Camera Positioning System

Team 79

Design Review Document

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1 Introduction

1.1 Objective

The University of Illinois's Renewable Energy & Turbulent Environment (RETE) research group with sponsorship from John Deere has been tasked with designing a camera positioning system for particle tracking research. The system must be able to operate with the same functionalities as the current particle tracking equipment but with additional scalability, precision, robustness, and ease-of-use in mind. The current equipment includes the use of a high resolution, high speed recording camera and a view splitter which produces four different views, converging them on the volume of interest. It is relatively small and thus limited in experimental range. Manual calibration of the four independent view splitting mirrors is very tedious and requires a minimum of two people to set up. It is also important to note that the total experiment set up time from scratch requires up to four hours.

A proposed solution was to create a four-camera system, replacing the view splitter, that can be electronically controlled. The cameras will be able to translate, pan, and tilt with a high resolution of movement using stepper and servo motors. The frame will allow simple adjustability in the system's dimensions to provide a wide experimental range and provide a robust foundation in which future scaling can be possible. A user interface will be provided showing the current position of each of the cameras as well as allowing different modes in which they can be moved. All calibrations will be hands-free from the physical system.

The prototype will stay in the RETE research group for one year to test its functionalities and then be transferred to John Deere to facilitate their research.

1.2 Background

Although particle tracking is not the focus of the project, a basic understanding of the experiment is important in the system design. In particle tracking, many views are often required to study the particle's movement in a given time and space. A 3D particle tracking velocimetry (3D-PTV) experiment allows particles to be tracked in a fluid. Further analysis can provide useful data on the particle's velocity and movement behavior. To accomplish such an experiment, a high resolution system must be used such as a camera positioning system. Different angled views converging onto a control volume must be recorded and examined. Each view should be adjustable to a certain degree of consistency to allow a repeat of or fine deviation from a previous experiment's view positions.

The previous team finished the mechanical design of the camera positioning system. It consists of two frames, holding two quadrants each. Each of the quadrant has two aluminum tracks in a "+" configuration as the XY traversing mechanism. A pan-tilt head, which holds the camera, is mounted on the vertical track. In terms of electronics, an Arduino Mega is used for data acquisition. A PWM add-on board is used to control eight servo motors. Additionally, Eight stepper motor drivers are used to drive eight stepper motors.

A user interface has been created in LABVIEW environment. It is used to process users' inputs and send control signals to other peripherals. The users can input desired positions and angles into LABVIEW. LABVIEW will process the inputs and send out control signals via USB to the controller. The controller will act as a hardware interface between LABVIEW and other peripherials.

Next Step is to add in sensors and design circuits to achieve more advanced and essential features for the product. The features include auto-calibration, homing and position feedback from both the linear movement and angular movement. These functions were not included in the prototype due to the lack of electrical engineers on the team.

Also, we are looking for a more compact and efficient microcontroller to replace the Arduino Mega as the data acquisition device. We will integrate most of the electronics onto one PCB.

In addition, each group member is responsible for one area. Junjiao is responsible for the Pan & Tilt head control, LABVIEW and communication between the team and sponsors. Jialu oversees the calibration unit as well as the LABVIEW VISA. Weicheng is mainly responsible for the design of the power unit.

Figure 1, Old Experimental Setup

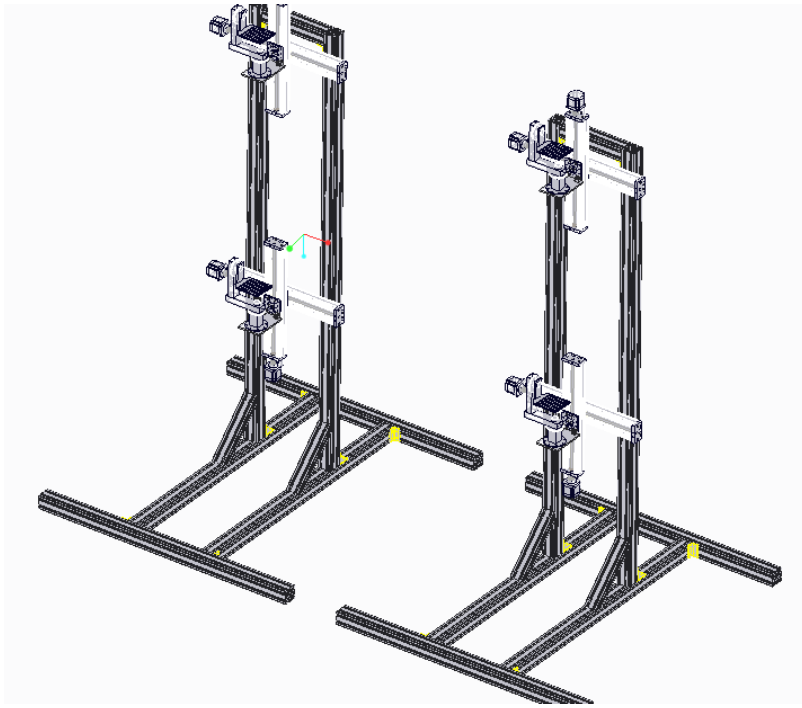

Figure 2, Proposed New Design.

1.3 High-level Requirements

As of right now, the system still requires manual calibration on startup. A user must measure the distance of the camera from the motor ends of both the vertical and horizontal beams to establish a local coordinate. Also, there is no boundary condition on the traversing system. The computer is not able to tell if the camera has reached an end or not. This is potentially hazardous to the system and the users because the motors will not stop running until either the power is cut off or the system breaks. However, we want to increase efficiency and minimize human error by adopting a technique used by many commercial gantry tables. We plan to design a circuit which would signify the controller whenever desired position is reached and stop the operation if physical limit is reached. Upon powering up, the XY traversing mechanisms should perform an auto-calibration test and resume to user pre-defined positions.

The pan-tilt heads are responsible for panning and tilting the cameras. Even though, we can derive equations to relate the user's inputs to the control signals for the servo motors. It is not clear how accurate this positioning scheme is. In other words, the system is open loop. Therefore, a control circuit will be implemented with a potentiometer and a 16-bit ADC to achieve angular position feedback from the pan-tilt heads. With the feedback, a control logic can be written on the computer to minimize positioning errors.

A new customized PCB will be designed to replace the current data acquisition device Arduino Mega and to group all other necessary inputs and outputs from the whole system, such as the homing signal, stepper motor driver signals, and the PMW add-on board for the servo motors.

We are also designing a power unit to power all the different electronics in the system. Currently the stepper motors and servo motors are powered separately from the wall. As more sensors and circuits are being added to the system, a compact central power unit is necessary to make the setup easier.

2 Design

2.1 Block Diagram

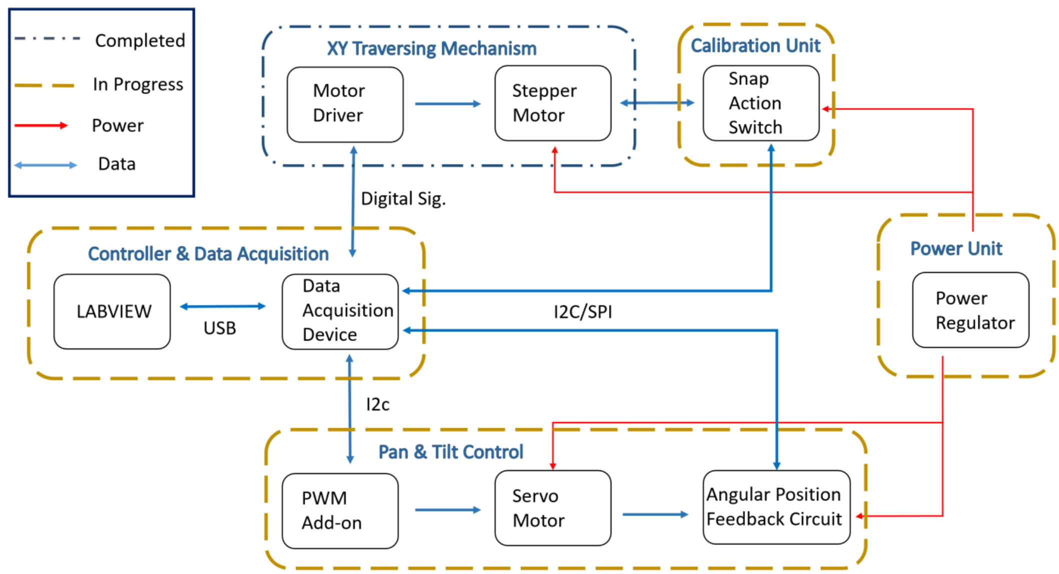

Figure 3, Overall System Block Diagram.

Except for the existing mechanical system, we are reinventing the whole hardware and software setup.

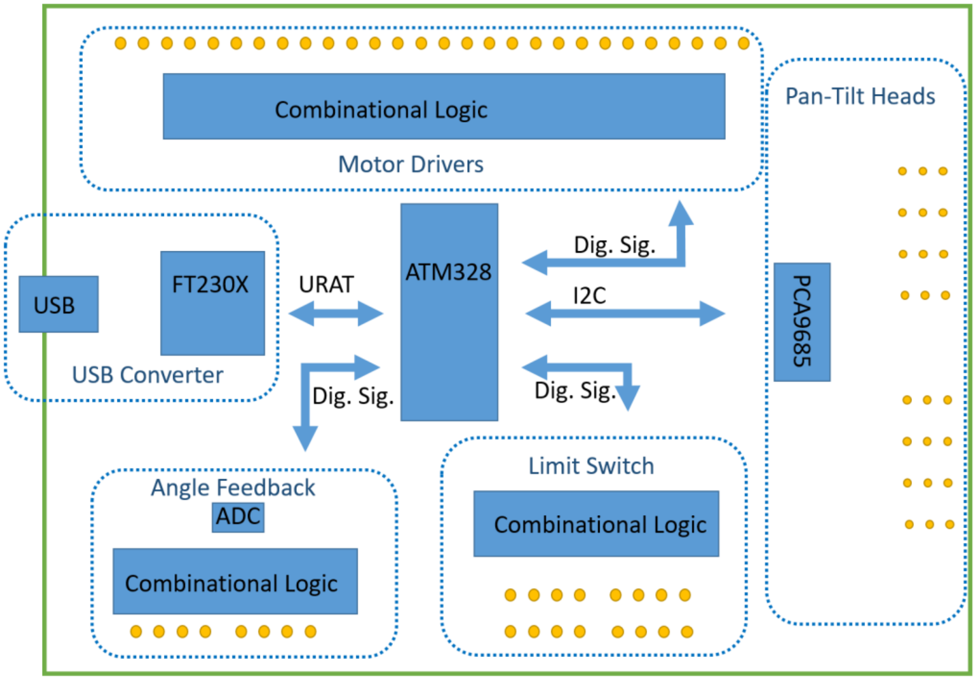

Figure 4, PCB Design Overview.

2.2 Functional Overview

2.21 Pan & Tilt Control

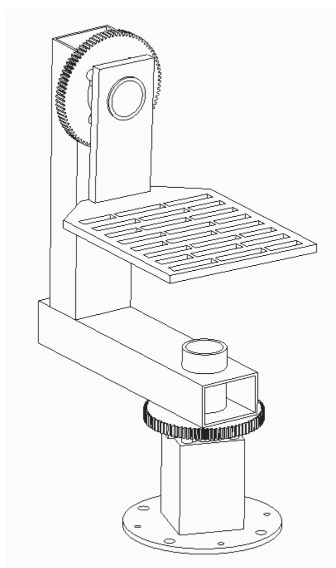

Figure 5, Pan & Tilt head 3D View.

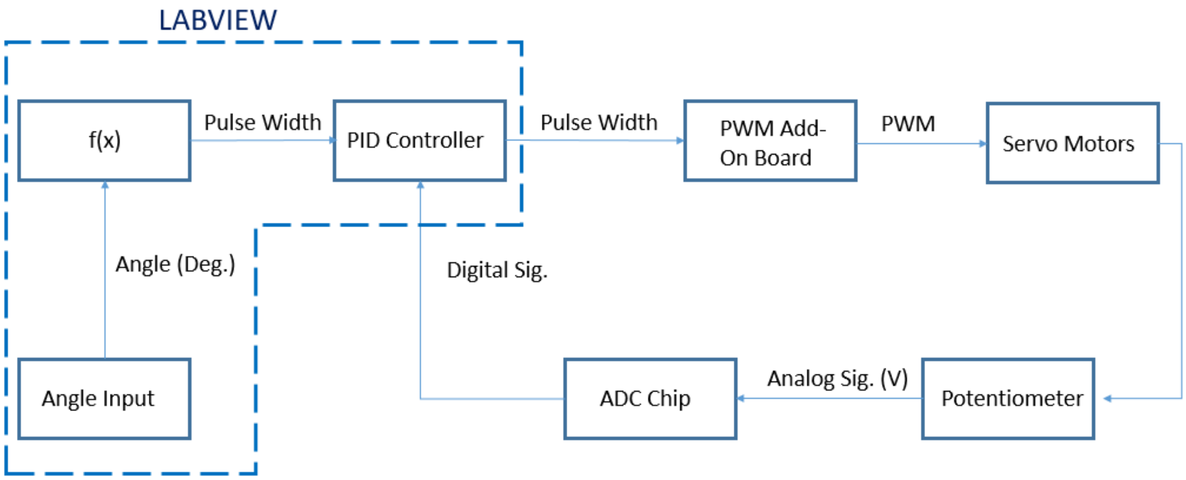

Figure 6, Pan & Tilt Head Control Block Diagram.

The purpose of this block is to provide accurate angle feedback from the pan & tilt heads. The commercially available pan & tilt heads come with two HS-785HB winch servos [2] [3] with approximately 2700 of rotation. There is also a 7:1 gear box between the rotating parts of the P&T heads and the servos. The angle of rotation of the P&T heads is mapped into PWM pulse width (micro-sec) through a linear function. The mathematical function relating the angle to the pulse width is developed through repeated experiments. However, because individual servo motor differs in its response to a certain pulse width the mapping is not very accurate. The inclusion of a potentiometer based angle sensor is expected to increase the accuracy. The potentiometer outputs an analog between 0 and 3.3 V and it will go through an ADC chip that has 16-bit resolution. The conversion result is then sent back to the computer through I2C/SPI. A control algorithm will be developed in LABVIEW with the angle feedback. Hopefully, this closed loop control can minimize errors accumulated through the process.

Table 1, Pan & Tilt Head Requirements and Verification.

Requirements	Verifications
1) The pan & tilt head can position within +- 0.5 deg. of the targeted angle	Move the P&T heads to 0, ±45, ±90 and measure the real angle. If the measurement is within the allowed range of error specified by requirement 1, the position feedback is functional.

2.22 Calibration Unit

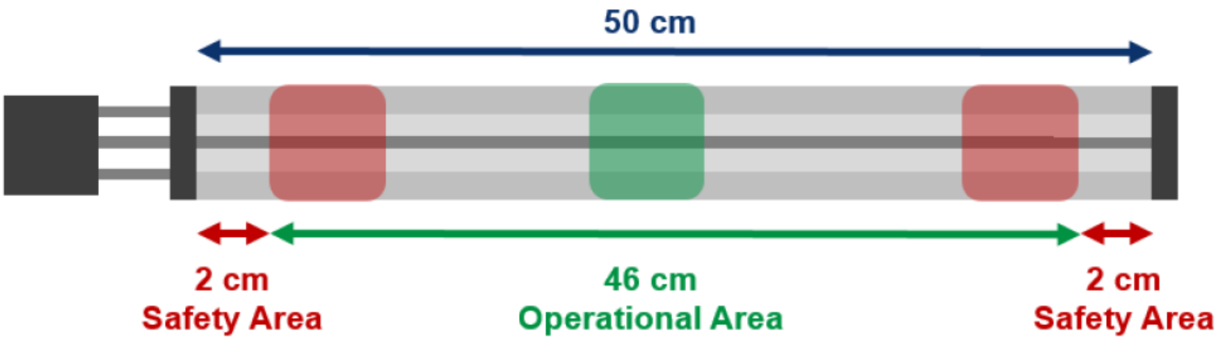

Figure 7, Linear Track

Since we will calibrate the camera one quadrant a time, using only one digit pin in our microprocessor ATmega328 is sufficient to control when the entire system should shut down. This means that if any of SPDT circuits pulls down, LabVIEW should receive the signal and shut down all the stepper motors in the system. To achieve that, we will add additional combinational logic gates on circuit schematic to handle the signals from 16 SPDT circuit.

The following circuit diagram shows the overall communications between SPDT circuits and the microprocessor.

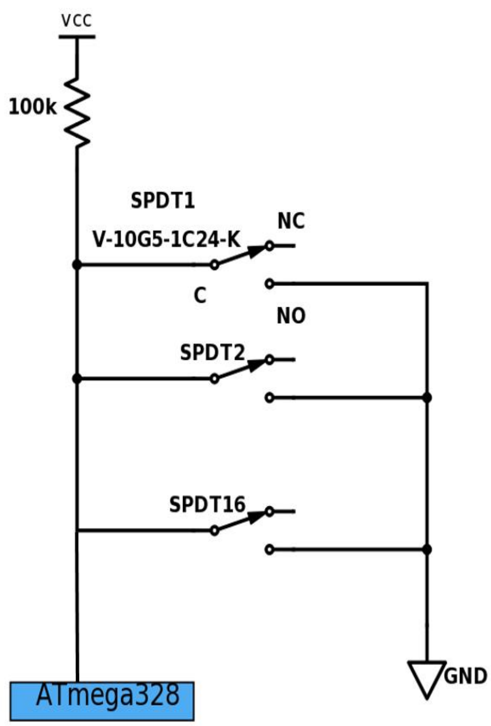

Figure 8, Snap Action Switch Circuit Design

Each circuit consists of a single SPDT. The switch has two states close(HIGH) and open(LOW). We choose Normal Open SPDT and stays HIGH if camera is away from the safe zone. When the camera approaches to the SPDT, the SPDT will close and output LOW. When the camera leaves away from the SPDT, the SPDT will open and output HIGH.

Table 2, Calibration Unit Requirements and Verification.

Requirements	Verifications
1) when camera beams touch it. The camera should stop at the boundary of the safe zone (2.00 cm away from the end of the beam), with tolerance ±5mm. This means the camera should stop within the range of 1.95cm to 2.05cm away from the end of each beam. from the end of each beam. 2) The SPDT should output HIGH when the camera is 2.05cm away from the end of the beam. 3) The SPDT should operate under the condition 5V.	1) Boot the whole system. 2) Choose one quadrant to begin with. 3) Move the camera along the horizontal direction to approach one end, and it should be stop at 2 cm safe zone boundary within the tolerance defined in requirement. 4) Move the camera along the horizontal but opposite direction of step (2) to the other end, and it should stop at 2 cm safe zone boundary within the tolerance as defined in requirement. 5) Repeat steps (2) and (3) for several times to fully test the functionalities of the SPDT. 6) Repeat steps (3), (4), and (5) for testing SPDT mounted on vertical beams. 7) Repeat steps (3), (4), (5), and (6) for the other three quadrants.

2.23 Integrated PCB Unit

We are designing a new PCB unit to accommodate newly added components and group as many electronics together as possible. The PCB will consist of six functional areas, the motor driver logic, angular position feedback logic, pan & tilt head logic, limit switch logic, USB converter logic and a central processor.

For the motor driver logic, there are eight motor drivers and each requires 3 digital control signals from the board. The control signals are pulse, direction and enable. Therefore, there are in total 24 digital signals going into the PCB. Since the processing is sequential, we are going to use demultiplexes to direct the control signals from the processor to a specific motor driver. In this case, the number of port pins reduces to 6 where 3 signals are for addressing and 3 are the actual signals.

A similar design is adopted for the angular feedback logic. There is expected to be 8 analog signal coming from the pan-tilt heads. However, we can only process one at a time. Therefore, an 8 to1 multiplexer will be used to select the desired input. The number of signals from the processor is 4 where 3 are for addressing and 1 is the actual data input. We might add an external ADC on the PCB instead of the embedded ADC in the processor to increase resolution.

For the Pan & Tilt head logic, we use PCA9685 16 channel LED driver to drive 8 servo motors. It is worth mentioning that there are two power inputs into this chip, one is for maintaining logic operation of the chip itself, the other is for powering the servo motors.

For the limit switch logic, we will use TTL gates to reduce the number of signals into the main processor. We plan to use OR gates to group all the signals from the switches. As soon as one switch is triggered, an interrupt to either power off or log data will be called in the software.

For the USB converter, we will use the FT230X chip which is a USB to serial URAT interface. It is necessary to include this chip to establish communication between our computer/LABVIEW and the main on board processor. The data transfer rate is from 300 baud to 3 Mbaud at TTL level.

For the main processor, we will use the ATmega328 chip. It has a 10-bit ADC, programmable serial USART, SPI AND I2C interface. More importantly, it provides just enough GPIO pins to support our application.

By utilizing LabVIEW built-in Virtual Instrument Software Architecture(VISA) and related Application Programming Interface(APIs), we can make LabVIEW interface easily communicate with the microcontroller through USB ports.

The following figure is an incomplete schematic of the PCB design. However, it has all the main components in place.

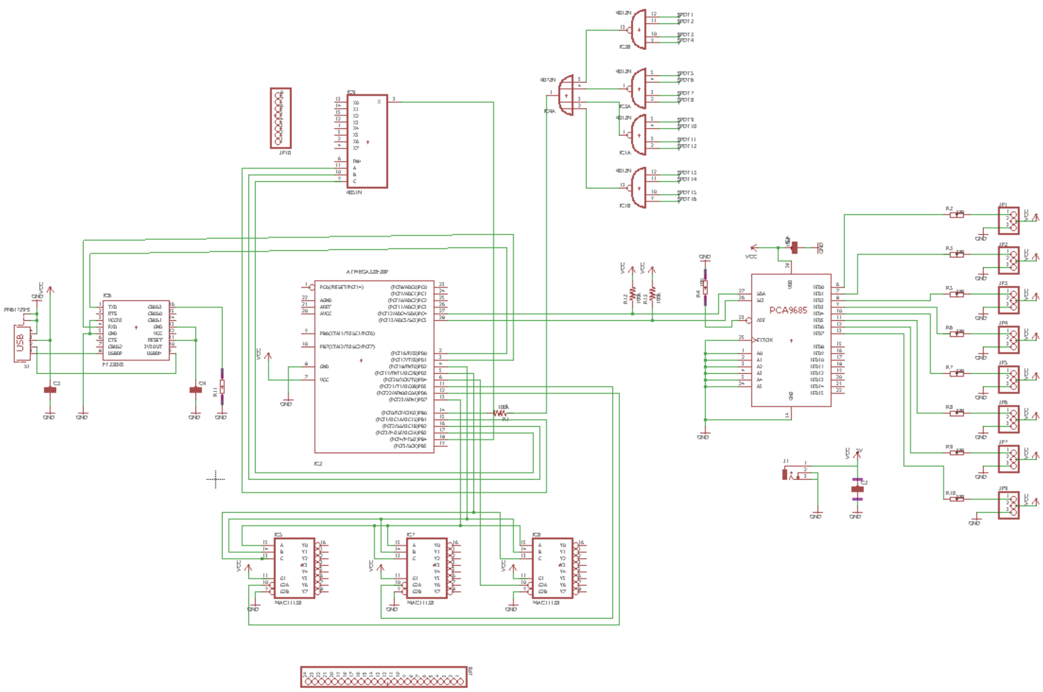

Figure 9, PCB Overview

Table 3, PCB Unit Requirements and Verification.

Requirements	Verifications
1) The microcontroller should be configured without any errors 2) The microcontroller should be able to receive commands from and send data to the LabVIEW interface 3) At least two-thirds of the pins should be used by the system 4) The microcontroller should be operating under 2.0V to 3.6V and room temperature	1) Boot the entire camera system 2) Check the voltage use multimeter 3) Start LabVIEW interface program 4) Test calibration unit: Move the camera towards the safe zone until the snap action switch turns to HIGH. Verify whether the LabVIEW interface receives the switch signal. 5) Test XY traversing position: Enter numerical values or use arrow keys to move the camera along horizontal or vertical directions. Verify whether the camera moves

	to correct position and the LabVIEW interface receives correct position coordinates. 6) Test Pan&Tilt unit: Enter pan and tilt degrees of the camera. Verify whether the camera responses correctly and the LabVIEW interface receives correct pan and tilt degrees.

2.24 Power Unit

To design and build a single power unit to power the whole system, we ran the system in different situations and measured the current it drew respectively.

Since the current meter we can find has a maximum allowed current of 10 A and the total current of the whole system may exceed that value, we chose to measure the peak current of one stepper motor driver and then multiply that value by the number of units we have to get the total required peak current of the system (the motor driver controls the stepper motor and supplies the power the motor needs). After measuring the driver current of one stepper motor that moves vertically and that of another stepper motor that moves horizontally, we find out that the stepper motor draws the most current when it moves up. Since we are mostly concerned about the maximum current required to design our power unit, we tested one stepper motor that moves vertically and recorded its peak current in different situations:

	with maximum load required	without load
idle	338 mA	338 mA
moving 10 cm up at constant speed 500	672 mA	654 mA
moving 10 cm down at constant speed 500 mA	637 mA	647
moving 10 cm up at constant speed 1000	789 mA	756 mA
moving 10 cm down at constant speed 1000	726 mA	745 mA
moving 10 cm up at constant speed 1500	745 mA	684 mA
moving 10 cm down at constant speed 1500	676 mA	675 mA
moving 10 cm up at constant speed 2000	697 mA	649 mA
moving 10 cm down at constant speed 2000	548 mA	611 mA

Observations: 1. the stepper motor draws more current when it moves up than when it moves down;

2. when idle, the stepper motor draws the same amount of current with and without load at a constant 337 mA;

3. the peak current occurs when the motor starts up and stops

4. when the stepper motor moves at a constant speed, the current it draws is approximately constant

We used the same method to measure the idle current of one servo which was found to be 12.5 mA, and the maximum current a servo draws, which is when its rotating axis is fixed stationary was found to be 285 mA.

Conclusion: we did all the testing with the chosen voltage of 19.5 V for the stepper motor and 6 V for the servo. The maximum current drawn by one stepper motor driver is always below 800 mA and that by one servo is always below 300 mA. The system is designed to be the way that only one stepper motor or servo will be moving at any given time, and there are 8 stepper motors and 8 servos in total. For a large safety margin, we want to design our power unit to be able to supply maximum current at 8*1 A + 8*0.4 A=11.2 A.

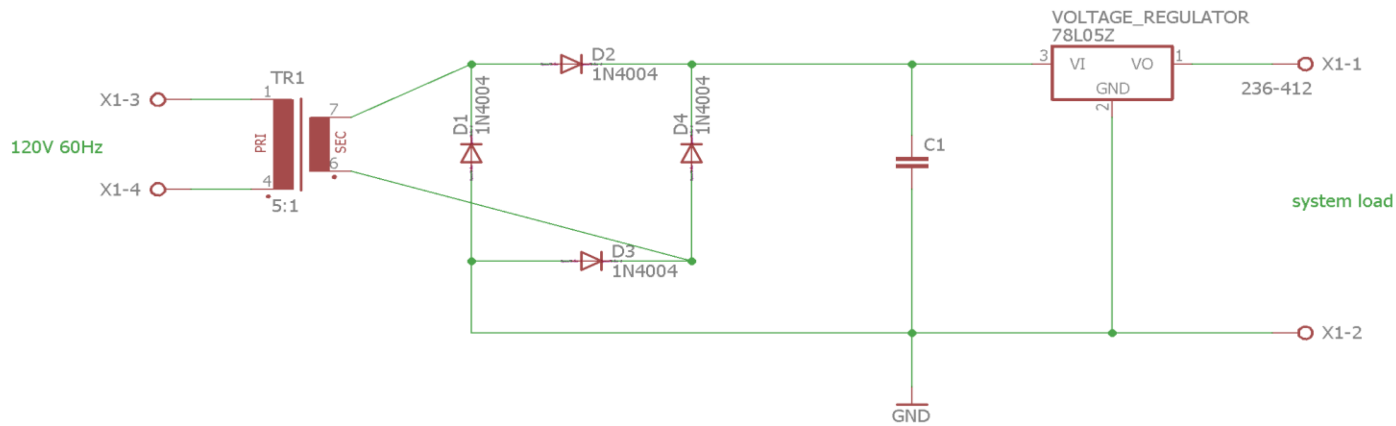

Figure 10, Power Unit Schematics.

Table 3, Power Unit Requirements and Verification.

Requirement	Verifications
1) Every stepper motor unit must have a constant voltage supply of around 19.5 V, with maximum allowed error of +/-5%, that is between 18.525 V and 20.475 V 2) Every servo unit must have a constant voltage supply of around 6V, with maximum allowed error of +/-5%,	1) Use a voltage meter to measure the open circuit voltage of the voltage supply of the stepper motor driver unit to check if it is between 18.525 V and 20.475 V. 2) Use a voltage meter to measure the open circuit voltage of the voltage

that is between 5.7 V and 6.3 V. 3) The power unit must be able to supply a total current of 11.2A, since it is hard to get exactly 11.2 A and easy to exceed 11.2 A to destroy the circuit, being able to supply a total current in the range of 10.64 A (5% error) and 11.2 A suffices	supply of the servo driver unit to check if it is between 5.7 V and 6.3 V. 3) Use a large motor that can operate at 19.5 V and at a same time can draw current larger than 11.3 V. Use our power unit to power the motor and gradually increase the motor speed to the point that the motor draws a current in the range of 10.64 A and 11.2 A and check if the power unit is able to safely and stably supply the power for 10 seconds in the range of 10.64 A and 11.2 A and for 1 minute at any current below 10.64 A.

2.3 Supporting Materials

2.31 Pan & Tilt Data Conversion Resolution

i. 12-bit PWM Board (PCA9685) [1] resolution

The board is configured to send a 60 HZ PWM signal to the servo motors and it has a 12-bit register.

$$resolution = \frac{\frac{1}{60} * 10^6}{2^{12}} = \ 4.07\ \mu S/step$$

ii. 16-bit ADC (ADS1118) [4] [5] conversion resolution

The ADC chip offers six full-scale ranges (FSR), ± 6.144V, ± 4.096V, ± 2.048V, ± 1.024V, ± 0.512V, ± 0.256V. According to the data sheet “the highest measurement resolution is achieved when the largest potential input signal is slightly lower than the FSR of the ADC”. [5] Suppose that the potentiometer is in a 3.3V circuit, the largest input signal is therefore 3.3V. The ± 4.096V FSR will be used. The resolution of the ADC chip is calculated by the following formula.

$$resolutoin = \frac{4.096 * 2}{2^{16}} = 125\ \mu V$$

iii. Angle VS. Pulse Width Experiment

To relate the angle of rotation of the P&T heads to pulse width input to the servo motors, a series of experiments have been conducted to collect data points. The following plot uses linear regression line to fit the data points and the corresponding equation is displayed. The R-square value is very close to unity indicating that the relationship between the angle and the pulse width is very linear.

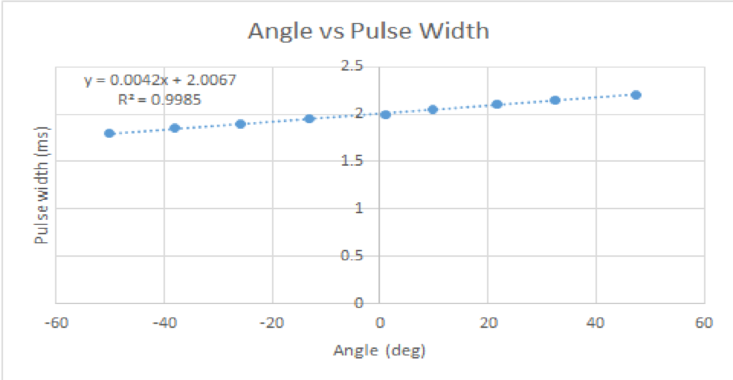

Figure 11, Pulse Width VS. Angle of Rotation.

2.32 Software Flow Chart

The figure above is the current LABVIEW flowchart. It includes four functionalities, absolute-distance traversing, incremental-distance traversing, P&T head control and calibration. We are expecting to modify the P&T head control and calibration algorithms by including angular position feedback and auto-calibration respectively. The flow chart reflects our current design and will be constantly updated in the process.

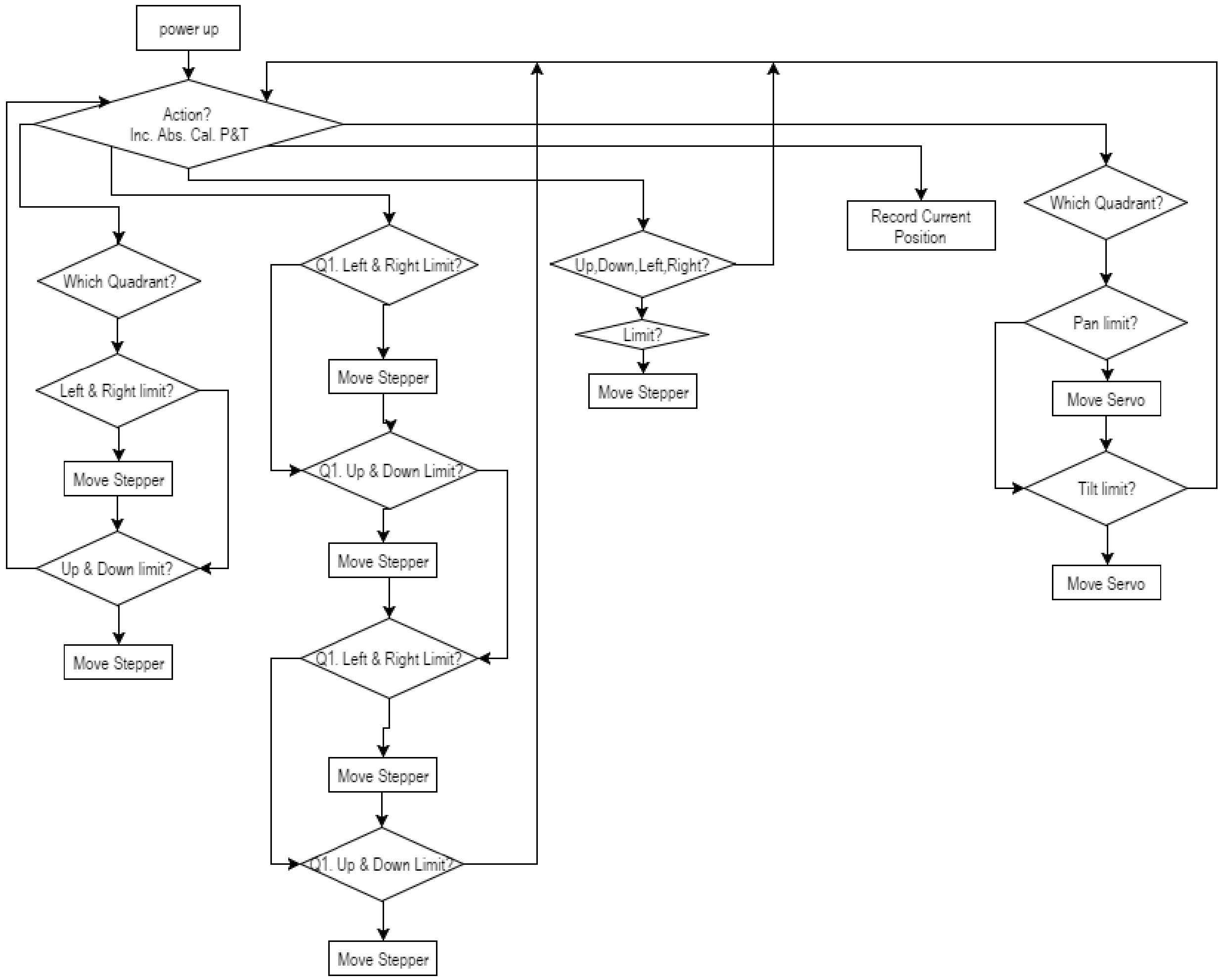

Figure 12, LABVIEW Software Flow Chart.

2.4 Tolerance Analysis

The previous mechanical team has tested the mechanical strength of the system and conducted simulation in Creo. The system can support the required load without failure.

Among all the modules we will design for this project, the integrated PCB unit has the most risk to cause the whole system to fail. The bus-powering method provides a single 5V power supply, which needs to power up all other units on the board. The main microprocessor ATmega328 must operate within 1.8V to 5.5V. The servo controller operates within 2.3V to 5.5V. The additional servo motors need separate power supply from the bus-powering USB line. The system may fail if the USB bus-powering cannot supply enough power, or some parts of the circuit are accidentally shorted and burn the whole board.

The previous mechanical team has tested the mechanical strength of the system and conducted simulation in Creo. The system can support the required load without failure. For very low probability, the stepper motors or servo motors are provided over maximum current than it can tolerant. Even under such cases, the built in protected circuits of stepper motors and servo motors will prevent the motors burning.

3 Cost and Schedule

3.1 Cost Analysis

3.11 Labor

The minimal stipend for a graduate student who has 50% teaching assistantship (TA) or research assistantship (RA) is about $1817.87 per month [graduate min]. Considering the standard working time 40 hours per week, the hourly salary for a graduate student can be safely estimated around $11.36.

Our team consists of three members, and we estimate the hours need to complete this project is about 40 hours in total. Thus the total cost of labor in this project is estimated around (graduate student minimal salary/hour) x (2.5) x (hours to complete) x (number of members) = $11.36 x 2.5 x 40 x 3= $ 3408.00.

3.12 Parts

The following table is a detailed part lists of all purchases for this project since last semester.

Table 4, Part List

	Item Name	Supplier	Quantity	Cost Per	Total	Notes
XY Positioning						
1	C-Beam Linear Actuator Bundles	OpenBuild	8	139.75	1006.2	500mm
Pan/Tilt						
2	PT785-S Pan & Tilt System	Servocity	4	349.99	1399.96	7:1 ratio option
3	Aluminum Plate	McMaster Carr	1	31.24	31.24	
Frame						
4	Caster Corner Bracke	OpenBuild	8	1.5	12	
5	Corner Bracket	McMaster Carr	16	5.39	86.24	
6	Frame Tubing 60mm (10 ft)	McMaster Carr	9	109.89	989.01	30ft. Total
7	Frame Brace	McMaster Carr	4	27.36	109.44	
8	Frame Bracket	McMaster Carr	16	8.96	143.36	
9	Extended Frame Bracket	McMaster Carr	4	12.06	48.24	
Controls						
10	Arduino Mega 2560 R3	adafruit	1	45.95	45.95	
11	8-Channel PWM	adafruit	1	9.95	9.95	
12	DQ542MA Stepper Motor Driver	OpenBuild	8	39.95	287.64	
13	2-Axis Joystick	adafruit	1	6.95	6.95	
14	Toggle Switch	adafruit	1	2.95	2.95	
15	6V, 3A Power Supply	Servocity	1	24.99	24.99	
16	Laptop AC Adapter	LaptopPartStore	1	79.99	79.99	
17	2-axis Joystick	Adafruit	1	6.95	6.95	
18	Power Adapater	Adafruit	1	6.95	6.95	
19	On-Off Button	Adafruit	5	1.95	9.75	
20	Plastic Case	Amazon	1	9.48	9.48	
21	Plastic NEMA Box	Amazon	1	25.39	25.39	
Tool + Hardware						
22	Wire Cable	OpenBuild	8 ft	2.5	20	4 Conductor Option
23	Square Nut (94855A216)	McMaster Carr	1	2.75	2.75	
24	Socket Cap Screw (92220A153)	McMaster Carr	1	11.79	11.79	
25	Low Profile Cap Screw	McMaster Carr	1	6.25	6.25	
26	No.8 Washer	McMaster Carr	1	3.87	3.87	

27	Wire Sleeve	McMaster Carr	3	3	30	50ft. Option
28	WD40	McMaster Carr	1	1	6.77	
29	Twisted Wire	Servocity	1	15.95	15.95	
30	Male/Female Set	Servocity	8	2.99	23.92	
31	Security Clips	Servocity	3	3.95	11.85	
32	4-Strand Cable	Amazon	1	37.99	37.99	
33	Electrical Tape	Amazon	1	4.42	4.42	Single Roll
34	Prototype Board	Amazon	1	5.17	5.17	
35	Heat Shrink	Amazon	1	11.16	11.16	3/8 Diameter, 48 Inch
36	SPDT Limit Switch	Digikey	16	3.25	52	
37	ADC Chip	Digikey	8	2.6	20.8	
38	STM32F103RB	STMicroelectronics	1	10.99	10.99	
				Current Cost	**4618.31**	

Table 4, Parts List.

3.2 Schedule

Table 5, Individual Schedule.

	Junjiao Tian	Jialu Li	Weicheng Jiang
week 4 (2/13-2/18)	1)Discuss design	1)Discuss design	1)Discuss design
week 5 (2/19-2/25)	2)Prepare Design (Pan & Tilt control unit)	1)Prepare Design Document (Calibration Unit)	1)Prepare Design Document (Power Unit)
week 6(2/26-3/4)	1)talk to Prof.Chamorro about funding 2)pick a potentiometer 3) update LABVIEW 4) figure out how to connect the feedback to computer	1)Look into the communication between 16 circuits and the data acquisition device 2)Think about the dimension fits for PCB to put on beams	1)experiment with the whole system to get all the realistic power characteristics of the stepper motors and servos 2)think about how to safely and efficiently step down the wall voltage to the required low dc voltages

week 7(3/5-3/11)	1)Soldering Assignment 2) start designing circuit and for angle feedback	1)Soldering Assignment 2)Design of the circuit schematic 3)Revise Design Document	1)Soldering Assignment 2)Design PCB for the power unit
week 8(3/12-3/18)	1)same as week 7	1)Design and Revise the circuit 2)Verify the design and start doing PCB layout 3) Start implement the whole circuit	1)design and refine PCB design for the power circuit
week 9(3/19-3/25) (Spring Break)	1)finalize the circuit and send it to machine shop	1)Finalize the circuit and put on manufacture 2)Ask machine shop people to do PCB layout revision	1)finalize the circuit and send it for manufacturing
week 10(3/26-4/1)	1)work on individual progress report 2)start assembly	1)Individual Progress report 2)Start implementation of the circuit 3)Test PCB using	1)work on individual progress report 2)start testing the power unit before connecting it to the system
week 11(4/2-4/8)	1)same as week11	1)Implement the circuit 2) Test customized PCB layout	1)use power circuit instead of the commercial AC adaptor to power the system and test its functioning
week 12(4/9-4/15)	1)update LABVIEW	1)Coordinate the circuit with software	1)organize all the wires and power unit to make it safer and more user-friendly
week 13(4/16-4/22)	1) Prepare for mock review demo 2)work on LABVIEW if not	1) Prepare for mock review demo 2)Finish the implementation of the	) Prepare for mock review demo 2)Finish the implementation of the project

	finished	project	
week 14(4/23-4/29)	1)prepare for final review demo	1) Prepare for final review demo	1) Prepare for final review demo
week 15(4/30-5/6)	Finalized the project Submit notebook and final report	Finalized the project Submit notebook and final report	Finalized the project Submit notebook and final report

4 Discussion of Ethics and Safety

The whole system consumes a significant amount of power in operation. Especially, the 8 stepper motors require a relatively large amount of current supply. The datasheet of the specific model of NEMA 23 stepper motor indicates that the maximum current draw of the motor is 2.8 A/Phase. The current required to power the servo motors scales up with the load applied. The stepper motors draw current even when they are idle. We know the power regulator not only needs to supply appropriate voltage but also tolerates the theoretically maximum current draw. Therefore, the power unit will be designed with the maximum current and voltage settings in mind. This is to prevent the system from overheating and damaging the power unit.

In accordance with the IEEE Code of Ethics, #6 "to undertake technological tasks for others only if qualified by training or experience, [8]" all group members will be trained and certified to use standard lab tools. Only members experienced with and trained to use prototyping machines such as laser cutter, milling machines, etc. will oversee manufacturing parts if necessary.

We will adhere to and honor the IEEE Code of Ethics, #7 "to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others [8]." The team will keep in contact with the users and listen to their feedback. We will accept honest criticism from our sponsors and try to improve upon current work. We appreciate all participants of this projects for their valuable suggestions and feedback.

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