TRUE SIGHT

ABSOLUTE VISION SYSTEMS

PROGRESS REPORT FOR REAL-TIME 3D LASER SCANNING DEVICE

PROJECT TEAM

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REVISION

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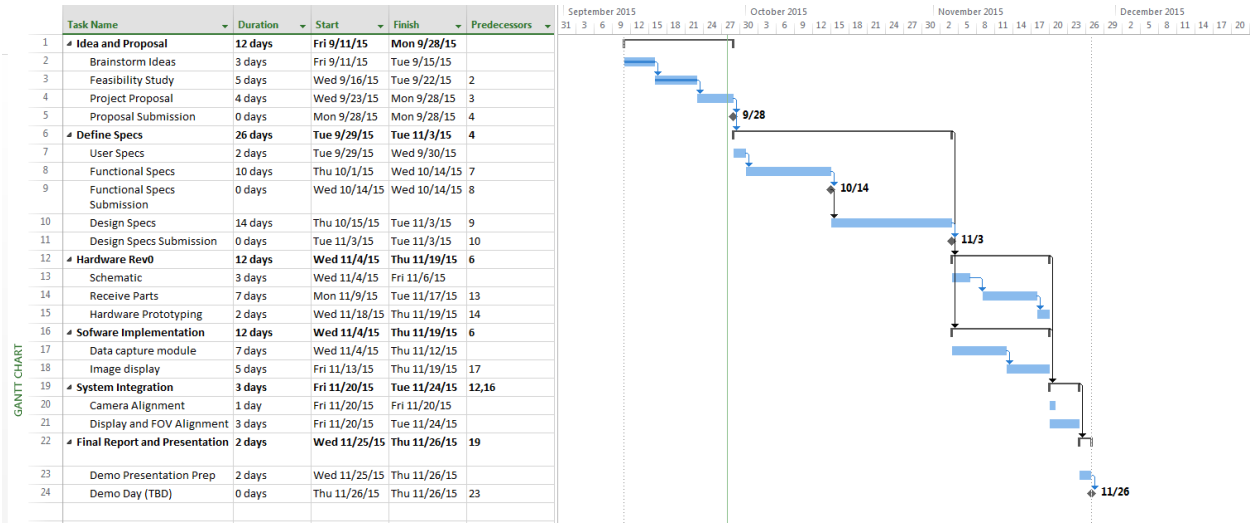
1. Introduction

TrueSight, by Absolute Vision Systems, is a real time laser mapping system intended to enhance and supplement human vision in low visibility environments. TrueSight is a helmet-mounted device which uses IR depth data and projects this information into the user's field of view in real time. Our goal at Absolute Vision Systems is to create a unique visual system which is a robust and simple-to-use solution for emergency response teams. This document outlines the current schedule, financial status, and overall progress we have made on TrueSight product.

2. Schedule

The initial projected schedule is shown in *Figure 1*. The initial schedule assumed the demo date would be set for the end of November. With our date officially set for December 21st, the schedule has been adjusted to better utilize the extra few weeks to optimize the prototype model of the TrueSight system. The research and design stages are completed. The integration phase was projected to be complete on Nov 24th, with testing going from the 25th to December 1st. Currently we are in the middle stages of integration in software and mechanical, and are in the testing phase for hardware. Our initial schedule for integration was unreasonable as we only allotted 3 days for system integration. With the final demo date in place, our revised schedule includes finalizing integration and debugging up to December 8th and testing up until the demo day. The updated project schedule is show in *Figure 2*.



	Task Name	Duration	Start	Finish	Predecessors
1	**Idea and Proposal**	**12 days**	**Fri 9/11/15**	**Mon 9/28/15**	
2	Brainstorm Ideas	3 days	Fri 9/11/15	Tue 9/15/15	
3	Feasibility Study	5 days	Wed 9/16/15	Tue 9/22/15	2
4	Project Proposal	4 days	Wed 9/23/15	Mon 9/28/15	3
5	Proposal Submission	0 days	Mon 9/28/15	Mon 9/28/15	4
6	**Define Specs**	**26 days**	**Tue 9/29/15**	**Tue 11/3/15**	**4**
7	User Specs	2 days	Tue 9/29/15	Wed 9/30/15	
8	Functional Specs	10 days	Thu 10/1/15	Wed 10/14/15	7
9	Functional Specs Submission	0 days	Wed 10/14/15	Wed 10/14/15	8
10	Design Specs	14 days	Thu 10/15/15	Tue 11/3/15	9
11	Design Specs Submission	0 days	Tue 11/3/15	Tue 11/3/15	10
12	**Hardware Rev0**	**12 days**	**Wed 11/4/15**	**Thu 11/19/15**	**6**
13	Schematic	3 days	Wed 11/4/15	Fri 11/6/15	
14	Receive Parts	7 days	Mon 11/9/15	Tue 11/17/15	13
15	Hardware Prototyping	2 days	Wed 11/18/15	Thu 11/19/15	14
16	**Sofware Implementation**	**12 days**	**Wed 11/4/15**	**Thu 11/19/15**	**6**
17	Data capture module	7 days	Wed 11/4/15	Thu 11/12/15	
18	Image display	5 days	Fri 11/13/15	Thu 11/19/15	17
19	**System Integration**	**3 days**	**Fri 11/20/15**	**Tue 11/24/15**	**12,16**
20	Camera Alignment	1 day	Fri 11/20/15	Fri 11/20/15	
21	Display and FOV Alignment	3 days	Fri 11/20/15	Tue 11/24/15	
22	**Final Report and Presentation**	**2 days**	**Wed 11/25/15**	**Thu 11/26/15**	**19**
23	Demo Presentation Prep	2 days	Wed 11/25/15	Thu 11/26/15	
24	Demo Day (TBD)	0 days	Thu 11/26/15	Thu 11/26/15	23

Figure 1 Initial Proposed Project Schedule

	Task Name	Duration	Start	Finish	Predecessors
1	**Idea and Proposal**	**12 days**	**Fri 9/11/15**	**Mon 9/28/15**	
2	Brainstorm Ideas	3 days	Fri 9/11/15	Tue 9/15/15	
3	Feasibility Study	5 days	Wed 9/16/15	Tue 9/22/15	2
4	Project Proposal	4 days	Wed 9/23/15	Mon 9/28/15	3
5	Proposal Submission	0 days	Mon 9/28/15	Mon 9/28/15	4
6	**Define Specs**	**26 days**	**Tue 9/29/15**	**Tue 11/3/15**	**4**
7	User Specs	2 days	Tue 9/29/15	Wed 9/30/15	
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9	Functional Specs Submission	0 days	Wed 10/14/15	Wed 10/14/15	8
10	Design Specs	14 days	Thu 10/15/15	Tue 11/3/15	9
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17	Data capture module	7 days	Wed 11/4/15	Thu 11/12/15	
18	Image display	5 days	Fri 11/13/15	Thu 11/19/15	17
19	**System Integration**	**10 days**	**Fri 11/20/15**	**Thu 12/3/15**	**12,16**
20	Camera Alignment	3 days	Fri 11/20/15	Tue 11/24/15	
21	Display and FOV Alignment	3 days	Wed 11/25/15	Fri 11/27/15	20
22	Switch and ADC interface	10 days	Fri 11/20/15	Thu 12/3/15	
23	**System Testing**	**7 days**	**Fri 12/4/15**	**Mon 12/14/15**	**19**
24	Hardware Testing	3 days	Fri 12/4/15	Tue 12/8/15	
25	Software Testing	3 days	Fri 12/4/15	Tue 12/8/15	
26	Integration Testing(Complete System)	4 days	Wed 12/9/15	Mon 12/14/15	24,25
27	**Final Report and Presentation**	**5 days**	**Tue 12/15/15**	**Mon 12/21/15**	**23**
28	Demo Presentation Prep	5 days	Tue 12/15/15	Mon 12/21/15	
29	Demo Day	0 days	Mon 12/21/15	Mon 12/21/15	28

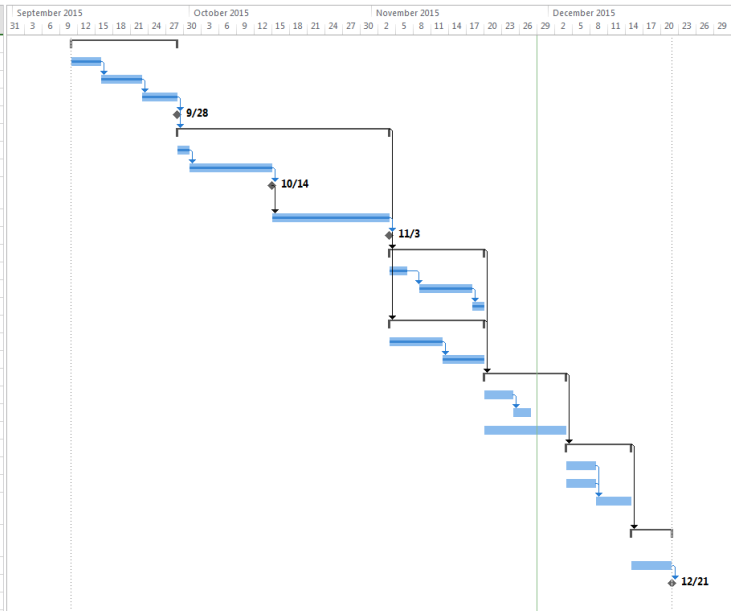

Figure 2 Updated Project Schedule

3. Financial

We initially started with a budget of $665 and currently have spent $1300 on the project. A total of $500 of the expenditures have been covered by the ESSEF Endowment Fund and the remaining amount has been covered by the group members of Absolute Vision Systems. We foresee spending approximately $100 more on miscellaneous parts such as switches and mechanical components. Our budget was significantly underestimated due to the following factors - the PCB manufacturing costs/electrical components, the display/projector, and shipping costs. Initially we chose to use a pico-projector system, but eventually decided against it in favor of a LCD screen, which increased the cost significantly. Also, we eventually decided to create our own PCB to power each subsystem. In doing so, TrueSight will only require one power source, reducing the system's weight. In the future, we need to take into account shipping, duties, and taxes, as this increased the budget significantly. Table 1 compares our initial estimated costs with our current budget.

Table 1 Estimated Vs Actual Budget

Equipment	**Estimated Cost ($)**	**Actual Cost ($)**
Kinect V2	$150	$179.19
Nvidia Jetson TK1 Dev. Board	$200	$271.02
Kinect USB Adapter	$60	$68.20
HW8G3 Pico-engine	$30	N/A
Projector PCB	$50	N/A
Adafruit LED Screen	-	$167.14
Helmet with Visor	$50	$0.00
Materials for Mechanical structure	$50	$51.50
Miscellaneous electrical components	$50	$38.98
Batteries & charger	$25	$154.49
Power PCB	-	$141.00
Power PCB Components	-	$229.85
Total Cost	$665	$1301.37

4. Progress

4.1 Hardware

4.1.1 Power PCB

The main purpose of the power PCB is to power all of the subsystems on the TrueSight off of one battery. Schematic design and PCB layout were completed on Altium Designer. The power PCB has been fully populated and is currently in integration testing. Our team is in the process of troubleshooting the board. Currently we are having issues with the LMR12010 step-down voltage regulator, which is responsible for the 5V power rail. We suspect that when powering the LCD screen while connected to the Jetson TK1, the LCD is drawing a higher current than we anticipated causing blatant screen flicker. We are investigating the cause of this issue, but should our investigation prove fruitless, the LCD monitor can still be powered via the Jetson's mini USB port.

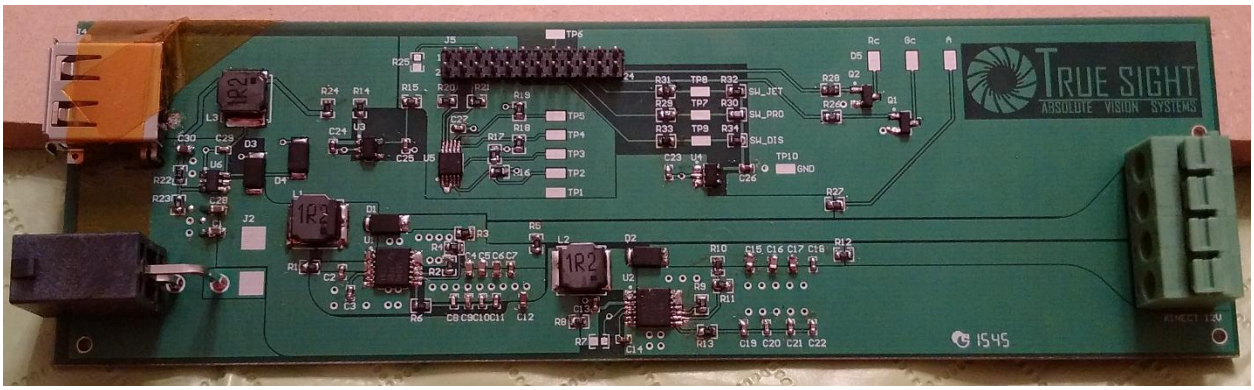

Figure 3 TrueSight Power PCB

4.1.2 Mechanical

Mechanical design has been completed for the project, however integration is still in process. The enclosure which houses the display and switches is close to completion. However, the functionality of the switches and buttons needs to be confirmed before we mount them in the enclosure. The enclosure for the Jetson TK1 and power PCB has been purchased, but not much integration has been done with it. However, the integration is fairly simple and only requires mounting the two boards and drilling holes for the power switch and cables which supply the other devices. The display enclosure also needs to be mounted to the helmet, which should happen once the enclosure has been fully integrated with the switches.

4.2 Software

The software design for TrueSight program has been completed, but integration with the hardware is still underway. The main functionality that still needs to be added is the bootup functionality and some general background scripts. Switches and Status LEDs still need to be explicitly coded into the main software, but the I^2C and GPIO interfaces have been successfully tested and confirmed to work as intended. Initial testing has already begun for software, particularly for the functionality control such as calibration and mode-toggling. Some further experimentation and testing will need to be done once the integration has been completed, which hinges mostly on the mechanical construction.

5. Conclusion

Throughout our progress report, we have highlighted the current issues with the software and hardware, and described their solutions. The document also describes the current financial status of the project and our current timeline. Functionality of all modules has been completed, but final integration and testing is underway. We are confident we will be able to deliver a fully-functioning system on demo day.