Team: Null

EEL 4914C Electrical Engineering Design  
(Senior Design)

Preliminary Design Report with Diagram(s)

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Team Members:

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Beach Ball Sniper

Team Name: NULL
Project Abstract

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Project Abstract
This project deals with tracking a moving beach ball in real time and shooting it with a projectile. This project will track the ball in the vertical-horizontal plane but will not consider the issue of depth, the firing mechanism therefore will be able to rotate on two axis. This is accomplished using image processing and a firing mechanism attached to a pivoting device. This project could be extended in the future to track more complex objects and could have applications in the military or various other fields.

**Figure 1: Block diagram of project**
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- Uses a webcam for vision
- Image processing with OpenCV on a laptop
- Lower level uP to take care of servo commands and firing signal
- USB interface from laptop to uP
- Firing device to hit beach ball
- Debugging GUI on laptop and/or LCD on uP
- MOSFET switch to firing device
- ? Power supply 120V AC to 5V DC

Components

Webcam

A USB webcam will be used to do the image capturing ideally this webcam will have low resolution and high data transfer rate. Low resolution will insure shorter execution time for the image processing code, the higher data transfer rate having obvious improvement. This is being investigated.

![Webcam](image)

**Figure 2:** webcam from logitech

Laptop
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Both of our laptops should be able to execute the code maybe even a third computer which had no development done on it to insure portability. Development of the OpenCV code will take place mostly on Jeff Johnson's laptop, this is an existing item.

Figure 3: Dell XPS M140 laptop

uP

For ease of development we will use an Atmel atmega32 which has a free C/C++ compiler, AVR studio, which is a language we are familiar with. The atmega32 has more utility than we need and more than enough memory for data and programming space and costs only $6.00.

Figure 4: Atmel Atmega32 DIP
Image processing software

![OpenCV software logo](image)

**Figure 5**: OpenCV software logo

We chose to use OpenCV due to its ease of use and again being a collection of C++ libraries which is a language we are familiar with. The libraries include many easy to use, well tested and efficient functions for typical image processing needs.

Servos

Two 180 degree servos are used to actuate the two axis rotating device, we chose to use a GWServo S03N STD servos because it has enough torque for our application and I already had them. Servos are widely used in electronics projects because they are easy to interface to and only require one PWM signal, VCC and GND.

![Servo from GWS](image)

**Figure 6**: Servo from GWS

Cost Objectives
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<table>
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<th>Items</th>
<th>Price</th>
<th>Quantity</th>
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<tbody>
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<td>Servo Motors</td>
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<td>x 2</td>
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</tr>
<tr>
<td>Web Cam</td>
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Table 1 - Cost and components for Beach Ball Sniper project

### Competition

I don't think this is the sort of thing people normally buy. To my knowledge this sort of device does not exist commercially. We would likely be competing for a defense contract interested in human assisted semi-autonomous robot based warfare. I don't think such a defense contracts information is likely public record, although I would hope our implementation is extremely competitive especially with price. In the future, we can develop this project to distinguish between American soldier’s combat uniforms and other enemy’s combat uniforms. Therefore, when the auto defense switch is on, machine guns will fire automatically when the enemy is around. The advantage of this is that it will protect our base 24 hours/7 days without having any injury of our soldiers.

### Division of labor/Gantt Chart
Figure 7 - Gantt chart for Beach Ball Sniper

References
Intelligent Machines Design Lab from http://mil.ufl.edu/5666/

Image figure 2 (page4) : "webcam". logitech. 05/27/2009

Image figure 3 (page5) : "XPS M140". Dell. 05/27/2009
<://absoluteraleigh.com/blog/uploaded_images/dell-xps-m140-775814.jpg>.

Image figure 4 (page5) : "ATMEGA32 DIP". ATMEL. 05/27/2009

Image figure 5 (page6) : piponazo , " Opencv 1.1pre + ffmpeg en Linux " . 05/27/2009

Image figure 6 (page6) : "GWServo S03N STD Motors". GWD. 05/27/2009