

# WEEKS ONE THROUGH FOUR

Individual/Team: **P10216 Robot Navigation Team**

Total Score: **4**

## MSD I Deliverables Checklist

\* Scores: try to use whole points

Deliverable (weight)	Score in Week (#)	Max. Score	Score*	Excellent/Very Good	Good/Acceptable	Barely acceptable	Unacceptable	Comments, Target, Date Completed
Customer Needs (TEAM GRADE)	(3)	2	1	Customer needs are complete and prioritized (and include ethical considerations), are not solutions, and have been logically grouped. (2 points)			Customer needs are incomplete or involved little customer input, or do not accurately reflect customer desires. (0 points)	Looks good. Some minor cleanup for full credit. If not already, reach closure with Customers.
Engineering (Design) Specifications (TEAM GRADE)	(3)	3	2	Complete list of measurable outcomes (including ethical outcomes), mapping of needs to quantitative specs. (3 points)			Design specifications are not complete, are not defined in engineering terms, or are poorly mapped. (0 points)	This looks great! Excellent preparation. Some minor cleanup for full credit.
MSD I Project Plan ("Plan" phase) (includes a 1 page work breakdown structure, and Gantt chart, with roles definition) (TEAM GRADE)	(4)	3	By Friday, week 4	A project schedule of 25-60 activities (scoped for the project) has been created from a work breakdown structure of 5-10 categories. The other elements of the plan (objectives, communication methods, etc.) are also defined. (3 points)	A project plan has been created and there is some evidence of use; some elements may be missing, or use may not be as disciplined as it should be, or plan structure may be illogical relative to project structure. (1 - 2 points)		Project plan is missing or has only minimal content elements. (0 points)	Please have ready for review for this Friday if not before, 10/2/09.
Team norms/values (including ethical considerations and plans to realize) (TEAM GRADE)	(3)	1	1	Key values articulated and plans in place to realize. (1 points)			No effort made to tailor "standard" values or to define realization plan. (0 points)	okay
Concept Generation and Evaluation (TEAM GRADE)	(3)	3	By Friday, week 4	Creative concepts were generated at the system & subsystem level, and evaluated against customer-oriented criteria and competing products. (3 points)	Valid concepts were developed but some customer criteria were not addressed or competitive benchmarking was sketchy at best. (2 points)	Key customer needs were addressed but many were left unaddressed, or evaluation process was not followed. (1 point)	Minimal concept development or key customer needs unaddressed, reliance on only a few ideas; evaluation process not defined or followed. (0 points)	From last Friday, the one Concept via Functional Decomp diagram looked good. For Concept Development, two perdominate functions are control board & software architecture concepts (verbally discussed and seemed good) and robot containment concepts. Other functions such as wireless schemes but I believe you have a good direction.
Concept Improvement and Selection (TEAM GRADE)	(3)	3	By Friday, week 4	Team clearly took advantage of the evaluation process to improve or combine existing concepts or to uncover fixable weaknesses, and the selection process was structured and effective. (3 points)	The team showed some ability to use the evaluation process to improve on original concepts or combine concepts, and a selection process was structured and followed. (2 points)	The team made minimal effort to improve on original concepts during evaluation process, and the selection process was adhoc (1 point)	The team did not take advantage of any opportunities to use concept evaluation to improve existing ideas, and a selection process was not followed. (0 points)	Once multiple Concepts are ready (if not already), then Selection Criteria is needed. If you have questions on this, we can discuss Friday. This is quick.
System Analysis (Translation, Specification, Flow-down)	(5)	5		Customer Needs translated to system-level Functional Specs; Functional Specs flow down to Engineering Specs; Engineering Analysis complete to establish Ideal/Marginal Target Values (5 points)	Translation, Specification and Flow-down is performed, but with some important gaps/inconsistencies (3-4 points)	No Functional Specs defined, and/or they do not translate from Customer Needs and/or do not flow down to Engineering Specs; Engineering Analysis is incorrect (1-2 points)	No translation, flow-down or analysis performed (0 points)	Translation from Needs to Spec's looks good. Review your Func Decomp diagrams to ensure all specifications are supported.

Deliverable (weight)	Score in Week (#)	Max. Score	Score*	Excellent/Very Good	Good/Acceptable	Barely acceptable	Unacceptable	Comments, Target, Date Completed	
System Design (System Architecture and Functional Decomposition)	(5)	5	By Friday, week 4	System decomposed into a system architecture, all functions represented, consistent with selected concept(s). Appropriate representations exist (e.g. flow charts, block diagrams, math models); interfaces are clearly defined (5 points)	System decomposition is complete, but is inconsistent with concept(s) and/or level of detail is inappropriate; System representations exist but are incomplete/incorrect; interface definition exists, but lacks detail (3-4 points)	System decomposition is incomplete, inconsistent with selected concept(s); System representations missing, incomplete and/or incorrect; interfaces are poorly defined (1-2 points)	No decomposition performed, no representation created, no interfaces defined (0 points)	Last Friday looked like a good start but I only saw EE functional decomp. I would like to see a CE behavior flowchart, as an example.	
Risk Assessment and Actions to Minimize Risks - System Design Phase	(5)	3		Detailed list of development risks identified (technology, cost/schedule feasibility), and actions to minimize risks defined. Project scope well defined. Feasibility experiments are complete. Detailed development execution strategy defined. (3 points)	Some risks identified, some actions to minimize defined. Project scope not perfectly clear. Feasibility experimentation is incomplete. Development execution strategy exists. (2 points)	Risk assessment and actions to minimize are incomplete. Under-defined and/or inoperable development execution strategy. (1 points)	No risk assessment performed, no execution strategy defined (0 points)	Has the team started documenting Risks?	
System Design Review Execution	(5)	3		Design review(s) held with appropriate attendees, focused at system level. Key deliverables provided - selected concept, system architecture, risks, results of analyses (3 points)	Design review(s) held, but some missing elements, some questions unanswered that should have been (1-2 points)		Design review was not held or did not address key issues. (0 points)		
Class and Within-Team Participation (INDIVIDUAL GRADE)		16		Grade based on Guide assessment of overall contributions to team activities (quantity and quality of results), and peer reviews.					
<b>Total:</b>		<b>47</b>	<b>4</b>						

NOTE 1: The "score in week" column is a suggestion to the Guides, and tells students when to expect specific feedback. There may be cases where the "scores" are revised as the project progresses, but the intent is to give feedback as early as possible in the quarter.

NOTE 2: The grading of the elements is noted as "individual," "team," or "nothing is indicated." In the last case, it may be either individual or team based.

Human Safety is always a "10" importance.

Setup "Excel Properties" similar to this page

Add Title - P10216 Robot Navigation Plant Platform

Customer Need #	Importance	Description	Comments/Status
<b>Sustain Growth of Plant</b>			
CN1	5	Robot shall utilize sensor information to monitor status of plant.	
CN2	3.5	Robot shall <sup>new to allow</sup> monitor natural resource levels. <del>select</del> <sup>select</sup> <del>and communicate</del>	Is this our teams need? Should we just provide interface? Calculate & communicate
CN3	5	Robot shall provide adequate sunlight, shade and water for plant. optimal	
CN4	5	Above all, robot shall <del>optimize safety and</del> growth of plant. Consider Wandering around in a curious manner, slowly	
CN5	4	Robot shall avoid obstacles to ensure plant/robot safety and safety of passer-bys. <sup>stability</sup>	
CN6	4	Robot shall keep a safe distance from passer-bys while still acting curious.	
CN7	3	Robot shall periodically wander in the event of inactivity.	
CN8	3	Robot shall be able to navigate an area up to the size of a small quad. within a predefined limited location (5).	
CN9	3	Robot shall have personality, possibly including quarks and be communicative gestures (I can only guess...)	
<b>Act as a spokes-person for various involved programs</b>			
CN10	2	Non-obtrusive visual and/or audio output to environment.	
CN11	4	Robots presence brings awareness, without obtrusive behavior.	
<b>Leash Robot/Ability to lead home</b>			
CN12	4	Robot shall have user controls to enable return home mode.	
CN13	3	Robot shall gradually shut-down for a more natural feel.	
<b>Maintain Wireless Connection</b>			
CN14	4	Robot shall have a built-in link and remains connected while on campus.	
CN15	4	Robot shall have an interface to relay status information and alarm information.	
<b>Safety</b>			
CN16	10	Robot shall have a shutdown mechanism in the event of unexpected behavior. <del>Robot shall not impede pedestrian safety</del>	
CN17	4	Due to wireless interface capability, robot shall be as secure as feasible from outside attacks.	
CN18	3	Robot shall stay on level ground.	
CN19	3	Robot shall be trackable while on campus.	
<b>Reliability</b>			
CN20	4	Robot shall be integrated from existing commercial building blocks.	
CN21	4	Parts for robot shall be easy to source and safe.	

Off-the-shelf components

Delight the Customer

CN22	1	<del>Robot shall include GPS for trackability</del>	
CN23	1	Robot shall be attracted to plant-like colors.	
CN24	1	Robot shall utilize social-networking to advertise program news and plant status information.	why? that's cool!
CN25	1	Robot navigation hardware should be low-power	
CN26	2	Engineers shall minimize likelihood of vandalism.	
CN27	2	Robot shall have options for expansion to build on existing design.	

Cust. Need #: enables cross-referencing (traceability) with specifications

Importance: Sample scale (1=must have, 2=nice to have, 3=preference only), or see Ulrich exhibit 4-8.

Description: organize as primary and secondary needs (hierarchy) -- Ulrich exhibit 4.8

Comment/Status: allows tracking of questions, proposed changes, etc; indicate if you are meeting the need ("met") or not ("not met")

EXCELLENCE!  
 with 12-20-2020

P10 Z16 Robot Navigation Plant Platform

Revision #:

Engr. Spec. #	Importance	Source	Specification (description)	Unit of Measure	Marginal Value	Ideal Value	Comments/Status
Sustain/Growth of Plant							
ES1	5	CN1	Air humidity sensing with +/- 6% RH accuracy	%RH	+/- 6%		To monitor needs of water
ES2	5	CN1	Temperature sensor with +/- 5F accuracy	F	+/- 5F		To monitor needs of sun/shade
ES3	5	CN1	Photoreceptor for light sensing. 1-100 Lux Input Range	Lux	1-100		
ES4	5	CN2	Provide interface for natural resource sensors	Sensors	1	2	
ES5	5	CN3	Robot seeks shade when humidity falls below 40	%RH		>40	
ES6	5	CN3	Robot seeks sun when temperature falls below 45	F	+/- 5F		
ES7	5	CN3	Robot seeks shade when temperature is above 85	F	+/- 5F		
ES8	5	CN3	Hardware/Software provides control of water dispenser	hw			Feature
ES9	5	CN3	Dispense water to plant when moisture is below TBD	oz			
ES10	5	CN3	Robot interprets light as a binary result (Bright/Dark)	lux	TBD		
ES11	5	CN4	Plant sensor interrupts resume highest priority (Safety) when wandering around in a curious manner, slowly	na			Feature
ES12	4	CN5	IR Relative Distance Sensor (8" - 60") for obstacle detection and avoidance	inches	+/- 2 inches		Above all, protect plant
ES13	4	CN5	2 sonar sensors (10 cm to 3m) for obstacle detection and avoidance	cm	+/- 5 cm		
ES14	4	CN5	IR Relative Distance (1.5" - 12") for short range obstacle detection	inches	+/- 0.5 inches		
ES15	2.5	CN6	Robot keeps >= 1m away from environment obstacles	m	< 1	1	
ES16	4	CN6	Minimum distance of passer-by from robot	m	0.5 to 1	1 m	
ES17	3	CN7	Time period of inactivity after which robot will move	minutes	30 s - 1.5m	1 min	Increase Visibility
ES18	3	CN7	Distance covered between inactivity	m/day	TBD		
ES19	3	CN7	Duration of movement between inactivity	minutes	30s - 1.5m	1 min	
ES20	3	CN8	Typ. radius of wandering area	meters	20-40m	30 m	
Act as a spokes-person for various involved programs.							
ES21	2	CN10	SBC includes audio out to speaker	ft	10	20	assumes normal hearing measurement
ES22	2	CN10	8-Ohm Speaker and Driving Circuitry with gain control	Ohms	TBD	8	Status indicator
ES23	2	CN10	High-brightness Green/Red Bi-Color LED for indication	lumens	TBD	TBD	
ES24	4	CN11	Range of audio volume	dB	TBD	TBD	
ES25	4	CN11	Maximum brightness for housed LED.	lumens	TBD	TBD	
Leash Robot/Ability to lead home							
ES26	4	CN12	Embedded hardware provides control signal for transmission disengage	na			Feature
ES27	3	CN13	Gradual shutdown period	seconds	5 - 15	10	
Maintain Wireless Connection							
ES28	4	CN14	Wifi 802.11b/g Wifi module for wireless connectivity	na			Feature
ES29	3	CN15	Robot sends warning to host when temp is below 45	F			Set point programmable
ES30	3	CN15	Robot sends warning to host when temp. is above 85	F			Set point programmable
Safety							
ES31	3	CN16	Hard shutdown to SBC via physical toggle switch	SPST			
ES32	4	CN16	Shutdown mechanism from Wifi connected remote host	na			Feature
ES33	3	CN17	WPA2 Encrypted Wi-Fi link	na			
ES34	3	CN18	Level Ground Sensor	m	0.25 - 0.75	0.5	investigate IR vs. sonar
ES35	1	CN19	Global Positioning device for home positioning (5 meter accuracy)	meters	+/- 5m		
Reliability							
ES36	4.5	CN20	All parts are commercially available	na			
ES37	4.5	CN20	Single Board Computer controls high-level robot logic	na			
ES38	4.5	CN20	Utilize an open source embedded OS (e.g. embedded linux) to leverage existing computing platforms	na			
ES39	4.5	CN20	Sensors interface through dedicated embedded subsystem.	na			Sub system takes care of sensor reading and low-level interpretation used by SBC
ES40	4.5	CN20	Subsystem communicates to SBC over a serial link	na			
ES41	4.5	CN20	Subsystem includes 12-bit 10-channel ADC	na		12-bit	

good, LED to indicate on state.

ES42	4.5	CN20	for sensor interface Subsystem includes a bootloader for updated firmware from host SBC over a serial link	10-Channel
<b>Delight the Customer</b>				
ES43	1	CN22	GPS positioning update frequency >=0.2 Hz	>=0.2
ES44	1	CN23	Ability to sense light to dark shades of green	
ES45	1	CN23	Periodically move within a foot of green-colored object while staying inside wanderable area	
ES46	1	CN24	Live Twitter feed listing plant status updated over WIFI	
ES47	3	CN25	Maximum power consumption of navigation system	Watts +/- 10% 4W
ES48	2	CN26	3-axis accelerometer with +/-2g sensing range	G-Force +/- 2g 0
ES49	2	CN27	1 Additional serial I/O port for expandability	
ES50	2	CN27	Software is host upgradeable over USB port	degrees +/- 5°

to face cross walls for solar cells

Monitoring charge level of power source.  
 Also software to point solar cells for max exposure, if necessary.

Stop Connector external to Robot surface to ease reprogramming  
 Power Regulation monitoring?

Electronic Compass?