Weekly Blog Posts

Alexander Bailey
Fall Term

Week 3

Our progress so far is that we have talk to our client and discussed what he wanted for the project and made a problem statement that he and our group agree on.
For next week, we will begin looking into the different types of cameras that are available and their APIs to determine which type of camera and API will best suit our needs. We will also research the various programs that currently exist that are related to our problem and how much our group will need to do from scratch.
Currently there have been no problems.

Week 4

This last week I gave an update to our client about the need to redo the problem statement and the impending requirements document. I emailed our TA asking for comments on our problem statement.

For this coming week, we are going to get our problem statement revised. We are meeting on Monday to work on the requirements document.

We haven't had any problems

Week 6

This week, we polished up our requirements document with feedback from our TA Jon Dodge and Professor Kirsten Winters. We are sending our client the requirements document for his input and signature. Next week we will be writing out tech reviews. There were no problems.

Week 7

This week we got approval from Alex Neighbors on our Requirements Document and submitted it. We also discussed our Tech Review and did some research.

Next week, we will finish up the Tech review and begin working on our Design Document.

One problem with this week is that we had not figured out what 9 things we were going to do for our Tech Review.

Week 8

Last week we wrote our tech review and got started on the design document

This week we will be continue to work our design document.

There were no problems this week.

Week 9

This week we began work on the design document.

Next week we are going to finish up with the design document and begin writing our progress report.

There were no problems this week.

Week 10

This last week we wrote the Design document.

Next week we are going to write the progress report and record it.

There were no problems.

Week 11

Due to Finals we did not do much work, but we did get our paper approved by Alex Neighbors.

In the next few weeks we intend to choose a camera.

We had no problems this week.

Winter Term

Week 2

This week we are having Alex Neighbors send us the Zed camera. I also began learning C#.

Next week we will continue to learn C# and making a GUI.

No problems to report.

Week 3

This week we continued learning C#.

Next week the camera should have arrived and we can begin testing it out.

No problems this week

Week 4

This Week we received the Xbox 360 kinect camera and are waiting on the usb adapter to begin testing with it. We also are making the skeleton for the GUI.

Next week we should have the adapter and can begin working with the kinect. Next week we plan to be able to view a camera within our GUI.

No problems.

Week 5

This week we received the USB adapter for the Kinect camera, so we can begin using it. I looked further into using image subtraction for tracking.

Next week I'll look more into using the Kinect with C#.

No problems.

Week 6

This week we worked on updating the documents for the alpha level release.

Next week I'll continue looking into Kinect.

no problems.

Week 7

This week I worked on getting the depth map to display on the screen.

Next week, I'll continue working on the depth map.

No problems this week.

Week 8

This week I got the depth map to display as a black and white screen, however the screen oscillates for some reason. More specifically as an object moves towards and away from the camera the object should move from black to white with white being closest and black being far way, but instead it the object will go black then white then black then white, etc.

Next week I will try and find out why the depth map is doing this.

No problems this week.

Week 9

This week I worked on fixing the depth map so that it doesn't cycle between black and white.

Next week I will continue to work with the depth map.

No problems this week.

Week 10

This week we mainly focused on the poster and progress report paperwork, so little was done on the actual project. We got confirmation to use colored balls for tracking and to scale back the recording and replaying feature.

Next week we will continue working on the paperwork.

No problems.

Spring Term

Week 2

This week we were able to get the object tracking working with the Kinect camera and began working on getting the depth data at a specified point.

Next week we will finish adding the finding depth of the center of the object.

One problem that we aren't entirely sure about is that if too much red enters the frame then the camera will not update, but as soon as the red leaves the frame, the camera is fine. Luckily, it works fine when only one ball of red is in the frame, so this will work for our needs, but we are also looking into Haar cascades, which would hopefully remove this problem.

Week 3

This week we mainly worked on a surprising error where only Ben's computer was able to run the Kinect. We also had the poster review session with professor Kirsten and were able to get some good feedback.

Next week we will probably abandon trying to fix the error due to the limited amount of time till the code freeze. Instead we will focus on the speed algorithm.

Currently we have the problem that we fear that we may not have enough time to complete all the things in our requirements document, such as the recording an play back, so we will talk to our client in order to identify the most important aspects of the project.

Week 4

This week we were able to get speed tracking working and displaying in a text box. We also made a final draft of the poster and had it approved by our client.

Next week we're going to get recording and the text output file working, should be in time for the Code freeze.

The only problem we had is that for some reason my computer has trouble running the recording software, whereas my teammates computers don't seem to have a problem. Mine will show the text of the balls position but won't show the video. However, if I remove enough code from our speed tracking function, it will show up.

Week 5

This week we tested the speed function. We also had the program output a text file of the data. We also started the recording process, but for some reason this caused problems with the live feed.

Next week we are going to work on the midterm report and recording feature.

No problems.

Week 6

This week we began the midterm report paper and video.

Next week we are going to finish our report and then we are going to make sure that our project is ready for the expo display and record a video in case we have trouble doing a live demo during expo.

No problems.

Week 7

This week we finished the paperwork for the progress report, made a demo for expo, and went to expo.

Next week we are going to start the 3 writing assignments.

No problems.

Week 8

This week we contacted our client about the final hand off and returning the kinect.

Next week we'll begin work on the final documents.

No Problems.

Extra Questions

If I were to redo this project from the fall term, I would tell myself to not be so ambitious in the design of the document.

Getting experience with C# is definitely big. Secondly would be working with a openCV.

Mainly the C# for GUIs, but possible openCV if I get into some kind of computer vision.

I liked the interactive nature of the project, it was fun to see the program recognizing objects as they were in motion.

My teammates taught me about openCV and finding the speed of the object in 3D space, as that was the pieces they were in charge of.

I might possibly be disappointment given the original design, but knowing more about object recognition and tracking I think I would be okay knowing that the students had no prior experience with it.

The next step would probably be multiple object tracking.

Dylan Washburne
Fall Term

Week 3

Since the start of the term, we have now been assigned into this project group, spoken with our client, and determined what we are going to be doing in the project. Personally, I attribute almost all of this to preparing the Project Statement, though honestly it had to be done eventually.

In the upcoming week, we will be researching the available varieties of cameras that would be applicable to this project. This involves researching which cameras can be most effectively used to capture real-time data, as well as determining if we want mono- or bi-focal cameras.

We are also looking into the apis used in the programming of these cameras. While not determined as of yet, we have discussed the point and believe looking into what cameras already have the capability to recognize objects in the frame is a serious consideration to work with.

Week 4

In the last week, I've mostly been looking up some camera options in my free time. The issue with doing this without dedicating serious time to it is that it's a little difficult to locate all the information pertaining to the coding side, and whether or not it has built-in capability to locate objects in frame. Granted, certain cameras like Kinect heavily emphasize that point, but I'm

going to need to look a lot more at the api side of things to see if it will behave as needed for this endeavor.

In the coming week, I'm planning on getting the problem statement fully revised, as well as typing out the requirements document. I also hope that the group can sit down and definitively decide what camera we're going to use, because that's going to be needed soon when we are able to begin the actual work.

Week 5

This last week was kind of hectic, but due to a lot of factors not directly influenced by this class. Apart from us redoing the problem statement and making a requirements document, I also had 2 midterms on the same day, so you know... everything suffered just a bit.

On a happy note, now that we've got all this out of the way we can finally start actually doing hard work on the project. And yes, this means actually selecting a camera to use, just as I said 3 weeks ago. That has been our client's number one request to us and we haven't been able to do it very well due to mass overlap in time where we can be together, and documents that need to get done.

Week 6

This week was terrible for me because of non-capstone reasons. As far as capstone itself goes, this week was fairly uneventful, as we mostly did edits to the requirements document. I did personally look a little into cameras and object tracking, but I still have no concrete idea what would be best overall for our purposes.

We really need to get the type of camera locked down. Whatever work we get next week is hopefully trivial so we can, as a group, come together and finally research that.

Week 8

This week was a nice slap in the face to me for our writing. A lot was done between Sunday and Wednesday to make the tech review actually happen. For me, though, I most hustled in redoing our citations, and even that I know wasn't properly done, since /cite didn't want to work for me.

Upcoming, more documents to be done. Yay, more writing! Sorry that was sarcastic, but it's how I deal with being mad at myself over the last week. Writing isn't particularly hard, and I see the applications to all the assignments, so I don't really mind the writing all that much.

Week 9

This last week was Thanksgiving week, so not much time was devoted to this work. Nonetheless, we now have divided up the work for our upcoming document.

Going forward, we will complete that document for real.

Seriously, not much to say this week.

Week 10

The previous week was mostly us completing the requirements document. This took less time than anticipated, but only because it required us to understand everything before we could actually start, which means the combined time was much longer. We also did a little work towards the progress report, but there's still a long way to go on that.

Coming up, we must finish the progress report. After that, we can actually begin on the project itself over winter break. I anticipate we will group a little, but much of what we have to do requires all of us here. Our first steps to get setup complete I anticipate will take a few weeks.

Winter Term
Week 1

Winter break didn't really do anything for our project's completion, since we didn't meet up. We all seem to remember everything with good detail though, so there was no loss either.

We have researched stereoscopic cameras, and found that the market is somewhat cornered to models which have a maximum range of 20m. In fact, most only reach about 3m away, because the major market is peoples' living rooms. Our initial goal of 100m is not going to happen unless we construct it ourselves. That said, we have reevaluated how much we need to track every object in a football stadium, and while a bit more range would be welcome, 20m would satisfy our needs well. We are hoping we can update our requirements to reflect that.

Week 4

We have received the camera to work with. It was not the Zed as we had proposed, but rather a Kinect. I am cautiously optimistic about this change in scope, because narrowing it down is actually a good thing, so we are constrained by force to not over-deliver what we can't possible create.

I kind of wish we had heard the context for this selection from Alex before he sent it to us, but he's explained it now and we all understand. We just sort of wish we had heard this context before we got the package and were rather confused.

We need to do a loot in the coming weeks to get our alpha product done, but I'm hopeful we can get a compact starting product prepared. Unpolished maybe, but I think it can be done.

Spring Term
Week 2

In the previous week, we had a good number of new developments. We were able to make the object tracking perform correctly for objects with the color red, and we have begun implementing that alongside the depthmap. The implementation to make it coincide with the

depthmap is not yet complete, but quite frankly at this point the progress we have made is good enough for me.

The main difficulty here is that we are still moving slower than we should, for our point in the term. We have accepted that and been working hard to try and approach where we need to be.

Coming up, we are preparing to update our poster for expo (and the assignment where we need to update it), as well as once again sending a message to our client on how we are modifying the project requirements.

Week 3

This week we received some small red stress balls to work with as objects for the video to focus on. They appear to work well enough, although there are still some issues inherent in the program. We are hoping to resolve them well enough for our expo presentation to be workable.

We also did poster reviews for extra credit in Kirsten's office. To be frank, we knew our poster was a bit terrible going in. That said, we got extremely good feedback from the other group on how specifically to improve the poster. I feel we can make it look good by expo, so I am happy with the meeting.

I am still worried that we may not be able to fix everything by expo. I don't exactly have a plan for us being unable to do this, but it is my largest current concern for this project.

Week 4

This week, we completed a method to take the xy coordinates in the color image, the image which does the object recognition and tracking, and use those coordinates to look up the z distance away from the camera through the corresponding coordinates in the depthmap. This allows us to automatically locate the center of an object, and determine its precise point in space every frame.

From there, I was able to integrate some formulas to calculate velocity, half through knowing the Pythagorean theorem, and half through fiddling with data of a tracked ball at various depths to understand how many pixels it translates horizontally, based on its distance from the camera. Naturally, an object farther away travels fewer pixels horizontally than an object up close, when translating the same distance in the real world.

Coming up, we still need to hammer out a few issues before the code freeze. We are also actively working on touching up the poster before it gets turned in. We have already gained client approval, but we are looking for more minor isues at this point like visual spacing of text boxes (and only to a minor degree, nothing that would change the poster in any significant manner).

Week 5

Code freeze hit on Monday. We were working nearly until the deadline to submit what we felt could be a "complete" product. Granted, we completed most everything before this point, but the last-minute things were more of the small-scale issues which we felt should be featured in a "release".

We also submitted the poster and completed all the individual paperwork required to present at the expo. It was really just busywork, so it was completed in good time.

Since the code freeze hit and we have essentially "submitted" our project, we have actually let ourselves not meet up as often this week. I believe this to be a temporary measure, partially because there are also midterms, but we will be working again to complete the grading assessment paperwork before that is due. We plan to meet over the weekend to bang most of that out.

Week 6

No major breakthroughs have happened this week. To be brutally concise, we have not worked on the actual project in any significant capacity. This is mostly because of other events in each of our lives, notably midterms. It is also notably because we have been working on the "midterm" progress report.

The midterm still has to be completed. We are catching back up on the paperwork to reflect our actual state of affairs, relative to the previous progress report last quarter. Unlike the last 6 months, we actually have a product to show off for this. This will likely lead to more time spent making the video, to represent what has been completed.

Week 7

Expo happens this week. I think we are as prepared as we will ever be, and I'm honestly just waiting for it to be over. I am sure within 90\% tolerance that it will go smoothly, with probably a couple of people causing minor trouble, but nothing show stopping.

Week 8

Expo was last week. Overall I would say it went about as well as expected, though I do wish in retrospect I had packed some different shoes, more aligned to standing in place. Since then, we have not met up in any major capacity regarding capstone, even though we still meet for other class projects. I don't know about Alex and Ben, but I think we are all fairly satisfied with how the expo went.

Looking back, there are a number of things I would have done differently this term. For whoever is reading this, this is where I am beginning the retrospective questions.

If I were to redo this from the fall term, I wouldn't change much from the fall term until we hit the requirements document. There, I would say that we should have promised way less. Of course, we slashed it down to a moderate size as time passed, which I would also say is the

biggest thing I learned. I never before realized how often people in the industry would have to go back and tell the client they were cutting features.

In the future, I can see myself using a number of the delegation skills I honed over this term. My programming skills weren't really the largest factor over the project, though I did learn a few new things. Rather, the ability to work with the team and figure out the work loads was the most important skill I had to use nearly every time we met. I suppose you can also say this is what I learned from my teammates, because I can confidently say that all of my notable gains in skill from this project came from interacting with the team.

I liked that the project was truly us building an application from the ground up, with no preexisting code base, though that's a double edged sword because I know any job I acquire will want me to implement on an existing system instead of building my own, and I would have preferred to work on something existing so I could get more real experience.

If I were the client for the project, I am not sure if I would be satisfied with the work done. On the one hand, we delivered a working proof-of-concept at the quality you might expect from recruiting random college undergrads who have never had a job, but simultaneously we could have created something of higher quality that runs better with better market applications. Though, I also think the project itself wasn't exactly that aimed at top-end market applications anyway.

Were this project to be continued next year, I think they could get good progress by optimizing the object recognition algorithm because that's where all the processing is going, and from there expanding the objects it can recognize. They could even scale up to a higher quality camera with higher range to expand the applications the product would be viable in.

Benjamin Wick
Fall Term
Week 3

This week we learned a lot more about our project. We did some research on cameras that we might use for our project. We also worked on our abstract and problem statement. Next week, we plan on continuing our research and hope to come up with a list of possible cameras we can use.

Week 4

This week we got our camera and we began working on the user interface. We have to update our requirements and tech review. We plan on having a skeleton on the user interface done and able to receive video input by next week.

Week 5

This week we completed our final draft of our problems statement. We also worked on our rough draft of our requirements document. This was my first time writing a requirements document so I think there's going to be a lot of updating as we get feedback on it.
After we turn in our final draft of our requirements document, I think it would be a good time to get into researching possible cameras we want to use for our project.
Overall, proud of my team and the work we've done so far and excited to keep moving forward.

Week 6

This week we went and got feedback from Kirsten and our TA, Jon to improve our requirements document. Overall we got some really good feedback to improve the document. We all sat down and worked more on the document. We were unable to finish the final signed draft by Friday. However, we did finish our final copy and we just need to send it over to Alex to confirm and sign it. Once we hear back from him we'll be able to sign and turn in our hard copy.
So far we haven't really ran into any major issues. Our biggest issue is probably finding meeting times where were all available to meet because of our busy schedules. Other than that our team is making good project and I'm proud of the work we've done so far.

Week 7 and 8

We did a lot more research this week about cameras and what we'll need to do our project as well as our tech review. We made a lot of progress with researching things. After this week I have a lot better of an idea of what we will need and how we will finish our project. We started working on our tech review and though we did start later than I would hope because we struggled finding out 9 different topics we managed to finish on time.

Week 9

This week we mainly just worked on the design document. The document is due in two weeks so hopefully we're able to get a good start and not have to work on everything last minute. Our goal because the document needs to be signed, is to have it done I think by Wednesday next week.

Week 10

This week not much has happened besides wrapping up our project design. We focused on the design this week and we plan on doing our project report starting Monday.
We still need to talk about what we plan on accomplishing over winter break, which a head start would be very beneficial.
Winter Term
Week 1

This week our main accomplishment was choosing a camera for our project. We decided to go with the Zed camera because of multiple benefits. It had the farther range as far as stereoscopic cameras go and the fact that it is stereoscopic will make depth finding a lot easier.

Week 2

We have emailed our client and are currently waiting to hear back from him on the approval of the camera we chose. No problems have occurred otherwise.

Week 3

We still are waiting on our camera, we started to learn more C# and looked further into the design. Other than that, we won't have much to do until the camera arrives.

Week 4

This week we got the Xbox 360 Kinect. At this point all we can do is more research and work on the GUI as we wait for the USB adapter to come in. Next week we should get the adapter and can start implementation.

Week 5

This week we got the USB adapter for the Kinect. We plan on working on the input using the Kinect camera. We need to look at how we can use OpenCV with the Kinect as well.

Week 6

This week we mainly worked on the assignments and worked on our alpha release product. We still haven't been able to track objects yet. My main concern is using EmguCV instead of OpenCV because we plan on using C# as opposed to C++. Finding a good resource to help implement tracking with EmguCV are a little more difficult than OpenCV.

Week 7

Started to work on EmguCV and playing around with the functions in C#. Making slower progress due to loads in other classes.

Week 8

This week I started trying to track a red ball. We all figured a solid color might be easier to track than detecting people themselves. Still unsure if this will be the method of tracking we implement in our final release though.

Week 9

Ran into an issue where the camera to my program wasn't able to connect. I think if I can get it to connect the code for tracking a red object should work.

Week 10

This week I continued to work on the issue with the camera. Not much progress there and may pivot in tracking method because of discussion with team. Going to try and work on tracking using background subtraction. This will detect any moving object thought. Hopefully can finish before final progress report.

Spring Term

Week 1

This week we're able to start tracking red objects and recording their X and Y coordinates using a webcam. We don't really know the units of these coordinates. We will need to do further research on this so we can figure out how to do the speed calculations. We are now trying to implement a speed algorithm that will help us calculate the velocity of the red ball we are tracking.

Week 2

So far this week we combined our depth map and our tracking into one main program. We ran into some issues where we needed to convert the bitmap image to a EmguCV MAT object so we can apply the tracking onto the image being captured from the Kinect. We figured this out and now we have Dylan doing some more research on the speed calculations. We split up roles to

revamp the tracking, maybe using haar cascades, and we also have Alex and Dylan working on the speed algorithm.

Week 3

This week I worked on trying to use haar cascades but after more research I read that for simple objects, like a ball that is it not the best method. So for the lagging issue I'm going to try and draw rectangles instead of circles because the problem was with drawing circles. We also ran into problems where the development environment isn't working for Alex and Dylan and only my machine. As far as requirements go we are thinking we might not be able to finish the file saving and are shooting to just get the speed calculation working.

Week 4

This week we made a lot of progress. We finished up our poster as well as almost completed our speed algorithm. We are really close to wrapping up before the code freeze. We still have a few more features to work on including text file output. We decided that video recorded playback isn't really feasible right now because we are comparing images instead of recording a video. One problem we still are encountering is creating the development environment on systems other than mine. This is something we plan on fixing and we will also create a step by step compiling instruction so that ideally any system can compile our program. We also will work vigorously to finish outputting to a text file.

Week 5

This week we made some good progress on the project entering the code freeze. We finished up saving the information to the text file. The only problem I would say is the tech review. I think there was miss understanding about having elements from the tech review as actual requirements for our project. I didn't anticipate that things in the tech review were going to be graded in our final project, only thought it was the requirements document, so that was a little strange. Other than that We plan on getting started with our midterm project report.

Week 6

This week we mainly focused on documentation and our midterm progress report. We started working on our written document and mostly finished it with the exception of adding in a few images. We haven't ran into any problems this week as we haven't done much to the program itself. We plan on doing the video in the next few days.

Week 7

This week all we did was wrap our midterm presentation as well as prep for the engineering expo. We had to create a video of our demo. We also haven't ran into any issues yet. Next we simply await instructions on our next assignment from Kevin.

Week 8

This week we didn't do any work regarding the project itself. All we did was start creating a template for our final written document as well as e-mail our client about the expo. No problems so far. We plan on just chipping away at the final report to try and get it done early.

If you were to redo the project from Fall term, what would you tell yourself? I would first tell myself to set realistic expectations in the beginning. At first I feel as if didn't really have an idea of what we would be capable of or not capable of and we ended up overshooting on requirements. We ended up having to scale down.

What's the biggest skill you've learned? I think the biggest skill I learned from this is the ability to go out and find certain information I need to make a project with no previous knowledge. I also learned how to make a program using .NET and visual studios which I think is a great skill to know.

What skills do you see yourself using in the future? Depending on where I work I can see myself using visual studios, ability to use external libraries, and creating things with .NET. No matter where I work, this project helped me develop my soft skills. It helped teach me more about working in a team, writing documents, and just the process of development in general.

What did you like about the project, and what did you not? I liked how our project was really flexible and more so a proof of concept instead of dealing with the stress of creating a marketable product. I did not like how the project relied so heavily on hardware. Certain computers had different performance rates and we weren't able to solve it.

What did you learn from your teammates? My teammates were awesome and I enjoyed working with them. I learned how to communicate and also how to manage time within a team environment. We all were so busy with other classes as well that we had to utilize time we did have to work on the project together.

If you were the client for this project, would you be satisfied with the work done? Yes I would be.

If your project were to be continued next year, what do you think needs to be working on? I think the tracking algorithm can be worked on to further track different objects and track objects more accurately.