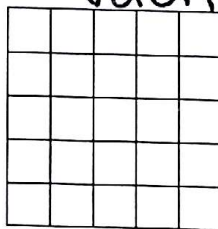


Graph Composition

Stephanie Chan

Graber: Underwater Power
Vault Inspection Robot



5 x 5 RULED

- 100 Sheets
- 200 Pages
- $9\frac{3}{4} \times 7\frac{1}{2}$ in.
- 24.7 x 19.0 cm



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10/3/2018
Stephan Chen

meeting 1 (just group)

bases already made

1) ethernet

2) RC

can rebuild if we want

focus on control system

possible drone idea to get cameras
to eye level

budget $\approx$ \$500

Robot with the track wheels run on
RC

Robot with "triangular ~~shape~~ shape" with
on ethernet

✓ talk to professor Graber about a good
meeting time (10/4)

✓ talk to team about availability &
email Graber (10/4)

- ~~availability~~ mutually available
times are before 12pm on
Tuesday, Thursday & after
Senior design on MW.

meeting 2

10/11/2018

Stephanie
Chen

- first meeting with professor Graber

Meeting 2 : Pre meeting thoughts :

- first meeting with professor Graber
- location : Rm 117 Van Leer
- Time : 11am Thursday

Things ~~to discuss~~ I'd like to discuss :

- * ☒ ~~scope~~ scope of project (10/12)
- * ☒ ~~topics~~ topics / technologies we need to research in technical papers (10/12)
- ☒ set a time / discuss ways to meet up with group (possibly weekly or as needed) to get project started (10/13)

We really need to ~~at~~ assign topics for research papers so we can get started on these individually

→ Note : Technical papers due @ Oct. 22

meeting 2 (with Graber)

10/11/18

Stephan
Chen

In general, Professor Graber will be guiding ideas but overall we can make the project what we want.

- project summary due Nov. 5
- possible weekly meetings
- proposal is a "growing" document that we will continue working on next semester

* Meeting next week Wednesday Oct 17.
at 11 am

→ weekly meeting ~~on~~ on Wednesdays
at 11 am

History / What's existing w/ robot

- project was originally sponsored by Neetrac
- problem: underground power vaults are very dangerous and utility companies don't want to send people in
- take gas samples for flammable/toxic materials
- mini substation
- what robot to do initial check
 - has to be able to sense water and toxic gas
 - fast response
- robot should be robust enough to have good sensors
 - infrared sensors for heat

- Possible meeting with Georgia Power SC.

Project scope

- ~~not~~ suggested to focus on TraviBot
 - doesn't have many sensors or controls so we can add that / modify whats existing
- another robot: AutoSol can be used also
- PVI BOT → control & sensor package
- would be useful for the robot to be real time controlled instead of autonomous

Final notes / future plans

- ☐ talk to Georgia Power to see what they want in the field (better to do this semester)
→ This will be next due sem (11/28)
- ☑ go see BH power vault (11/28)
- ☑ ~~decide~~ decide which base we'd want to use or if we'd like to build our own → using flat robot (meeting 9)
- ☑ pick location of where we'd want to work on robot
→ senior design lab (meeting 9)
- vehicle control
- navigation
- sensors (gas, infrared, lighting, noise)
- user interface
- power
 - efficient motor & batteries
- be able to get the sensors high enough to get info on transformers
 - most readings are eye level

* meeting w/ just group on Monday

meeting 3 (just group)

~~10/15/18~~
10/15/18

Stephanie
Chen

Topics to research

- Sensors
 - gas
 - infrared } me or any cool sensors and
 - lighting
 - noise
 - Communication
 - wifi
 - Control system
 - robot control (power motor)
 - user interface
 - programming library
 - VR integration
 - keep processes in mind for ~~processes~~ proposal
- Processors
→ capabilities
→ which ones go well with each other

meeting 4

10/17/18

- don't worry about researching every possibility for paper ^{→ super}
- Send Professor Gruber paper by Friday if we want it proof read.
- Files share on OneDrive w/ Georgia Tech email
- Team roles / organization
 - leader
 - website
 - different design aspects
 - communication
- Weekly updates -
 - slides on one-drive
 - what's been done
 - plans for future - gantt chart
- Think about location ~~sto~~ to store and work on robot
 - makerspace → make sure we can leave it there
 - office

* Next week meeting possibly in lab to see robot

- - Senior design rooms can also be used to work on robot
- we can also work on robot in the lab that the robot is already in
- Robot operating in search-rescue environments.
- don't forget about the mechanics of the robot - don't have to ~~research~~ research for paper but something to keep in mind

10/17/18
Stephen Chan

- goal of this semester is to have the project completely designed
- ☑ visit makerspace to scope out space for robot (10/17)
- ☑ talk to Kevin Ferri and/or James Steinburg about locker space for senior design rooms (~~#720~~) (10/19)
- maker space lockers are mainly for PI to leave their stuff while working or for ~~small~~ small student projects people w/out senior design space.
- definitely won't be able to leave for more than a week at a time.

~~* confirmed: meeting next week Wednesday, 11/21 at 11am~~

* confirmed: meeting next Wednesday (10/24) 11am at GTRI robotics lab to pick up robot.

☑ confirm place to move the robot too.
↳ currently in West's Lab

* Got a locker in senior design lab. locker #50 code: 6090

↓
will move to senior design lab next semester (11/29)

meeting 5 - GTRI Lab

10/24/18

Stephen
Chen

- can use Google tango tablet for 3D modeling
 - uses kinect and SLAM
- previous sensor tower has cameras and sensors that are working
- can work on robot in lab if need be
- ✓ make sure they don't empty senior design lockers over Christmas break
 - They do empty lockers
- let Nest know what sensors we need, he might have them for us

materials
will be kept
at Lemek's
apartment
over break
(11/29)

meeting 10

10/31/18
Stephan Chen

- worked on homework assignment 5 and project summary assignment
- create list of tasks to be completed over course of project.
- create Gantt chart and CPM chart
- ☑ finish Gantt chart and upload to Google Drive (11/2)
- ☑ work on Project summary form (11/5)
 - assignment 5 and project summary due Monday @ 11pm on Canvas (Nov 5)
- ☑ email Gruber with assignment 5 and project summary form attached.
 - ask for comments and suggestions to improve. (11/5)
- calculate critical path for our plan, optimistic plan and pessimistic plan

meeting 7

11/7/18
Stephen Chan

- we can use fiber optical ethernet as a possibility to reduce risk
 - maybe can have an antenna to put in in order to use wi-fi
 - we can test using copper ethernet and just ~~write~~ ^{note} that for market usability we would use fiber optics but because of price we use copper for demo.
 - Spend more time with the design of the robot & making a good working and sensing robot over the communication aspect.
 - Video stream → large bandwidth
 - Use TCP/IP protocols and then we can decide later to use wifi or ethernet standards
 - Possible Setup
 - arduino → hardware
 - Raspberry Pi → software→ they are "connected" and talk to each other for info
 - OR - Pi controls both hardware & software & expand port numbers
 - OR - Texas Instrument 43
 - requires hard coding
 - can operating in high frequency
 - OR - Use Labview
 - Pi can't handle too much current
- ☑ bring 2 or 3 solutions for how everything will be set up in block diagram form to next meeting (11/12)

11/7/18
Stephan
Chen

- we have two ~~robot~~ motors existing in robot, need new battery packs
- kevie for user interface

~~start~~ start thinking about ways to split up the task

- Bill of materials due at the end of this semester
 - \$500 limit per team

11/12/18

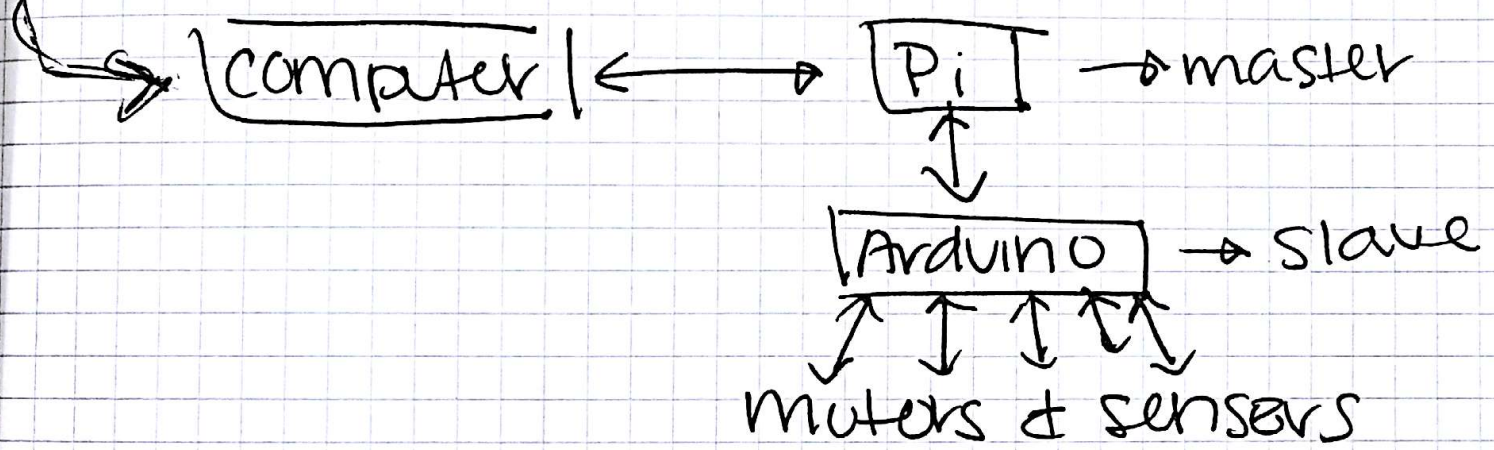
Stephen Chen

meeting 8

- decide on if we're going to use 1 or 2 controllers
 - 1 Pi controllers
 - 1 Pi ~~at~~ 1 arduino controller (master/slave)
- we'll probably use 2 controllers

✓ we need to go to lab to see what they have for us to use & look at tango tablet

- camera & arm need to be ~~water~~ water proof
- use slides to move camera up and down



✓ Bill of materials (work in progress)
 - Verizon hotspot? (11/26)

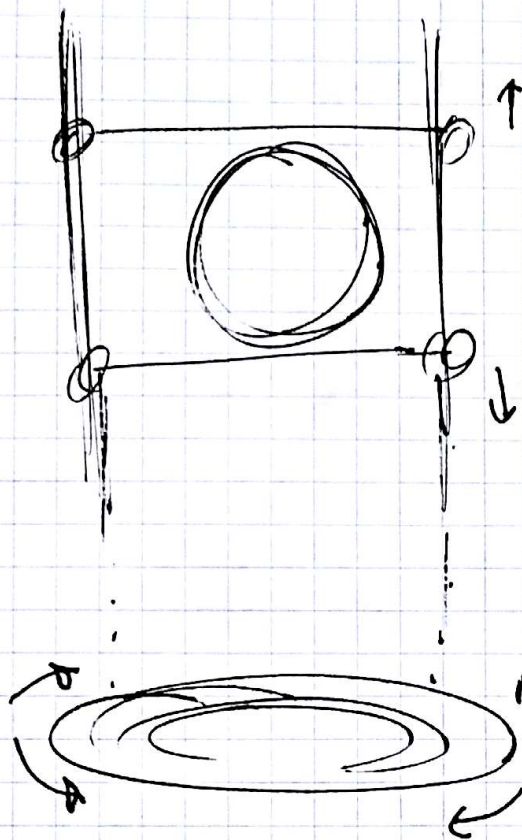
✓ Block diagram → for wednesday meeting (11/18)
 - 1 for hardware
 - 1 for software

✓ put final copies on one drive (11/2)

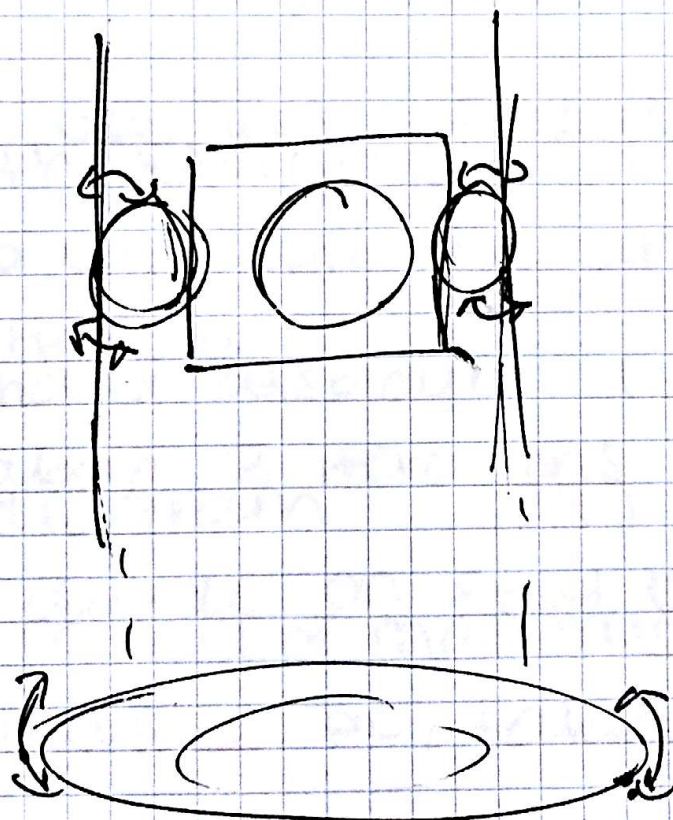
Meeting 9: Pre-meeting Brainstorming

11/13/18
Stephen
Chen

Possible camera hook up



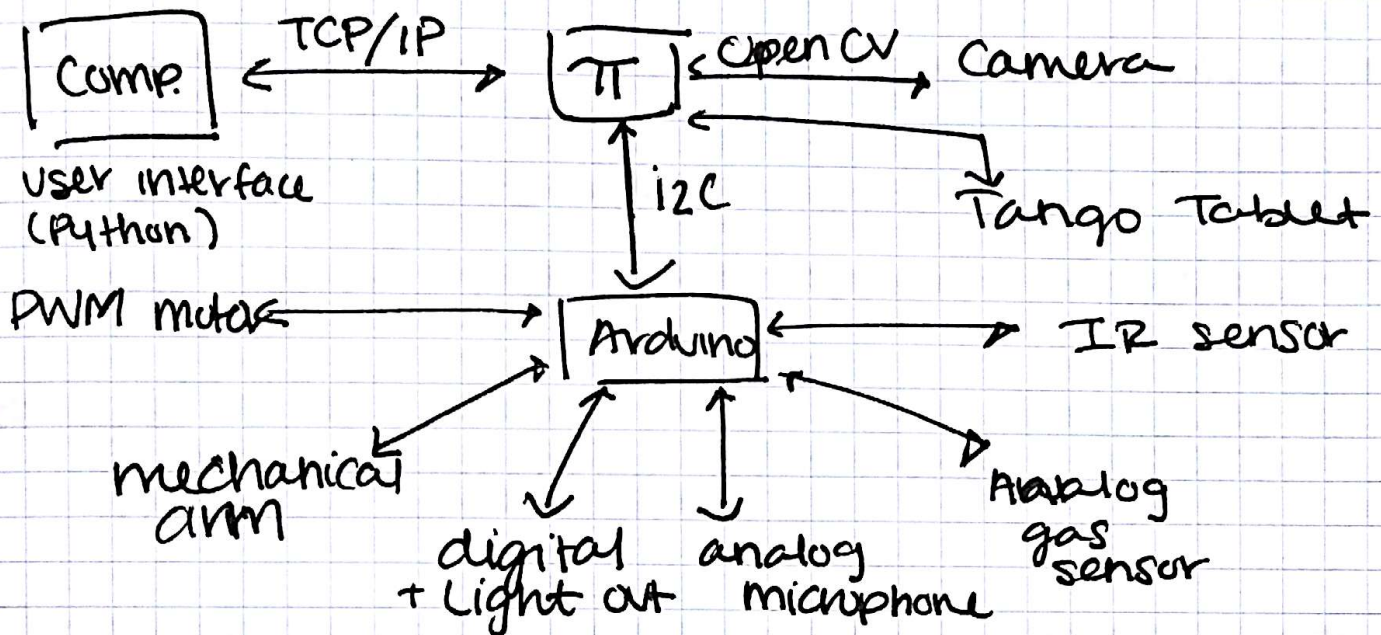
Newer 23.6"/60cm
Carbon Fibre
Camera Track dolly
Slider Rail System
w/ 17.5lb/8kg load



meeting 9

11/14/18
Sebastian
Chan

* Design proposal due on 28th
connection block diagram



User interface : controls & feedback interface

- will be able to be controlled with console controller
- Use wifi antenna for communication beacon
 - if we use wifi we need to replace lid with plexi glass

✓ come up with objective and purpose

- User Friendly
- information displayed (11/15)

✓ think about 3 iterations of connection block diagram (11/18)

- ~~come~~ decide on final layout and start on bill of materials
- User interface: PC, tablet, phones

11/14/18
Stephen Chen
Camera

- aluminum T-slot Profiles for Stand
- might not need the 360° swivel for the bottom of the camera
- Think about how we get the robot in
 - lower by rope
 - some vaults have doors
 - consider the foot print of the robot
- * We are using the flat smaller robot with the straight tracks (not triangular track)

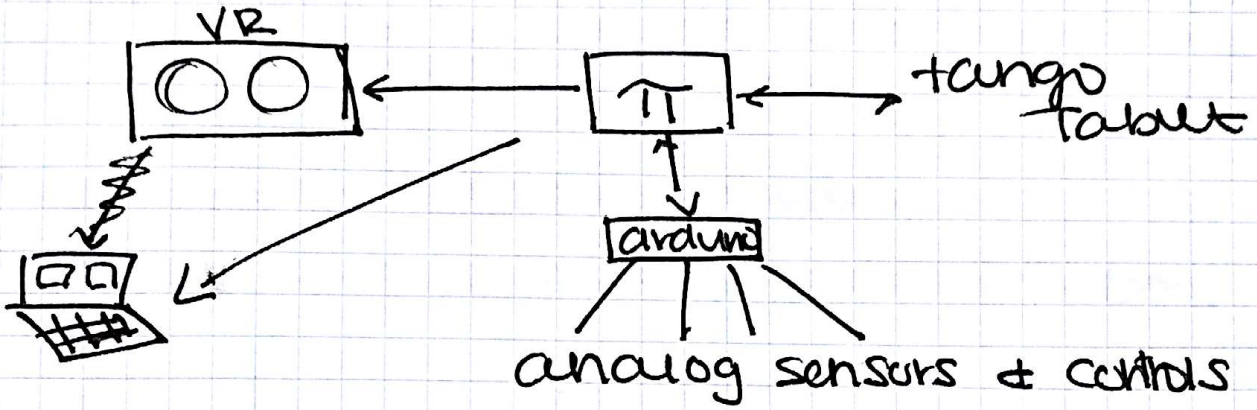
- ~~□ meeting Monday before Proposal due~~
- ~~- Purpose Statement & objective~~
- ✓ Assignment is due Monday (11/19)

11/18/18

Sequoia Chen

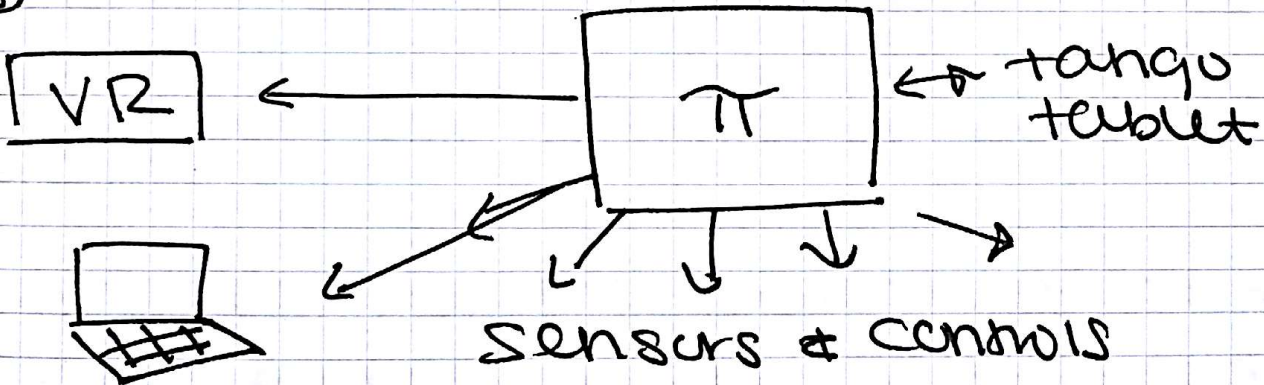
Meeting 10: Pre meeting brainstorming

① Connection / set up of devices ideas



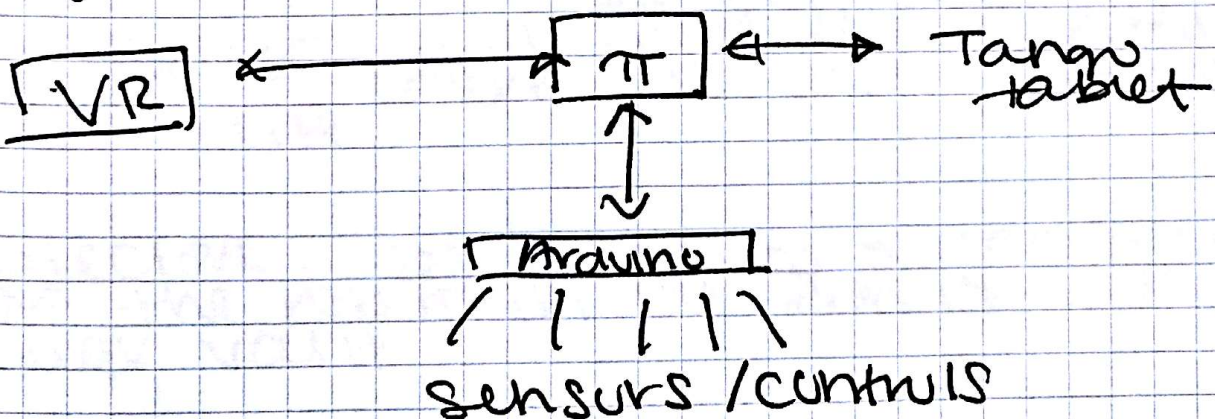
~~VR would use~~ This set up would require a two person operation, 1 person would use the VR to look around the vault / control the camera. The other person would have a laptop / computer / tablet to take the real time data from the sensors.

②



works the same way as before but only uses π to run.

③



11/18/18

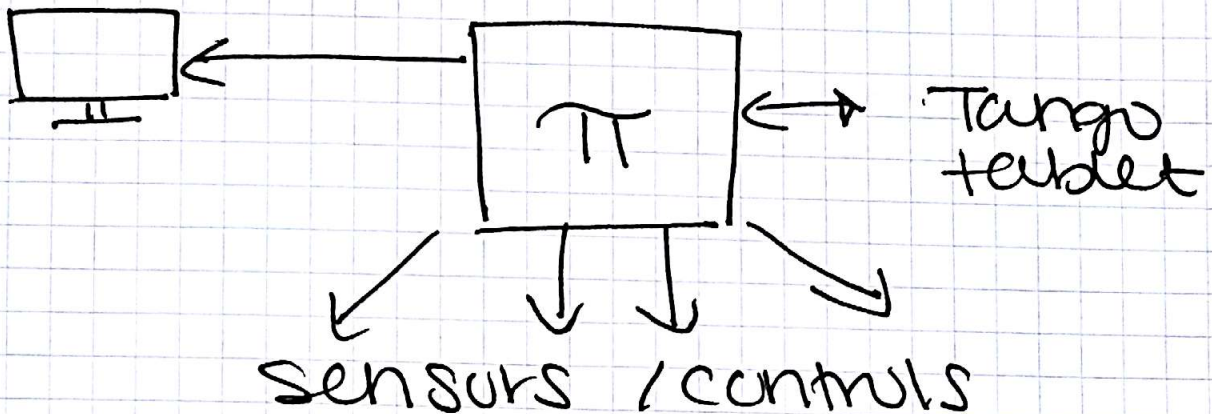
Stephane
Chan

This set up uses only VR to both control the camera and display the sensor data. This probably won't ~~work~~ be very usable because there will be a lot of information ~~to~~ on the small ~~computer~~ phone screen. This can also be connected w/ just the π .

~~The three steps were~~

~~For the 3 designs proposed here,~~

④



8/9 Same set up as proposed in meeting using only a computer / laptop / tablet to display the sensor info but only uses π as processor instead of both π & Arduino.

~~But~~ TO control the movement of the robot ~~and~~ for the 4 proposed ideas, a game system controller (xbox, playstation etc) would be used. *

- Purpose statement idea: User Friendly robot that will have the necessary sensors to ensure the safety of the power vault.

- Objective: be able to successfully test the robot in the Bunker-Henry power vault

Meeting 10

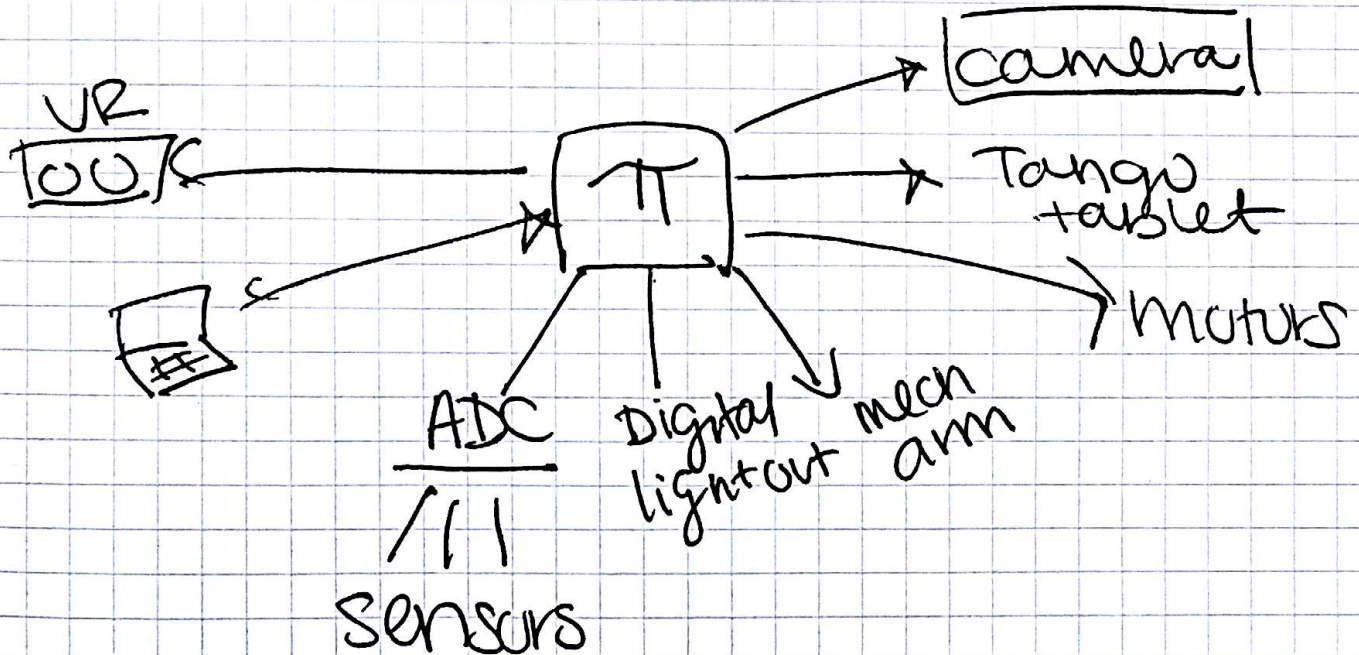
11/19/18
Stephen
Chen

- ✓ team name / robot name (11/26)
- ✓ Project proposal (due Wednesday (11/28) after break)
- ✓ make excel sheet for bill of materials where we can compare prices. (11/19)

Design of Robot:

- Use tablet for user interface, control using controller (game system)

For design with just Pi, we need a ADC to connect analog signals



~~Pros~~ using two micro processors

- Pros
 - NO ADC
 - can work in parallel using
 - everyone has some experience with
 - ~~data~~ takes load off Pi to reduce loss
- cons
 - debugging - prices
 - losing data / packet loss

11/19/18

Seephaw
Chen

Using one micro processor

- PROS : - everything goes through Pi
 - 1 programming language
 - communication will be easier (note need to communicate w/ arduino)
- CONS -
 - ADC needed
 - PWM simulation
 - harder to work at the same time
 - threading
 - not everyone has experience w/ python.
 - prioritizing w/ pi

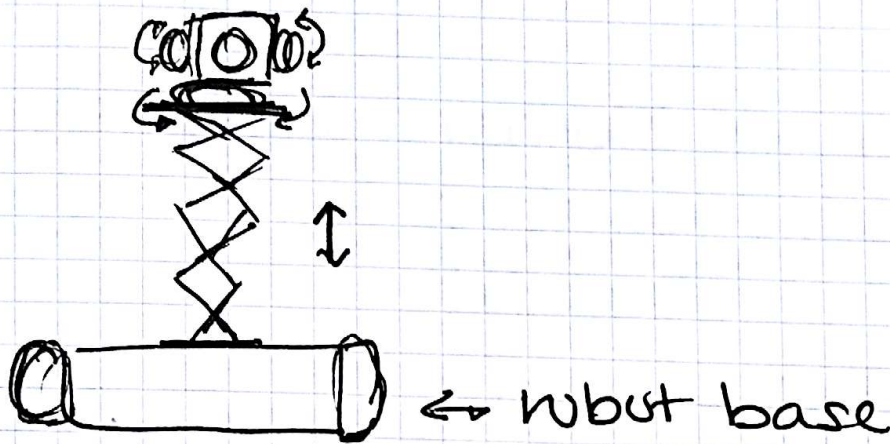
VR

- PROS : - something that would be cool to have
 - modularity
 - separation of tasks
- CONS : - something else useful to code
 - price of VR
 - more for pi to process.
 - 2 people operation

More mechanical arm brainstorming

11/27/18
Seaphan
Chen

- using scissor lift for mechanical arm



- idea for camera: if in budget we could use a Go Pro for the camera ~~over~~ over a webcam. That way the camera will already be water proof / dust proof instead of putting the webcam in a bubble.

meeting 11: Power vault

11/28/18
Stephan
Chen

Cases: Sulfur
to test AVR PCB

Ideal vehicle: remote controller

Possibly 2 man operation
1 VR controller
1 observer

Light: dimming / on the side to
reduce glare on
windows

Possible challenges with other
power vaults:

- cables running everywhere,
navigation of robot.

Contact: Tony

We can build for maybe a
ankle deep water / half the
height of the robot

□ Get ~~contact~~ contact info for Tony
from Professor Gruber

- Sensors for crash detection

Spring 2019 meeting 1

1/8/19

Proposal Presentation and updated ^{Seemur} ~~an~~
proposal due by end of next week

- in diagrams for proposals, include language / how objects will communicate for all connections
- could use Kinect camera instead of tango to get 3D imaging.
 - Kinect camera can run python.
- To send real time info from sensors to PC, ~~the~~ the two objects has to be on the same routers
- ✓ add iteration showing kinetic instead of tablet for update proposal
- macmaster website for + slots
- ✓ check ^{standard} manhole size
- ~~at~~ sensor should be able to read info at a height of 1 meter - 1.5 meter and a half. on average
- ✓ specify in proposal
- at capstone, set up fake transformers to demonstrate how the robot will be used in the real world.
- ✓ include in proposal
 - specify what aspects / specifications can be verified and explain how they will be verified
- ✓ expand task / member responsibilities. in proposal

* weekly meeting Tuesdays 4:30 - 5:30

22 Jan

1/8/19 SC
✓ proposal presentation next week
meeting.

To do before end of next week:

- ✓ make presentation
- ✓ 1/11/19 finalize project proposal
- ✓ contact Tony ~~about~~ about inspection standards.

ralph.carter@facilities.gatech.edu

- ✓ update gantt chart

Meeting attendance

- Graber
- Adrian
- Nelson
- Leinek
- myself

Individual tasks

1/14/19

Steven
Chen

- worked on proposal presentation
- updated PERT CHART
- updated Gantt chart

Note: - Test old robot parts should be done by the end of the week

- Sensor Package schematic and control system design should be started
- according to task list, these tasks belong to Elizabeth.

1/15/19

- ✓ send weekly report
- worked on proposal

Meeting 2

1/18

1/15/19
Stephen
Chen

- ✓ add expo to gantt chart
- update due dates for website.

increase font size in presentation

Check for example code for speed controllers.

Check ~~current~~ how much current the motor draws

Maybe can ~~en~~ include a speed setting that is dependent on the height of the sensor package on the arm.

Two ways to make robots turn

- RC servos
- Stepper motors

To move sensor

- lead screw and rails

To move up and down

- pulley

→ or CNC parts for bigger

Look up 3D printer Reprap Parts

- Bearings
- lead screws
- coupler
- Stepper motors

Turn table for the base bearings

or lazy Susan

- screw in new circle to bobot

1/15/19
Stephan
Chen

- Stepper motor driven w/ 1.2A
- Stepper motor sensor should - Adafruit
 - should be able to find example code
- Timer belt and pulley for motor shaft

- ✓ 1/19 Update Proposal and send to Graber
- ✓ 1/15 Send weekly Report.

Meeting attendance

- Graber
- Myself
- Adnan
- Nelson
- Lemek

West's Lab

1/18/19
Stephan
Chen

- need account for back emf in the circuit to protect batteries
- definitely need to buy new batteries. ↑
smaller
circuits
- Robot dimensions
 - Just box:
~~length~~ length: 35.13 cm ~~width~~ width: 35.5 cm
width: 25.5 cm
height: 10.2 cm
 - with wheels
length: 40.3 cm
width: 41 cm
height: 15.5 cm
- cavity / inside height: 9.1 cm
- existing robot uses spectrum DxSe 5 channel proportional radio control system.
- existing batteries can charge with 14 VOLTS
 - 12.77 V DC
 - 12.35 V DC

Meeting attendance

- Nelson
- Adrian
- Myself
- Lemek

Meeting 3

1/22/19
Stephen Chan

- If there are things with the robot that doesn't match up, talk to West b/c there was a team between our ~~team~~ team & M.E. team
 - * create weekly powerpoint for meetings
 - include improvements
 - problems with encountered
 - Sensors that are found use I2C but arduino doesn't have enough I2C ports
 - Order battery for robot
 - Robot functions
 - turning on the robot's verticle axis
 - look into tank robots / vehicles with tracks
 - possibly control motors seperately
 - have a counter to make sure you're aware of where the sensor package is along the arm
 - To help tracking the camera position
 - have a sensor for a reference point
 - * to calibrate
 - have an arrow on the robot for the utility worker to ~~set up the robot~~ ~~be~~ like up the robot before turning it on.
 - scissor lifts are less modular and can be sharp at the top. very hard to make.
- 1/30 ☒ go ahead and order sensors and perf board & arduino one, jumper wires,

- for robot communication ideas.
 - ethernet directly connected to robot
 - with router dropped into vault with the robot
 - with router connected to the robot.
- currently all of these would work with the current set up.
- using infrared camera / lighting to light the space.
 - * Night vision module for Raspberry 3 on amazon. ≈ \$24
- for mechanical arm
 - ball screw to lift sensor package.
 - telescopic arm lift.
- GUI has login and data storage capability.
- 1/23 ✓ check about lockers in senior design lab
- 1/22 ✓ send weekly report
- 1/22 ✓ update gantt chart
- not giving out lockers or accepting order forms til they give us new group numbers

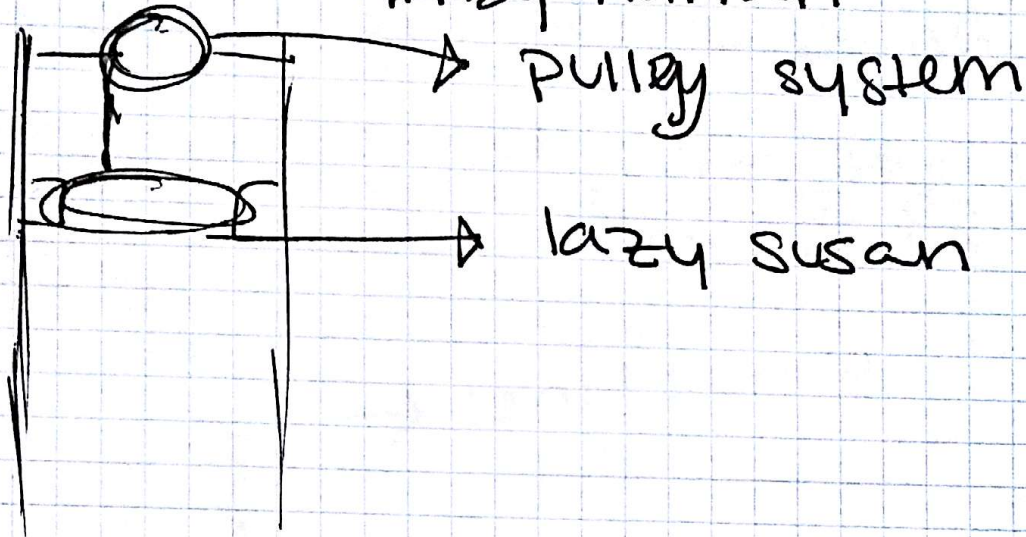
Meeting attendance

- Group members and Graber

After class update (group only)
- No meeting tomorrow due to weather concerns

1/28/19
Elephant
Chen

- Adrian found that scissor lifts are very expensive - not worth it
- new arm design by Adrian

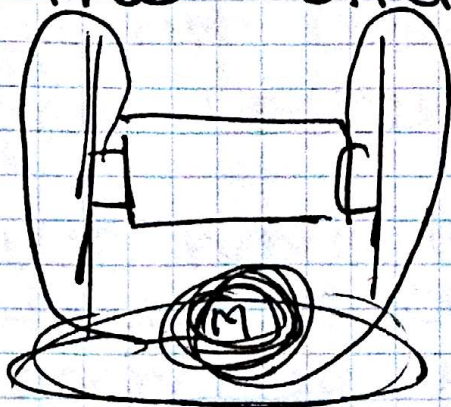


PROS: the whole structure wouldn't have to rotate, just the camera.

CONS: - ~~loss~~ loss in field of vision when camera crosses bars

- pulley system up top would be bad for center of gravity when robot is in motion

- changes / modifications
 - use a belt with the motor on the bottom
 - lazy susan stays on bottom

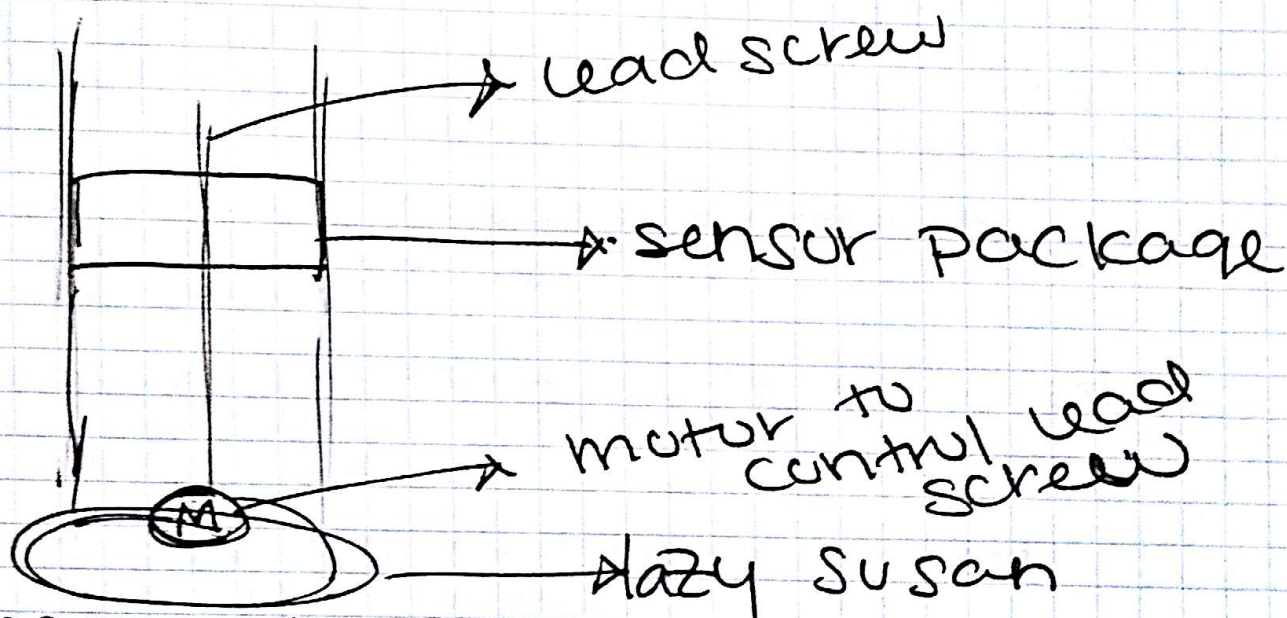


- Both of the designs uses T-slots. 1/28/19
SC

Note: I personally just like the lead screw design. We know it works because we've seen it with the 3D printer. ~~Also there would be less work~~

- less moving parts
- one motor
- already have proof of concept.

only downfall with the lead screw design that I can see is that it might be a little ugly.



Meeting attendance: group members
1/29

- ☒ 1/29 send weekly report
- ☒ 1/29 send update powerpoint
- ☒ 1/30 submit order form for first order
- ☒ 1/30 get locker

↳ we have locker 51 again but they are out of lockers at the moment. We can use our own until they get more.

West's lab

1/30/19
Stephanie
Chen

parts in the robot

- 2 motor controllers - keeping → need connectors for large side
- 3 Relays - not using
- 1 Arduino DUE - keeping
- 2 motors - keeping
- they have encoders
- 1 spectrum signal receiver - not using
- 1 Arduino power cord - keeping

- ☒ 1/30 add 16 gb SD card to parts form
- ☐ add connectors of motor controller to parts list

* let Graber know that gas sensor that was ordered can detect methane & hydrogen smoke

→ air quality sensor can detect carbon monoxide but couldn't be ordered

* Steinberg wasn't able to order the air quality sensor b/c links to those websites wouldn't work

Parallax ~~MQ~~ Carbon monoxide sensor was ordered instead

meeting attendance: group members

Note: SD card has been ordered
- sandisk 32gb

2/4/19
Seephaw Chan

Working on GUI w/ Lemuk

Data we want to show

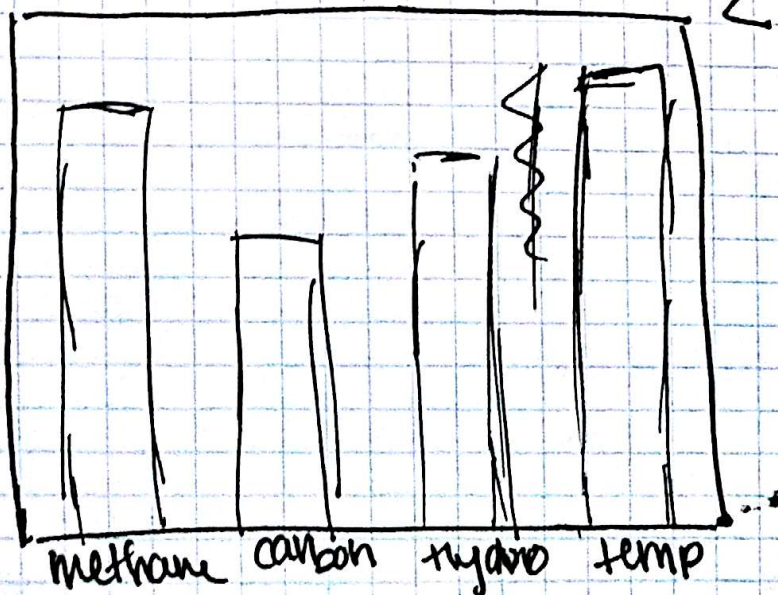
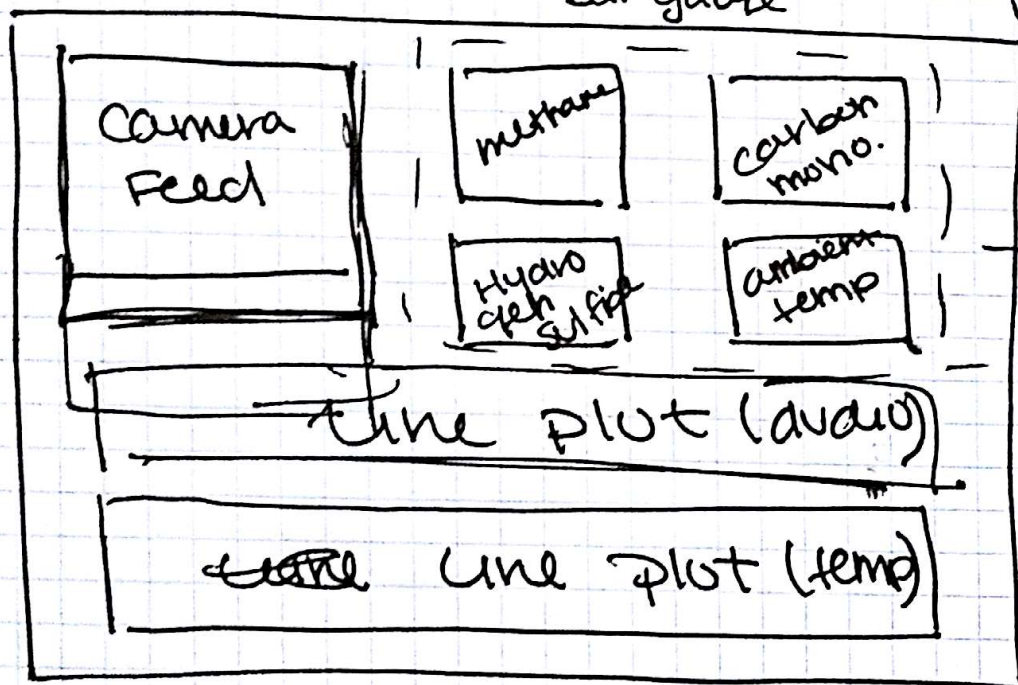
- Different gasses we want to sensor
- Time audio plot → line plot
- live camera feed → picture

→ Gases include:

- methane
 - Carbon monoxide
 - hydrogen sulfide
- } Bar gauge

Sensors

- Temperature sensor (IR) - Bar gauge
- gives both ambient & directional
- Bar gauge line plot



side note: New air quality sensor ^{2/4/19} link Se
has been found. So if we
still want it I can put it
on the next order form.
- this sensor can detect
carbon monoxide.

☒ ^{2/4} talk to Steinberg about locks for
locker

☒ ^{2/4} pick up items that have arrived

Meeting (Week 5)

2/5/19

Stephen Chan

- Relay can be used as internal switch and emergency switch
- The motor controllers we have are also DC controllers, not entirely PWM.
- keep in mind warm up time with gas sensors
- Arduino DUE can support 2 I2C connections
 - 3 PWM pins
 - we will be powering with 12V
- Regulator to help with the arduino powering

Put disclaimer in final report that we'd rather use utility grade sensors but it was out of scope and budget for this project

- Possible have analog output for CO_2
- make gas bar gauge into one gauge for general dangerous gases
- Histogram for analog output

Battery

- Raw power and regulated power.
18.75V cells for possible battery.
 - Samsung INR
 - Put a few in parallel
 - 3 in series for voltage
 - 3 sets in parallel to get current
 - or 2 sets in parallel

21700 cell Samsung INR

Pouch cells - polymer ion cell

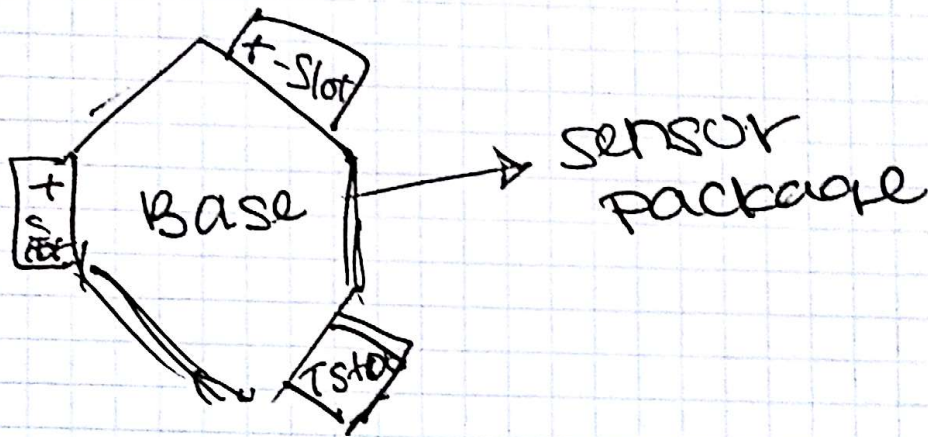
2/5/19
SC

- keep in mind about chargers for the batteries

LM7805 voltage regulators to get 5V for Pi

Mechanical arm design

- lead screw design
 - coupler for the lead screw motor



- show internal temp on GUI
 - controller that we are using
 - ✓ 2/5 weekly report & update gantt chart
 - ✓ 2/7 → live line plot complete
 - ✓ Data display for GUI
- meeting attendance: Graber & group members 30

2/6/19
Stephan
Chan

Locker number 51, code: 6090

items that have arrived

- SD card - 32 gb
- RPi camera module - (F) model
- Perf board set - amazon 65 pcs
- Breadboard set - amazon 3 pcs
- IR temp. sensor - (2) sensors
- jumper cables - amazon set

Senior Design Lab

2/11/19
Stephen Chan

- gas sensor gives us output data
- temperature sensor gives output data, maybe need calibration
- ✓ ^{2/12} order power parts
- Robot position tracking for GUI



θ °

→ tracks ~~each~~ angle of camera

ft

→ tracks distance traveled

↳ tracks

where the robot is facing

- RPi camera works
- ✓ ^{2/12} order parts for arm

meeting attendance: group members

Week 6 meeting

2/12/19
Stephen
Chen

✓^{2/12} order mechanical arm parts

0.063" aluminum may need to be bent to make it stronger.

- add quarter inch plate of aluminum for lid

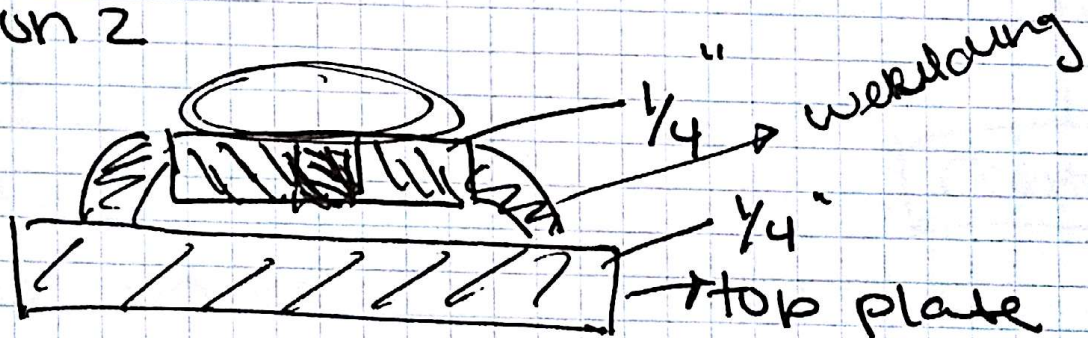
To attach lazy susan:

Option 1



✓^{2/12} Order top plate for robot

Option 2



Arm order form

- Switch to 8" turn table
- Aluminum sheets: 1- $\frac{1}{8}$ " 1- $\frac{1}{4}$ "
- screws/ bolts

AS SOON AS the top plate comes in put in work order to get top plate machined.

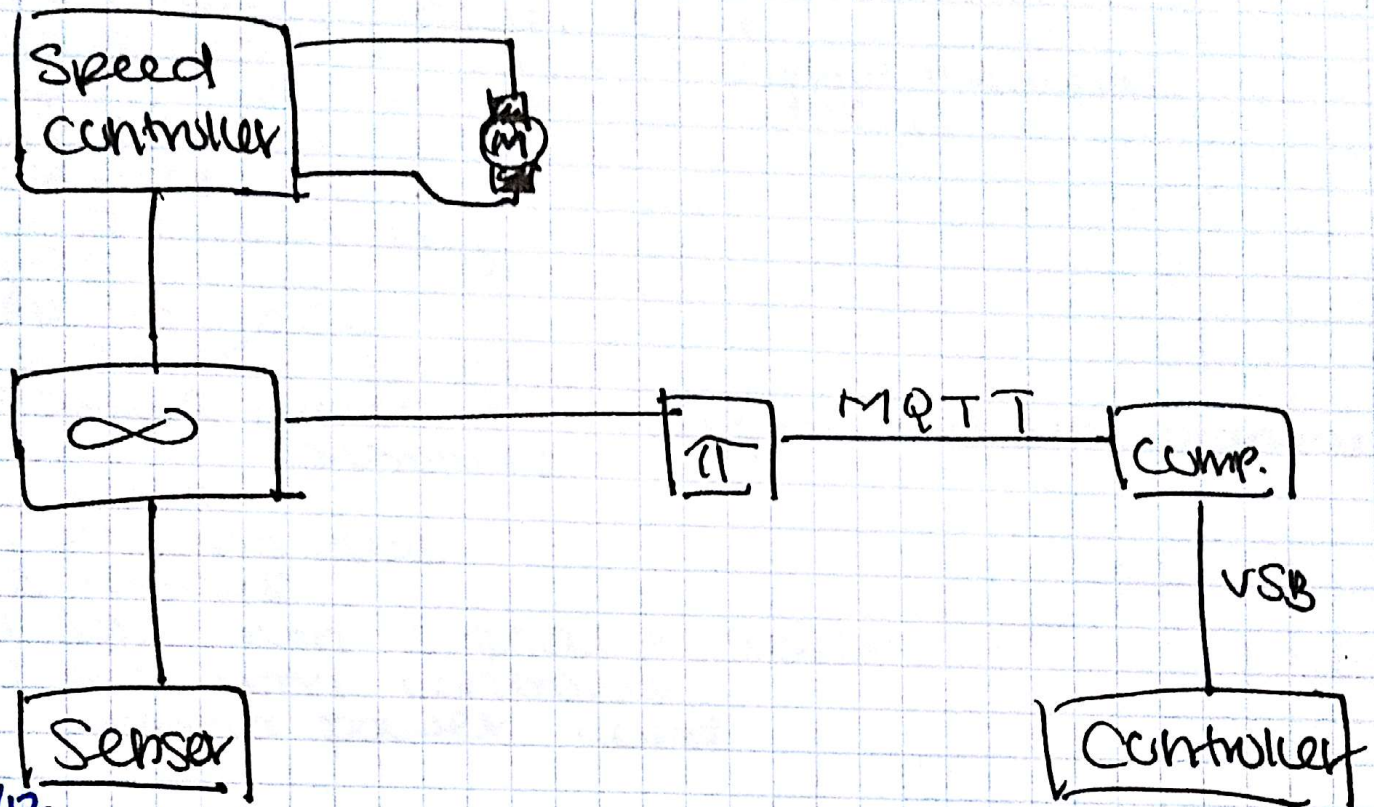
* Arm parts that need to be ordered

- T-slots
- Aluminum sheet: 1- $\frac{1}{8}$ " 1- $\frac{1}{4}$ "
- 8" round turn table

- order 2 4-channel over
1 10-channel

2/12/19
Stephan
Chen

- sensors need to be calibrated
- RPi camera works
- MQTT RPi communication works



2/12
✓ Order parts

✓ work on GUI: gauge display

2/15
✓ help with mechanical arm and
order remaining parts

2/12
✓ Submit weekly report

meeting attendance: group members &
Graeber

List of parts from Previous Projects

2/13/19
Sepphan
Chen

- Tango Tablet
- Logitech HD 1080 Webcam
- 5ft green ethernet
- Turnigy power system
- MOVO Microphone
- square plexi glass
- Raspberry Pi model B+ V1.2
- Ring light w/ 3D printed housing unit
- Spotlight? w/ mounting things
- Winch Servo HS-785HB
- Beluxl. Servo HS-422
- 3 USB-USB-B cables
- USB-USB-C cables
- Audio jack cable
- 2 small breadboard
- Various wires and screws and wire organizers
- 2 motor controllers
- 3 relay
- 1 Arduino due
- 2 motors
- 1 Spectrum signal receiver
- 1 spectrum controller
- 1 Arduino power cord

Total money spent is: \$71.55

2/13/19
Stephen
Chu

- sensors have been calibrated
and gas sensor ~~sent~~ responds to
rubbing alcohol.

✓ work on gauge for GUI

✓ ^{2/15} over PAAS Elizabeth address
to the list.

Items that came in

2/19/19
~~Seamus~~
Crew

- Batteries
- Battery mounts
- Battery chargers

Note only 1 battery charger came in

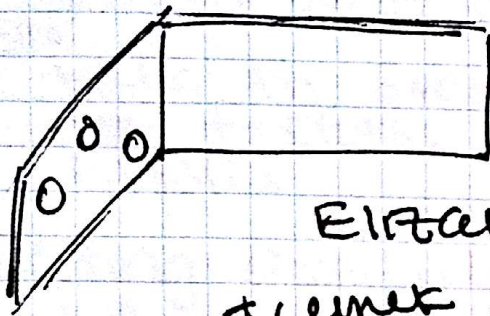
Week 7 meeting

2/19/19
Stephen
Chen

- For the ^{CAD} ~~code~~ design add platform between turn ~~table~~ & arms table

✓ ^{2/20} talk to Steinberg about storage for testing environment.

- for testing environment: L-shaped structure



Elizabeth + update x-box controller
+ Cernet + MQTT to go back & 4th

- Nelson is going to focus on serial connection between Pi and arduino
- show both motors in communication schematic.
- show pin numbers, arrows show signals
- USB, serial, & MQTT will be bi-directional
- analog input going towards arduino due

Power

- 12V for motor and arduino
- 5V for pi
- move motor from load end to point PRI.
- 12V to 5V converters to replace LM7805CT
- all batteries have to have the same status to work

GUI

- clean up
- CFC files for data for line chart

✓ ^{2/21} make gauge graphic

2/19/19
Stephanie Chen

Arm

- T-slot nuts (make sure to use metric) are needed.
- still need screws
- use L-brackets to connect platforms to the ends

✓ 2/22
meet group to make robot move
Friday

✓ 2/20
email West about lab access.

✓ 2/20
talk to Steinberg about storage for t-slots, and test environment supplies

meeting attendance: Graber, Umek,
Elizabeth, Nelson,
& Stephanie

✓ 2/20
talk to Steinberg about missing parts

PAVTS received

2/20/19
Stephen
Chen

- 10 ft ethernet
- 8" turn table
- Both 12" x 12" $\frac{1}{4}$ " aluminum
- 1 12" x 24" $\frac{1}{8}$ " aluminum
- 5 L-brackets

Current Total of items that have
come in: \$379.74

Current Total of items ordered but
not received: \$128.96

Total money spent: \$508.70

Note: The $\frac{1}{4}$ " plate does not
look like it will cover the
entire top of robot

GUI update

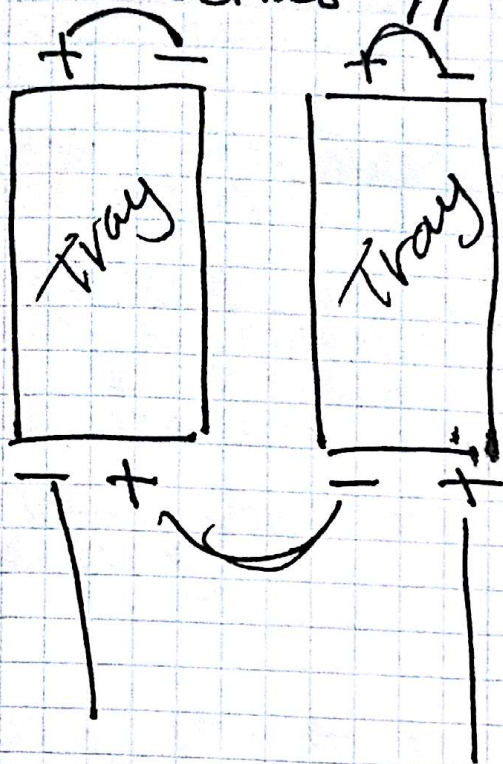
~~Temporary gauge graphic is
coded~~

- Gauge graphic is coded
 - able to change number
of wedges
 - can rotate label/colors
360°

Senior lab and West's lab

2/22/19
Sepphan
Chen

- Battery tray connection
4 in series // 4 in series



- 8 gauge wire was used to make the connection
 - 30 screw holes in the base
 - Previous lid was disposed
 - West lab badging
 - need passport / birth certificate
 - go to badging office
- 2/25
✓ met with group ~~Monday~~ Monday

meeting attendance: group members

- 2/25
✓ email West about a time to meet and get card access.
- 2/26
4 ✓ go to badging office 2/26 at 10 am

Hive Workshop with group

2/25/19
Stephen
Chan

- after talking to Steinberg, we found that 8 gauge wire is not necessary. Now using 12 gauge wire.
- motor controller with Arduino Due now works.
- both set of battery trays have been soldered just have to make the parallel connection between the two
- 2/25 ☒ email Graber slides for tomorrow's meeting

* Items that have come in / been picked up.

- 3 gauges for display
- xbox controller
- xbox USB Breakaway cable
- T-Slot sliders
- T-Slot bars
- Timing belt kit
- 1/4 count C-bracket set
 - * this was the alternate link. both primary and alternate link was ordered for this item. *
- 2nd battery charger

Note: all items ordered have come in & instead of the carbon monoxide sensor.

Design notebook and badge access updates

2/26/19
Stephan
Chen

- Design notebooks deliverable
1 is due before March 15,
unfortunately we have not been
told how or when to actually
submit it.
- we still don't have web access
- Not able to get badge access
this morning. Wait for list to
get in touch with
- got to office with badging office.
at 11:45. at 9:45am, left

Week 8 meeting

2/26/19
Stephen
Chen

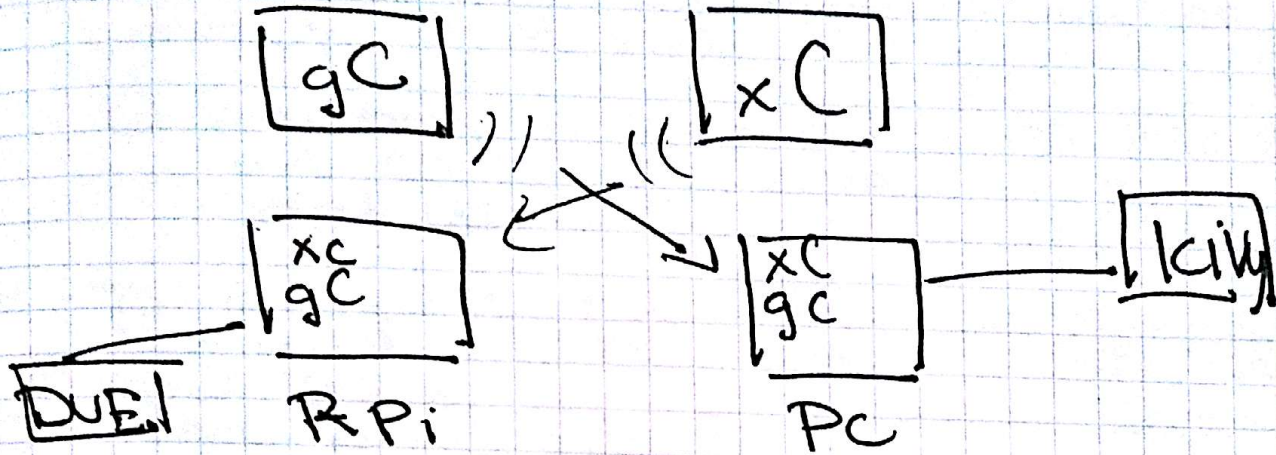
- don't charge batteries above 4.2V
- implement a controller system using two controllers:
 - 1 to control movement
 - 1 to control camera
- don't have to implement but...
 - include in proposal for future ideas
- Gui
 - camera window can be minimized and maximized
 - arm direction ^{graphic} may not be needed
 - ~~garage~~
- Mechanical arm
 - spacers to lift the lazy susan the height of the motor
 - screws are readily available at the invention studio.
 - ~~find new pulley for timing belt.~~
 - make sure the inner belt is ~~perp~~ parallel and straight.
 - to get wires out of base we can just pull the wire out and seal it.
 - top plate → disk shape
 - mounting pulley on the under side of the top plate.
 - pro: won't have to cut holes on top plate for timing plate

2/26/19
Stephan
Chen

- L298 motor controller for stepper motors

- Communications

- MQTT works both ways
- controller input to subscribing device (has latency)



3/1
✓ talk to Steinberg about returning items

3/4
✓ work on GUI with Umer

2/24
✓ Submit update report

- action items

- Elizabeth and Adrian will work to complete the arm and item list

- Stephanie and Umer, figure out GUI

- Umer & Nelson DUE ↔ Pi Connection

- Nelson work on latency problem

meeting attendance: Group members and Graber

Week 9 meeting

3/5/19
Silphum
Chen

- To solder the fuse, splice the wires to solder then put heat shrink
- ~~so~~ heat shrink with solder and flux are available for easy assembly
- Using wireless communication to connect from robot to PC
 - ☐ mention in final report that we could do either in the real world
- To prevent the cable from getting tangled include in a code to keep track of how many rotations have been made
- ordering cable
 - ☒ ask Steinburg about ethernet cables
 - need to be coiled.
 - need at least 8 conductors
 - cable specialist for coil cable (8 cond.)
- Ann.
 - collar clamp to keep rod in place for top pulley
 - technical drawings needed for different parts
 - need to tell the shop guys when do you want items to be done.
 - show DXF files
 - tell them materials that are used
 - give them a schedule
- Gul: 85% done
 - A/D converter to get battery voltage and voltage divider.
- ☐ work on bar graphic for temp.

3/5/19
Stephan
Chen

- add screen shot feature for entire screen
 - with timestamp.

- Pvt graphs on same window.

MQTT com.

- Serial connection b/w RPi & Due was (unsuccessful)
- OOP format for communication of GUI information works

Budget

- around \$35 over budget for ordered items
- Order 4 will be \$204.22 at the moment

Software To Do:

- camera code → RPi camera
- on/off button
- ~~stepper motor code~~
- sensor & arm code
- communication code

* Stepper motor controllers needed to be added to the list

3/8
☐ get completed order form to Graber by Friday

Action Items

Nelson: code clean up & test for serial connection for RPi → Due

Elizabeth: update schematic

Wmck: GUI → steaming

Adrian: DXF files for arm meching

Stephanie: bar graphic, button graphic
run time. Order form

Meeting attendance: group members & Graber

Team Meeting

3/6/19
Stephan
Chen

MEOC Invention Studio

- make the holes the size of the water jet. don't have to make hole the exact size. just make the picture with the locations of the hole.
- They have a drill to make it the actual size.

Item list:

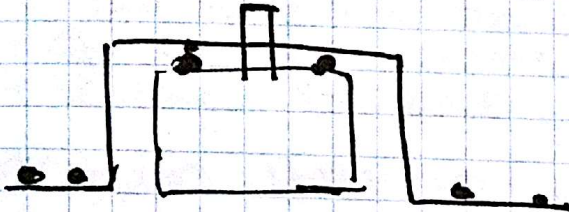
- TOP of lazy susan, top of arm moving plat form $\rightarrow \frac{1}{8}"$ (extra already on list)
- Robot lid & arm base $\rightarrow \frac{1}{4}"$
- either one $12 \times 28 \frac{1}{4}"$ to be added
- ethernet cable that Arabel mentioned yesterday (cable specialist website)
- stepper motor controllers (in Elizabeth's slides from 2 weeks ago)
- 1 inch screws for the robot edges (to screw the lid and arm base to robot.)

Meeting attendance: Stephanie, Adrian, Elizabeth, & Nelson.

Week 10 Meeting

3/12/19
Seephaw
Chen

- We can order more parts!
- Tip: you can download Solidworks designs to 3D PDFs
- mechanical arm:
 - now using a $\frac{1}{2}$ " plate instead of the $2 \frac{1}{4}$ " plates
 - water jet will be used to create the edge holes
 - threaded blind holes for inner holes
 - to mount the motor: (bottom turn table pulley)



□ make sure to give credit to where we designs from

- Gui: no update
- MQTT communications: Classes:

Client Obj
- broker
- topic
- port

Gui Publisher
- Pub's Data

Gui Subscriber
- connect sub

75% done

- software design: 50%

3/12/19
Stephen
Chen

- Website:
 - may not need to spend as much time on the website
 - Control system design
 - set a speed limit of max speed of the robot
 - possibly have a faster speed to drive to vault and ~~start~~ slower for inside vault.
 - Sensor:
 - links for existing sensor code has been found
 - To be updated:
 - decoupling cap. (on motor controllers (possibly) on arduino)
 - grounds connected
 - cable buses
 - Action Items
 - Nelson: Bridge design for motor mount
 - Adrian & Elizabeth: Test sensor communication and ask about water jetting the aluminum
 - Lemuk: GUI
 - ☐ bar graphic for GUI
 - ☒ ^{3/14} Expo sign-up
 - ☒ ^{3/12} Order form 4 to Steinberg
 - ☒ ^{3/12} Weekly Report 10
- Meeting attendance: Team members and Gruber

Design Expo Registration

2/14/19
3/14/19
Stephen
Chen

- Opened March 1
→ ends March 15
- Team ^{Project} ~~2~~ MUSEA (Team leader)
registered March 1st
 - Set up time 2-3pm
- Team members have been registered!

PARTS arrived:

3/15/19
Stephen
Chen

- 1-1/2 aluminum plate (10" x 2ft)
- 1 12" x 12" 1/8" aluminum plate
- 1 aluminum rod
- 4 stand off
- 4 L-brackets
- 1 pulley
- 1 wind belt

Team work meeting

3/25/19
Stephanie
Chen

Items that arrived over break:

- 100 PK Screws

RPI camera mount has been printed.
metal that's getting machined

- base plate
 - water jet the edge holes
 - blind drill the mounting holes
 - stand offs (3)
 - motor mount

Note: need to move the blind holes for the turn table in by ~~1 inch~~ 0.8 inch

Gantt chart has been updated,
Expo is Tuesday April 23rd, giving
us about 4 weeks to complete
the project

Important dates:

- Last day to order parts is April 8th 2am
- Next scheduled lecture is April 8th

meeting attendance: Nelson, Adrian,
Umek, & Stephanie

Week 11 meeting

3/26/19
Seaphan
Chen

mechanical arm
design : 95%

machining : - water jetting this week
- hole tapping
- getting the plates cut

motor mount : holes horizontally instead
of vertically

Rpi camera mount :

- put ball connection in warm water
to get it to fit better.

GUI :

- add info about short cuts on GUI
- line graphs ~~can freeze~~ can freeze and continue without losing data. can also be maximized.
- ambient temp. bar graph working and changes color based on temp.
- Gauge is now working with arrow changing
- possibly ~~to~~ add audio (headphones)
- ~~the~~ video streaming lags after a while
 - maybe ask on forums to get advice.

Communication :

- serial connection works with sending string

Sensor :

- sensor code outline created
- need to determine format
- need to figure delays when running motors vs. sensors.
- sending string to figure out delay times
- send on/off signal where the signal will stay until an off signal is given.

3/26/19
Stephanie
Chen

motor control

- outline code created
- excel sheet / table with values and

No meeting next week

Final report : note, use slices and graphics that we have existing

be prep prepared for expo, if we don't have wifi ~~port~~ bring ethernet cable

Action items:

Nelson: work on excel sheet for controls and communication

Umair: sensor code

Elizabeth, Adnan, & Stephanie:

machining & assembly

Stephanie: Final report.

☒ work on Final Project Report

☒ meet with team to ^{start} assembling arm.

Team attendance: Team members and Graber

Items arrived:

3/27/19
Stephen
Chen

- 20A fuse
- 515 pc Bolts/screw set
- USB → ~~usb~~ micro USB coil cable
- Coil ethernet
- Fastenre screws 50 count
- 25 pk waterproofing cable glands
- 2 stepper motor
- Step down buck converter
- 2 motor controllers

Team work meeting

4/5/19
Stephan
Chen

- Jumper wire color code

Black → Black
White → White
white w/ tape → Gray
Orange → Orange
Red → Red
Yellow → Yellow
Yellow w/ tape → Blue
Green → green

- Large coil cable for sensors has been stripped with female connectors attached at the ends

- holes on robot lid tapped

meeting attendance: (Emek, Adrian)
Elizabeth
Stephanie

To Do list to complete Project

4/8/19
Stephen
Chan

Robot assembly:

- cut rod $\rightarrow 1\frac{1}{2}$ " long
- make the holes to attach turn table to plate
- print new motor mounts
- make holes to connect motor to plate
- attach pulleys and motors
- 3D print tray for sensor package with

Testing environment

- cut and assemble foam board
- make stands for test environment

4/9/19
Seymour
Chen

Workshop

- used drill press ~~to~~ with 11/16" drill bit for blind holes into plate for standoffs $\approx 3/8"$ deep
- blind holes ~~drilled~~ tapped
- steel rod cut to 1 1/2" pieces using band saw
- outer ring of turn table holes drilled 13/16"

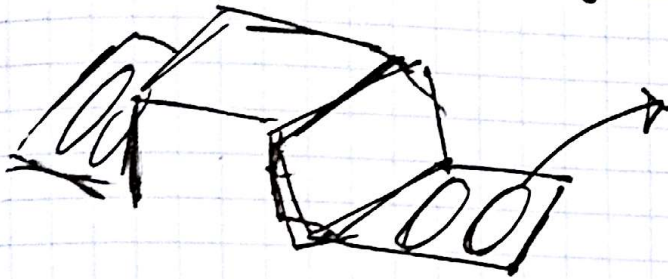
remember attendance: Team members

Meeting 12 w/ Team

4/19/19
Stephen
Chen

- assembly to do:

- attach pulley system
- drill holes for water proof gland
- 4/12 ☒ Put picture of workshop in poster
~~20~~ 10-20 pictures for website
and poster (good quality pictures)
- drill out holes on the lid holes
and counter sink the holes for the
screws
- motor mount



rotate holes
to be horizontal

- software to do:

- reaction time w/ sensors
- Started writing movement code,
reset code w/ IR sensor, & arm
movement code
- Move to do:
 - Update streaming method
 - incorporate data streaming
- Stepper motors have 400 steps per
rotation
- Final presentation after the expo
- Next week meeting at the lab
- 4/15 ☒ email west about access to lab
for next weeks meeting

For poster: focus on the background and why we're doing the project

4/9/19
Stephan Chen

4/10
✓ talk to Whit Smith about poster size, how to get submitted to get printed & laminated.

meeting attendance: Team members and Grabel

Workshop

4/11/18
Stephan
Chen

drilled holes on turn table
plate for L-brackets

- 8-32 $\frac{3}{8}$ " screws
- 10-24 screws $1\frac{1}{2}$ " screw
with 2 nuts under plate

- used B11/64 drill bit for L-bracket
holes

ordered new screws for stand offs

Workshop attendance : Stephanie, Adrian,
& Elizabeth

Work shop

4/12/19
Stephen
Chen

- fixed rails for L-brackets that
+ slots will be sitting on, for
bottom platform

Workshop / West's Lab

4/15/19
Sebastian
Chen

- moved materials to West's lab
- assembled arm on top of robot base.
- note, screws on one edge of top plate need to be expanded towards middle

4/14
[] top plate of robot arm needs to be fixed, holes for L-bracket are slightly off.

- stepper motor and motor controller has been tested with the turn table and arm and it works!

4/14
[] get 1" screws for outer ring to plate connection. 10-24 screws.

- new screws came in
- submitted poster for printing
- added ring around turn table to design

meeting attendance: team members

Workshop / West's lab

4/16/19
Stephen
Chen

- fixed holes on arm top plate for ~~A~~-slot L-brackets.
- removed the robot arm and motor for Graber at West's lab
 - to fix holes on robot top plate expand holes towards and recenter sink those holes
- added micro switch on top of sensor package to make a hard stop so the package doesn't hit the top. to the design arm
- make team P.V.I.R. tags to wear at expo.
- moved robot and all materials back to senior design lab

meeting attendance : Team members and Graber

Workshop

4/17/19
Sephem
Chel

- new sensor tray, turn table and motor mount are done printing.
- file for sensor tray has been queued to be printed
- drilled holes into sensor tray to attach tray the moving platform
- posters have been printed
 - picked up poster and attached to foam board
 - leaving poster in Graber's office for safe keeping
 - checked out easel for expo.
- made name tags to be 3D printed
- Workshop attendance : Adrian, Stephanie, & Elizabeth

Workshop

4/18/19
Stephan
Chen

- Arm top plate holes are finally fixed so the L-brackets can be attached
- assembled arm with sensor package sliding smoothly
- micro switch on top & bottom connected.
- holes for pulley to be mounted on robot ~~lid~~ has been drilled and threaded
- extra ring for turn table has been glued
- sensor package lid has been done printing

workshop attendance : Lemek, Adrian, Elizabeth, & Stephanil, & Nelson

Workshop

4/19/19
Seephane
Chen

- attach bottom arm motor
- cut holes for pulley belt into sensor platform
- put threads into top pulley dowels
- printed name tags
- mounted pulley on arm

attendance : team members

Workshop

4/22/19
Stephen
Chen

- Finished ~~the~~ name tags putting magnets on them
 - drilled hole in top plate for cords to go through
 - assembled arm with belt
 - fixed belt later in night to provide ~~for~~ more tension
 - began construction of test environment.
 - tested movement of both stepper motors
 - ~~for~~ 360° rotation pulley kept slipping
 - ✓ 4/23 fix motor when shop opens tomorrow
 - worked on presentation and final report: wrote Ex. Summary & Introduction
- attendance: team members

Workshop / expo.

4/23/19

Saphan
Chan

- fixed 360° pulley motor
- assembled testing environment
- transport robot to expo for demo.
 - both stepper motor movement works
 - RPi Streaming works
- expo check-in at 2pm

✓ 4/24 Presentation Wednesday 4/24/19
4pm

attendance : Team members