UCF Senior Design I

Self Zeroing LPVO

TODO: Augmented Scope

Department of Electrical Engineering and Computer Science
University of Central Florida
Dr. Lei Wei

Initial Project Document and Group Identification
Divide and Conquer

Group 13

Ahmed Al Busaidi	ahmedbusaidi9090@knights.ucf.edu	CE
Collan Dimitri	colland@knights.ucf.edu	PSE
Jacob Clevenger	jacobrclevenger@knights.ucf.edu	EE
Jose Vasquez Dickson	vdjosea@knights.ucf.edu	EE

Introduction

There exist many different optical elements for the firearms industry on the market, and most of them offer the same options with very little change. The price range for all of these can range from less than a hundred to multiple thousands, varying by company. The main difference with most of these companies, aside from quality and construction, is that they promote their own reticle that is seldom shared between brands. The main utilization for a reticle, however, requires the external information supplied by a rangefinder, a spotter who has one, our thorough knowledge of the terrain. The main goal of this product is to provide the information and automatically adjust for it. In order to do that, there needs to be a rangefinder built onboard, which consists of just a laser emitter and detector. There needs to be a respectable scope system as well, as having function without clarity would defeat its own purpose. The way to couple these together are to have a reticle that can display in some form the compensation for the changing distance of the target, which will be accomplished by having a string of μLEDs going along the y-axis of the reticle. The onboard electronics to make all this possible must also be compact enough that this scope is not bulky or overly heavy so that a hunter or a soldier is not fatigued by using this product. Products similar to this one exist on the market to solve this problem, but the only option that does not have a separate rangefinder is both bulky and extremely expensive, where our product plans to keep the cost down, weight manageable, and user friendly by only displaying the information needed.

Specifications

Housing with External Adjustment	Built with shock absorption
Variable Magnification Optical Set-Up	1x-6x Magnification, will require 7-9 lenses
Crosshair Reticle with µLED Strip	LEDs to run down y-axis
Bluetooth Module	Up to 100m
Microcontroller	Portenta H7 Lite
Laser Rangefinder Emitter	Support up to at least 1km
Laser Rangefinder Receiver	Support up to at least 1km
LCD Screen	20 x 4 ,I2C, 5V Power Supply
Tactile Button Pack	5 - 12 V Supply
Connector Wiring	Up to 5 - 12V

Constraints

Cost

We would like for the project to be relatively cheap to be able to out-compete other scopes on the market. Because of this, we would like to keep the budget for the project under about $1,000. The majority of this cost will likely be spent on the scope itself, while a fraction of it will be spent on the microcontroller as well as the electrical components for the range finder. The cost to produce a fully functional version of this project will likely end up costing less than the prototype takes to produce as we have not yet completely refined the components that we will need.

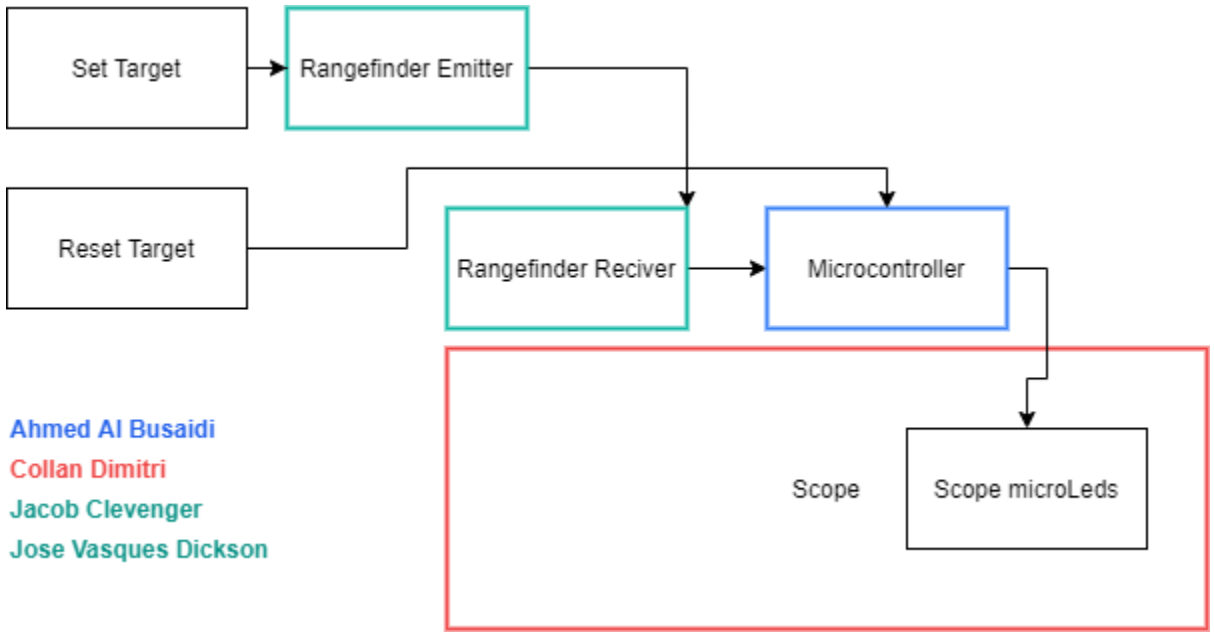
Time

As of writing this, we have about 14 weeks to finish the specifications for this project and we will have 16 weeks to build the project. This should give us more than enough time to produce a functional alpha version of this project.

Space

As mentioned before, one of our main priorities is to keep the entire project precisely compact so it can be carried by the hunter or soldier without any extra significant weight. The weight that we're concerned about isn't the scope as that will be treated as a fixed weight that we won't have a lot of control over. We are concerned with the weight associated with the electronics that we choose to use for our project design. Depending on our goals and objectives mentioned above, we will need to choose electronics that will be able to handle the code needed to make our project function correctly. Another big weight factor will be the rangefinder that will be built onboard, which consists of a laser emitter and detector. Depending on the range for the rangefinder that we want to design for, we will need a more potent laser emitter thus, this would add more weight.
Another factor to consider is that soldering the electronics could save us space to make our design more compact. Also, another advantage is that it makes good reliable connections which we need as the electronics will be subject to instant drastic motions.

Block Diagram



Collan Dimitri Optical Setup Research I/O – the target will be the input; the output will be a clear image with the reticle illuminated for distance overlapped	Optical system will consist of multiple lenses providing a magnification from 1 to 6 times. There will be an adjustment turret for the windage and elevation on the sides of the tube.
Ahmed Al Busaidi Integrated Rangefinder and Illuminated Reticle Researched I/O – The input will be the information gathered from the rangefinder; the output will be illumination of the corresponding µLED	This is the housing for the rangefinder. Its integration will allow for the reticle to display the appropriate information to account for drop over a determined distance.
Jacob Clevenger, Jose Vasques Dickson Electronic Integration and Arduino Board Researched I/O -	The windage turret will also house the battery while the bottom of the tube is where the Arduino board will be mounted.

Budget

Lens system	estimated $300
Portenta H7 Lite	$72
Bluetooth Transmitter	$5 - 10
LCD Screen	Size-Dependent but not more than $50
Casing for Fragile Elements	$N/A
Shock Absorbers	$N/A
Laser Rangefinder Emitter	$N/A
Laser Rangefinder Receiver	$N/A
Reticle Lens	$N/A
µLED Strip	$N/A

Schedule

Week #	Objective
1	Syllabus Week
2	Getting Group Member
3	Deciding Roles
4	Decide Project Idea
5-7	Start Report. Research project design for all components
8	Finalize Initial Scope Design
9-10	Research into Specific Parts
11	Finalize Bill of Materials
12-13	Order parts & design PCBs
14	Finalize project design.
15	Finish Report
16	Submit Report
End Fall Semester	
17-19	Build Rangefinder Start scope build Program microcontroller
20-22	Finish scope casing and lense system
23-24	Add micro-led display to scope lense
25	Start putting components together
26	Test system together
27-30	Fine tune and debug system
31	Cleanup project and make it look good
32	Present project