1. Had to use 3 to 2 prong adaptor (to disconnect earth/gnd wire) on light organ power plug to avoid servo noise getting on the audio speakers as well as falsely triggering the light organ lights. Need to check inside light organ to see what that gnd is connected to as it appears noise is getting on this gnd/earth wire which gets back thru the circuity to the audio line in and then back into the audio speakers. Possibly a ground loop problem?  
      
   Ensure that the volume level control of the PC is set appropriately otherwise if it is not high enough the light organ won’t work. The light organ has gain sliders on it as well so also check those (using photos taken of the slider positions) although they are typically left in the same positions used on Halloween. Used the PC 65% volume level to get the organ to work at its current settings (both at system volume and windows media player volume level settings). Used the LL and MM outputs of the organ and that seemed to work ok.   
     
   The user Mic amplified output, MP3 audio output, and PC audio output (headphone jack) go as inputs to a USB powered audio Mixer with its output going to the light organ and amplified speakers. This allows any of these sources to be used to feed those. This works well for when the prop say hisses or screams once in conjunction with a prop movement to scare the TOTers which then causes the organ lights to flash at the same time as that, enhancing the scare. The best settings on the audio mixer volume knobs are marked via blue tape but always test things out to verify they are working as desired and tweak if not. Note that the mic can cause feedback if the amplified speaker is in the same room as the user mic (or right next to the headphone ear speakers) so will need to see if this occurs in the actual setup where the amplified speaker is outside and the user mic inside. Any of the inputs to the mixer can be muted by the mixer via the associated audio volume knob when desired.  
     
   Note that when using an oscilloscope to view the audio output, 60hz 120 volt appears on the output which is not the actual case as a handheld battery voltmeter does not show this. It appears when the PC audio output is measured with the PC power input plugged in. Not sure why this occurs but maybe it is some type of ground loop issue?
2. Eventually to eliminate position recordings size limits, see if can get an SD card attachment for the Arduino so can store them on there. Not a big deal at the moment as can store all the current recordings (50msec interval) and total program memory taken up is 97K out of 256K.
3. Didn’t use the air cylinder again this year so not sure if that’s working ok still.
4. Check to see if can use the aluminum servo hub in place of the plastic one on the mouth servo although the plastic one seems to work ok.
5. See if can get some swing point on the left side of the mouth connected to the head to provide more support as didn’t use the backup/down since adding the mouth servo. Not sure if back up/down will cause problems with this so need to try out.
6. Ensure Foscam is working ok with laptop a few days before (use Internet explorer tab in chrome to access all functionality)
7. The up/down side of the IMUs is important in that if an IMU is placed upside down a surface (the chip side of the board is the up side , i.e pointing up, the solder side is the down side ) it can cause the yaw (heading) readings to go haywire when the pitch of the IMU is outside a certain range. If upside down, then when keeping the heading direction the IMU is pointing constant and moving the IMU so the pitch starts to change beyond a certain range (more than 30 degrees from horizontal pointing down) the IMU heading reading suddenly jumps to large values like 255 or greater. May be able to use the IMU config reg remap axis to fix this but simply having the IMU upside pointing up fixed the problem.  
   **When tried extending the length of the wires to the Head/Mouth IMU by approx. 3 feet it caused the readings of the Head Vertical to glitch to 0 degrees at several points in the 0 to 90 degree transition. This was observed also at the prop where the head would transiently bob up and back to the right position at various points during that transition when performing the ImuHeadMouth (i.e. mimic) operations. Verified this was the cause as when removed that extra length things worked again but when extended it is had the issue again. Did not look at it on the scope but guessing it is because of line capacitance and the I2C switch cannot drive that extra length. Hitec twisted servo wire is used for the existing connection. Used Futaba 22awg twisted wire for the extension which did not work. Possibly need some added drive in some manner.**
8. For the Mic to prop speaker the use of the MAX9814 with AGC disabled (TH pin connected to MICBIAS pin) eliminates the mic from picking up sounds far away from the mic.
9. **Remember to connect mic audio and turn on Battery supply**. In 2020 had forgotten to do this for the first few TOTers and they couldn’t hear me talk. Do dry run as should be able to hear from the headphones connected to mic on prop.
10. When using ISPY, the foscam video is setup on camera1 and audio on camera2-mic. Camera1 has the audio source selected as camera2-mic .. Audio and video streams should both be accessed by using http://192.168.1.30:8091/videostream.asf?user=admin&pwd=fozziegmbrr3 (for the camera 2 microphone VLC plugin setting with arguments “-I dummy --ignore-config” and the camera1 video source FFMPEG setting) while the video only stream is <http://192.168.1.30:8091/videostream.cgi?user=admin&pwd=fozziegmbrr3> but it can’t be paired with a mic to get audio for some reason. However the audio stream seems to be delayed 1.8 secs form the video stream and the video stream is delayed about 0.9 sec, when using .asf for both streams and things are working correctly. Also sometimes the delay can vary up to 2.5 seconds, and between streams for some reason, but turning the camera offline then on again and activating the listen a few seconds later seems to correct this some of the time, but still haven’t figured out a full workaround. For 2024 did use this but for some reason the video was choppy when tried this. Not sure if running 2 camera on ISPY on my desktop computer had issues or what. Had tested a few days before and seemed to work ok but that was with the foscam right in the study , and not out on the front porch which may have caused an issue. So still need to work on this. Possibly should have tried ISPY on the laptop but didn’t have time.   
    For 2023 and before, for files that also had prop head camera audio recorded was able to merge the audio from those to the porch camera video using Vidmore to extract the audio from the prop head mp4 file to an mp3, then using KAPWING online editor to merge that audio into the porch camera video. Note that couldn’t get RTSP to work and it seemed like the browser interface did not have RTSP options.
11. **Remember to turn on tea candles in front of Gargoyles**. Forgot to do this in 2022.
12. See if there is some way to make a skin cover for the bottom of the mouth to the neck to cover up the servos and make it look better, although having it exposed along with the arm/shoulder servos kind of makes it look the Terminator so still scary.
13. Note the following no longer seems to be an issue as the gobilda servo can hold the head pretty much in its vertical position without power (the Hitec couldn’t do that). Issue was - See if there is a way to limit the head from completely bending over where the chin hits the neck pvc pipe, when the servos are not powered. When servo class invoked the limits for the servo can be passed. Currently I set the servo to around 140 degrees before removing power and use a pvc pipe insulator to cushion the mouth hitting the pvc pipe when power is removed. That works as long as I remove mouth power before removing any other servo power. May be able to have a limit tab right at the servo hub and servo block to do this instead so don’t have to worry about power removal sequence as much.
14. Have light shining on the vampire prop itself to make it more visible as taller people can stand in the way of the porch light which is the only light on it now. However with the audio from the prop speaker being able to be mixed with the audio that triggers the light organ , this may not be needed.
15. Last time used base had a problem trying to fit the prop into it and ended up not using it? Will need this working if want to use back up/down.
16. Currently have quick connect disconnect at the prop itself so end up rolling up the wire/cable from prop to controller board, putting it on the board and transporting it with the controller board to the dining room and then unrolling the wire and cable and reconnecting it. That seemed to work ok along with having them taped at the ends into a line from left to right (both on the from the prop side and then on a separate one for the to the prop side) to easily match connectors without hunting around for the matching one. Also the much less flexible underground wiring needs to be replaced with the flexible servo wires to make it more manageable. Ideally a single circular connector for all the wires would be great as you have one connector to connect/disconnect.
17. Did add blocking capacitor to receive audio from prop before it goes to the Headset headphone which helped overdrive of speaker when headset volume control turned way up
18. Use of quaternions instead of Euler angles and then converting to Euler angles didn’t seem to help much in the arm IMUs where pitch can go wonky when Roll is above 85 deg but need to investigate this more. In the Adafruit\_bno055 class there is code that has special case when roll is 90 degrees so that pitch is always set as 0 and yaw works as is, but that did not seem to help. The basic problem is at certain points of the arm position (roll at or close to 90 deg), moving just a little off the position can cause the pitch to change drastically to move to this new slightly different position because yaw and pitch do the same thing at 90 deg roll. We do limit the use of IMU roll angles over 85 degrees (prop stays where it is until go back into range) but we still could get this small change causing large change issue in the IMU when we go back into range. One possible solution to avoid getting the IMU into these weird range singularities is to have two IMUs where one is offset by say 45 degrees by pitch, and by roll, and then the software determines which one to use (the one not in a singularity range) and calculates the actual angles of the arm/elbow direction and roll if the offset one is being used. Even if used quaternions it probably won’t help as the servos are arranged as yaw, pitch , roll anyway. Possibly the only saving grace is that the arm probably moves fast enough in most cases to smooth out most of these discontinuities.   
    In 2024 reordered the servos on the arm so it is yaw, pitch , roll now instead of yaw , roll, pitch as the euler angles from the IMUs assume the yaw, pitch, roll order. So now the prop arm follows the user arm movements much better. The resulting reordering didn’t make the shoulder physically much bigger. The skeleton arm itself is a bit longer due to this reordering (maybe 1.5 inches) but still get reasonable speed from the servos. Also using vector angle calculation between forearm and arm IMU Euler vectors to get elbow angle.
19. Added servos to arm and elbow and that worked out well (2021). GoBilda servos had enough torque and speed to do the job and are dead quiet when holding a position even when under load.
20. GoBilda servo for the head nod worked great (2022) as it was dead quiet when holding position. Ran it at 6 volts and speed seemed to be fine but try it at 7.4 volts to see if it is any quicker when bringing up head from looking down position
21. Using an adjustable arm brace with attached IMU for the arm, and one for the forearm. It is a bit restrictive but seems to be the best way to do this to avoid muscle movements causing significant unwanted movements of an IMU that is directly connected to the arm/forearm. The brace seems to filter these out. The brace is also easy to slip on and off. Best position of the brace is with the upper strap of the brace up on the arm as far as possible past the biceps and pretty much right at the edge of the arm pit.
22. See if there is a better way to get mouth IMU held on. Currently use scaling as the mouth moves very little when talking. Also when head is nodded down the mouth seems to open less. Also check to see if need to use the vector angle calculation instead of just diff between head and mouth pitches although seems like pitch difference should work.
23. New 2023 vinyl cloth printed cemetery backdrop looks good. Replaced the plastic 3 panel one.
24. Added remote control of flapping bat in 2024 but was having issues outside where it only lasted maybe 10 minutes tops then started to not work. Had tested it for short time periods (a few seconds at a time) inside at room temperature and it seemed to work ok. Outside was around 47 degrees. Was using new batteries for it.  
    Had measured the current draw with VOM at around 450 ma when the bat was flapping, and the added remote control draws about 6 ma when off and 36 ma when on so not sure what the issue is. (all measured at inside temps) Thought the 800 mah and above new alkaline batteries would be ok but not sure now. Need to investigate more. Also not sure if when reassembled it the wing operation was being restricted somehow intermittently.
25. Was so windy for 2024 Halloween that couldn’t put up backdrop. I had put it up about 2 days before and the window blew it off. Wind never let up until late Halloween night so had no chance of getting it put back up due to the time. Need to figure out a better way to have it held on to mitigate this as the painters tape just got ripped off by the wind. Possibly a wire or thin aluminum rod attached to the top of the backdrop somehow, and easily detachable (maybe the top of the backdrop has a loop it can be slid into)
26. The gobilda servos use a M3 0.5mm thread hex nut screw for attaching the servo hub to the servo shaft.

Enhancements -

1. See if using some type of motor instead of the air cylinder would work for back up/down as it would be easier to control the stopping speed than the elastic cord mechanism we have now with the air cylinder. The only issue would be the speed it could achieve and the torque it can produce (has to be at least as quick as the pneumatic cylinder). Or if there is a way to more accurately slow down the pneumatic cylinder at the end points. Or could use proportional valve controllers or possibly servos hooked to valve controller and Arduino PIDs (proportional integral derivative) control using feedback of the position the cylinder is at (haunt forum has posts on this in the pneumatics forum)
2. Update code so that player registered devices override interactive prop device movement when player is playing. This allows playing short mouth and audio sequences during interactive prop movements (like a scream from the mouth).
3. See about having voice activated mouth control option. Purchased an audio level board, see if can use amp output of it in some manner instead of connecting off LEDs on that audio level board for audio level. The audio needs to have enough release time to hold the level so that the Arduino is not taxed sampling that audio level.
4. Make LED eye brightness controllable. Either use DtoA output or pulsed width modulation although use of PWM reduces max number of servos can have connected.
5. See if can also have the prop audio go to the loud speakers (although the prop speaker did seem to be loud enough)
6. See if there is a way to cover/hide the shoulder servos.
7. GoBilda servo for the head nod worked great (2022) as it was dead quiet when holding position. Ran it at 6 volts and speed seemed to be fine but try it at 7.4 volts to see if it is any quicker when bringing up head from looking down position
8. See about using battery on Gargoyles to light up LED eyes.

2019 – 39 degrees high 22 low, snow on ground but not sidewalks - Count 60 Trick or Treaters

2020 – 58 degrees on Halloween night, clear and windy. Short of wind it was very nice night. Count 40 TOTers. Had candy in bags on table and used vampire prop to interact with TOTers only.

2021 – 50 deg on Halloween night, clear and windy. Turned out to be nice night for TOTers. Count 31. So had a lot of candy left as was expecting a lot more TOTers after the 2020 pandemic year.

2022 - 56 degree at 7:00 pm, clear and little to no wind, dry, perfect night. Count 66 TOTers. Used the vampire grasping at people player setup. Also used Mic to whisper “Over hear” to get TOTers to look/move closer to vampire, then triggered the player manually when they were. Worked pretty good although may want to add this “Over hear” audio to the player recording (maybe two times) so it’s automatically done when the sequence is played. Did not use synchronized operation that year although dry run of it worked fine (except need to get arm/elbow IMUs working on actual arm/elbow instead of simulated arm/elbow wood hinge). Also remove the short little movement of the arm at the start to make the prop dead still till it makes its movement.

2023 - 38 degree at 5pm, very windy (although wind from NW so didn’t affect setup much). Count 49 TOTers. . Also used Mic to whisper “Over hear” to get TOTers to look/move closer to vampire, then triggered the player manually when they were, and worked pretty good. Prior suggestion of putting that Over Here in the audio file is if people don’t hear it or lag looking over and miss the prop movement. Did use interactive operation on one scare and it worked good (only head and mouth, not arm). Did not remove the short little movement of the arm at the start as it kind of draws the kids over to as well.

Had bought qty two of 18 full size candy bar boxes (Hershey, KitKat, Reeses), qty two of 12 count popcorn ball bags, 1 mini Hershey bar bag, 1 min Reeses bag, 1 mini KitKat bag. Out of that handed out around 30 full size bars, 16 popcorn balls, and a few mini Hersheys.

2024 - 47 degrees at 5 pm and very windy (wind from WNW around 23 mph).   
64 TOTers came in 28 groups from about 6pm to 8:12 pm (got 29 TOTers from 6pm to 7pm, and the rest afterward). Lots of interesting costumes.  
Did not have backdrop up because it was too windy (put up 2 days before and wind tore it down and wind did not let up until late Halloween night). Also did not put down skeleton bones as did not know if was going to rain again. Wind broke the tombstone that had the stick holding it together so probably need to get a new one.  
Used the “I See You” sequence for first time and worked pretty good in conjunction with the light organ flashing on the “I” word. Mostly used that but did use the “Vampire Grasp At” one a few times and that one is still a good scare especially with the hissing causing the light organ to flash (wanted to mix up things a bit so kids from prior years didn’t expect what was coming). Again used the Mic to whisper “Over here” to get TOTers to look/move closer to vampire, then triggered the player manually when they were, and worked pretty good. Note that **did not** have the Mic mixed/feeding the power speakers when doing this. Having the prop mp3 audio mixed in to the power speakers and light organ worked well for flashes when the prop had a burst of loud audio.   
Did Not use interactive operation as things were too busy as it would be hard to pull on and off the arm brace to do this, even though recent changes made the arm brace work pretty decent for mimicking. Either have Lynn help hand out candy or come up with a wireless low latency option for the orientation sensors on the body, or make it easier to slip on/off the arm brace (it seemed like loosening the top upper arm strap helps take off and put on as it slids on easier then can tighten the strap afterwards).  
Forgot to put tea lights out in front of gargoyles.  
Had bought qty two of 18 full size candy bar boxes (Hershey, KitKat, Reeses), qty two of 12 count popcorn ball bags, 1 mini Hershey bar bag, 1 min Reeses bag, 1 mini KitKat bag, 1 mini payday. Out of that handed out all the full size bars, 12 popcorn balls, and a several mini Hersheys, reeses ,and paydays (although had quite a bit of the Reeses and paydays left and half the hershesy). Did not open the Kit Kat and returned it. Didn’t have receipt to return the unopened bag of popcorn balls. Later on in the night told TOTers to take two pieces of candy.