4	2/11	2/18	2/25	3/4	3/11	3/18	3/25	4/1	4/8	4/15	4/22
1	Snapshot 1										1												-										
1.1	Team Contract	9/10/17	9/17/17	1	100%																												
1.2	Project Learning - General	9/10/17	10/1/17	3	100%							1																					
1.3	Client Interview	9/17/17	9/24/17	1	100%			-											<u>)</u>				8										
1.4	Specifications Summary	9/24/17	10/1/17	1	100%																												
1.5	Portfolio Submission 1	10/1/17	10/8/17	1	100%		1				Ĵ.			1	Ĵ.								2				Ĉ.						
1.7	Snapshot #1 Board	10/8/17	10/15/17	1	100%																												
2	Snapshot 2																						1										
2.1	Project Learning - 3D Vision and Controls	10/15/17	12/3/17	7	10%		1				0								0				0										
2.2	Robot Arm Prototyping	10/15/17	12/3/17	7	5%																												
2.3	Wiki Page Draft	10/29/17	11/5/17	1	0%		1										1						1										
2.4	Control Method Prototyping	11/5/17	12/3/17	4	0%		1												1				1					2					
2.5	Portfolio Submission 2	11/5/17	11/12/17	1	0%																												
2.6	Design Review (with client)	11/12/17	11/19/17	1	0%		1				0								2				1										
2.7	Snapshot #2 Board	11/26/17	12/3/17	1	0%																												
2.8	Finalize Wiki Page	11/26/17	12/3/17	1	0%						1																						
2.9	Portfolio Submission 3	11/26/17	12/3/17	1	0%		3				1				1								3				1						
3	Snapshot 3																																
3.1	Robot Arm Design	1/14/17	3/4/17	7	0%																												
3.2	Control Method Design	1/14/17	3/4/17	7	0%		1				1	1														2	1	1					
3-3	Design Review (with client)	1/28/17	2/11/17	2	0%																												
3.4	3D Vision Prototyping?	1/28/17	3/4/17	5	0%		1				0			1	1				1								()	Į					
3-5	Portfolio Submission 3	2/25/17	3/4/17	1	0%																												
3.6	Snapshot #3 Board	2/25/17	3/4/17	1	0%																						-						
4	Design EXPO										1												1										
4.1	Final Implementation	3/11/17	4/8/17	4	0%																												
4.2	3D Vision Development?	3/11/17	4/22/17	5	0%						1																						
4-3	Wiki Page Review	3/25/17	4/1/17	1	0%		1				1												1					1					
4.4	EXPO Presentation Materials	4/15/17	4/22/17	1	0%																												

Team Name Team Discoverbot