Battlebot Automatic Targeting System

Initial Project Proposal

Group 2

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Sponsor

Lockheed Martin

Introduction

Object tracking and targeting technologies are used in many industries, both domestic and military. Radar in particular has seen prominent use since as early as the 1930s, when it was utilized primarily to defend against air assaults. Similar to radar, many related sensor technologies have long seen employment by the Space and Defense industry. Lockheed Martin, a leading global defense contractor, currently produces and maintains over a dozen targeting and detection systems. Among these products span a variety of sensor modalities under use, including thermal infrared and radar. Developing a robot with similar capabilities to those found in real-world military applications will provide an opportunity to gain valuable knowledge and experience that can prove attractive to employers interested in graduates with these related sensor backgrounds. In addition to practical experience gains, personal student growth will occur with the unique advantage of collaborating with mechanical engineering senior design students.

Objective

During the course of the following two semesters, successful collaboration with the mechanical engineers will enable to the electrical and software team to integrate a fully autonomous targeting system onto the manually controlled mobile unit. The autonomous targeting system will allow a synced projectile weapon to hit two long range targets, two medium/close range targets, and the enemy team's mobile robot. The weapon will fire at high speeds of approximately 30 mps across distances of 40 feet at most. The targeting system will provide wireless video imagery overlays to a display via datalink, allowing the user to determine when the weapon has achieved target lock. A total of two sensors may be considered for the system. Different sensors such as radar, ultrasonic, infrared, etc. will all be considered. The advantages and disadvantages of each will be weighed. In the end, the most efficient and accurate sensor will be used based on the findings and successful image fusion between the two systems will be implemented. The system will accomplish as many hits as possible on the enemy targets and demonstrate accurate, stable target tracking functionality.

Technical Specifications / Requirements

Firmware / Hardware Requirements:

- ❖ No more than 2 weapon systems
- ❖ No more than 2 sensor modalities
- ❖ Wireless Datalink
- ❖ Microcontroller
- ❖ Custom PCB
- ❖ At least one Motor driver
- ❖ Durable and Sturdy Weapon Mounting Structure
  - ➢ Enables capability to Pan and Tilt weapon system
- ❖ At least one Power Supply

Software Requirements:

- ❖ User interface (UI) Application
  - ➢ Allows for manual wireless control of robot
  - ➢ Enabled by Wireless video datalink
    - ■ Provides Video Imagery Overlays
      - ● Automatically highlight detected targets
      - ● Viewable wirelessly by user through UI
- ❖ Autonomous Targeting Program
  - ➢ Image Fusion capability

Performance Requirements:

- ❖ Minimum wireless robot usage duration: 30 minutes
- ❖ Maximum all-up robot size of 3’ x 3’ x 3’
- ❖ Minimum Sensor range: 20 feet
- ❖ Minimum Projectile range: 20 feet

Project Development Requirements:

- ❖ Total Firmware and Software costs will not exceed $800
- ❖ Total Robot development cost will not exceed $2000
- ❖ Total robot cost as-built will not exceed $1000
- ❖ Parts ordered by December 2016
- ❖ Working finalized product by April 2017
- ❖ >90% costs covered by Lockheed Martin & UCF

House of Quality

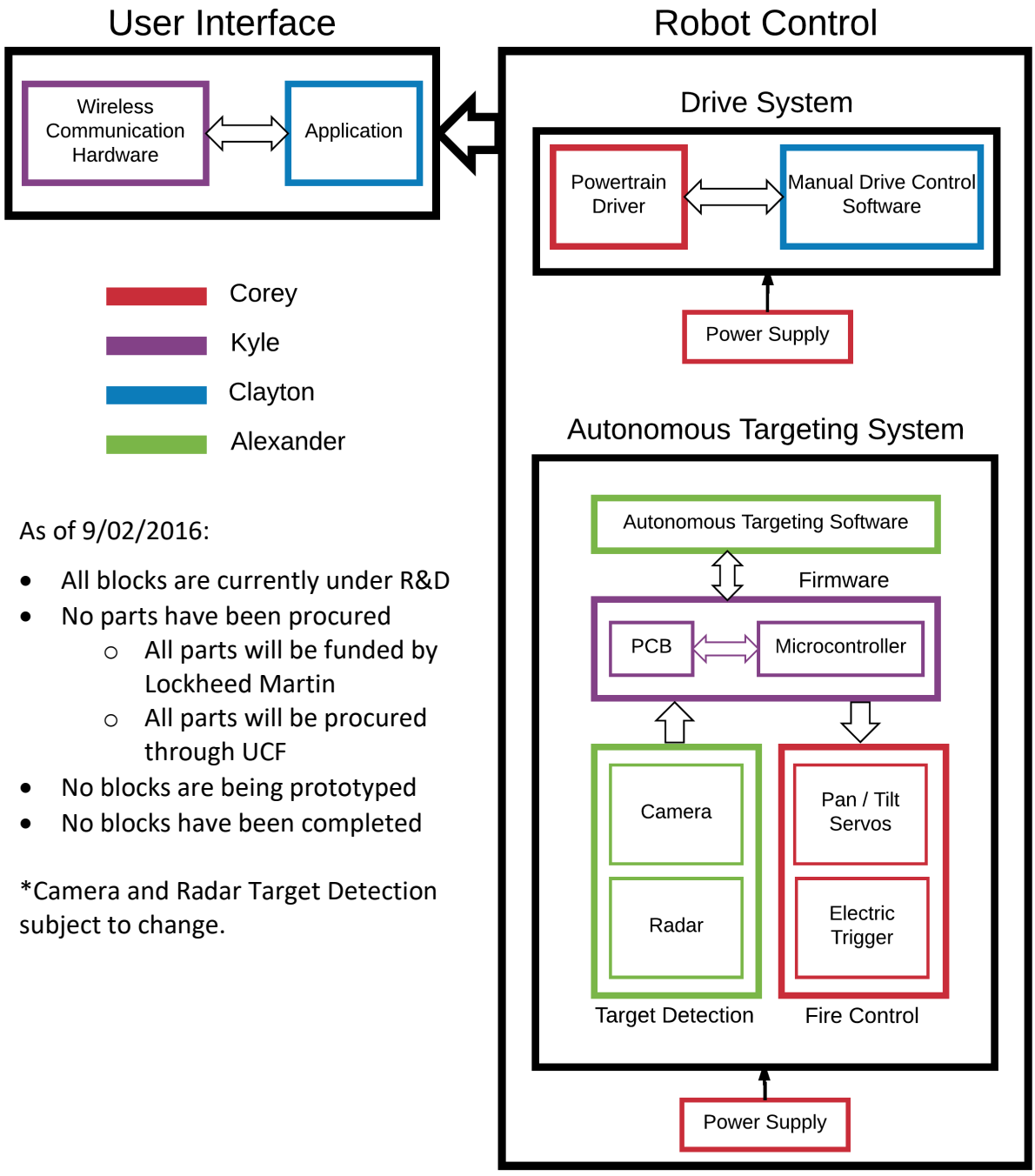
Everyday engineers must consider tradeoffs. They must decide what is more important for the overall quality of a product. It is understood that there are requirements when engineering the product and requirements when marketing the product. The graph below helps to illustrate how engineering requirements affect marketing requirements and vice versa.

			Engineering Requirements				
			Range	Accuracy	Dimensions	Power	Cost
		Polarity	+	+	-	+	-
Marketing Requirements	Quality	+	↑↑	↑↑		↑	↓
	Installation	-			↓		↓↓
	Portability	+	↓		↑↑	↓	↓
	Cost	-	↓↓	↓		↓↓	↑↑

Legend:

- ↑↑ = Strong Positive Correlation
- ↑ = Positive Correlation
- = Unknown or No Correlation
- ↓ = Negative Correlation
- ↓↓ = Strong Negative Correlation
- \+ = Positive Polarity (Goal is to increase the requirement)
- \- = Negative Polarity (Goal is to decrease the requirement)

Nested Block Diagram



As of 9/02/2016:

- All blocks are currently under R&D
- No parts have been procured
  - All parts will be funded by Lockheed Martin
  - All parts will be procured through UCF
- No blocks are being prototyped
- No blocks have been completed

*Camera and Radar Target Detection subject to change.

Budget and Financing

The total budget for the project will not exceed $2,000 and the as-demonstrated cost will not exceed $1,000. The Firmware and Software team plan to receive at least full financial coverage from the University of Central Florida Office of Research and Commercialization. The following chart provides an estimated budget breakdown:

Item #	Nomenclature	Price	Qty.	Comments
1	Sensor 1	$30	1	One of two required sensor modalities
2	Sensor 2	$50	1	One of two required sensor modalities
3	Power Supply	$20	2	At least one power supply will run the robot
4	Weapon / Projectile Launcher	$70	1	
5	Pan / Tilt Assembly	$55	1	
6	Tilt Servo	$40	1	
7	Pan Servo	$30	1	
9	Microcontroller	$30	1	
10	Custom PCB	$10	2	Two will be purchased as a safety precaution
11	Motor Driver	$15	1	
	Total	$350		

Initial Project Milestone Timeline for Fall 2016 and Spring 2017

Fall 2016 (Senior Design I)		
Description	**Duration**	**Dates**
Project Idea	1 Week	8/22 – 8/26
Project Discussion / Divide and Conquer	2 Weeks	8/26 – 9/9
Initial Project Documentation	-	9/9
Research Parts/Past Projects	2 Weeks	9/9 – 9/23
Project Documentation Development	1.5 Weeks	9/23 – 11/4
Table of Contents Due	-	11/4
Prototyping	2 Weeks	11/4 – 11/18
Draft Document Due	-	11/11
Finish Project Documentation	2.5 Weeks	11/18 – 11/2
Final Documentation Due	-	12/6
Spring 2017 (Senior Design II)		
Build Prototype	8 Weeks	TBA
Test Prototype	2-4 Weeks	TBA
Finalize Project	1 Week	TBA
Final Report/Presentation	1 Week	TBA