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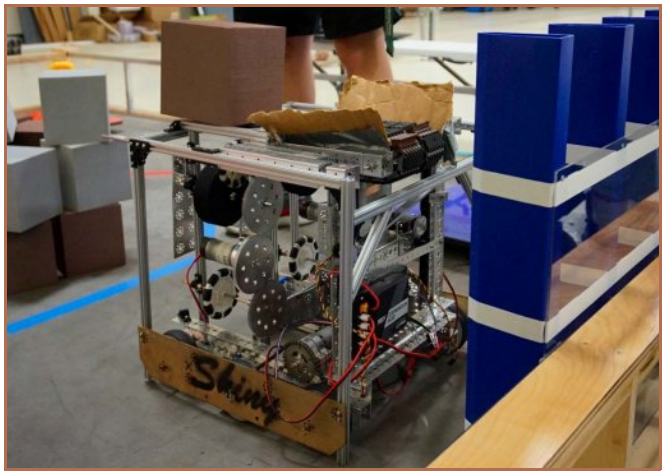
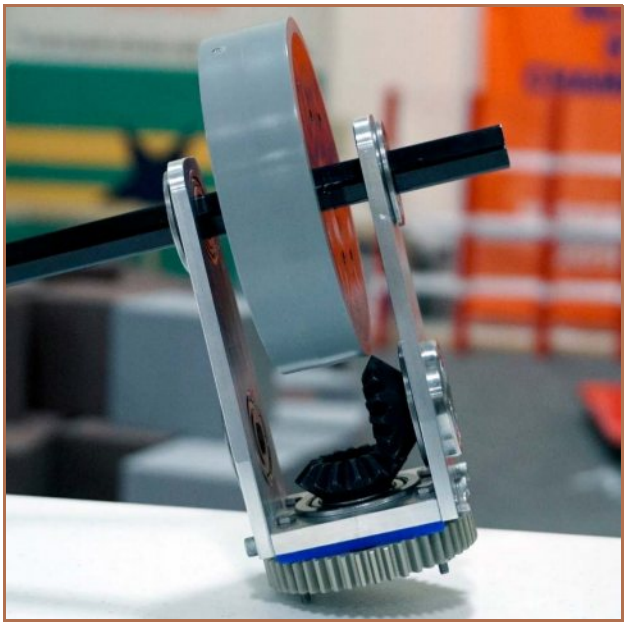
Team 7842 Engineering Notebook - *FIRST* Relic Recovery

Date	Location	Start Time	End Time	Week #
November 3, 2017	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	9
Meeting Goals: Elevator, Swerve Drive, Prototypes				

Team Members in Attendance:
Andrew, Anthony, Brooklynn, Ian, Megan, Joseph, Patrick, Rosie

Tasks	Reflections
Glyph Collection System	Megan worked on her design for the elevator. She didn't go deeply into depth about it, as she is hoping to do it next week with CAD drawings from Ian, but the both Ian and Megan explained what they have in mind and how they plan on going about the revisions to the elevator.
Drive Train	We assembled the first Swerve wheel module today, and the team is waiting on the axles to be cut.
Relic Arm	Anthony put together a relic grabber, which was made out of tetrix beams with latex to grip the relic and keep it in place. His design will grab the relic from the top. The advantage to this design is that it would be easy to store in the robot, but one of the disadvantages is that more than likely, it will not be able to pick up the relic if it falls, and in addition, it couldn't be used for a multipurpose glyph collection system.
Autonomous Navigation	Joseph continued looking into OpenCV. OpenCV is an image analysis software, similar to Vuforia. However, he found that it is better at finding shapes as opposed to location images and objects. OpenCV cannot, therefore, completely replace Vuforia.


Shiny



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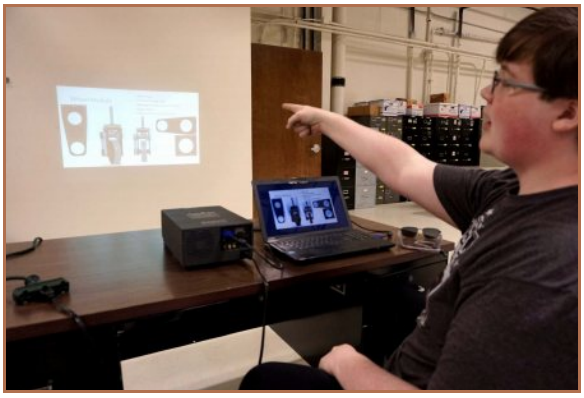
Date	Location	Start Time	End Time	Week #
November 10, 2017	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	10
Meeting Goals: Elevator, Swerve Drive, Relic Arm and Relic Grabber Presentations				

Team Members in Attendance:
Brooklynn, Ian, Megan, Joseph, Patrick, Rosie

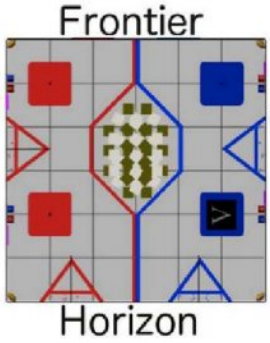
Tasks	Reflections
Glyph Collection System	Megan presented the current prototype elevator, showed how it works, and explained what she wants it to do. There are many flaws with the current design, as the drive train it was built on is too narrow, making the elevator too tight, so the wheels grip the glyph too snugly, which tears them apart. Another is that the glyph won't always make it to the conveyor belt at the top, and other times will fall off completely. She's working with Ian to come up with solutions to the problems in CAD. One of the possible solutions is to eliminate using wheels entirely, though there might be omni wheels at the bottom to feed them into the elevator if need be. At the moment they are looking at Andymark's compliant wheels to feed the glyphs in. The plan is to use belts in the elevator, which should decrease points of failure. Also, instead of having the glyphs shoot directly up, they will be sent upwards diagonally, with timing belts on the bottom and on the top, which will hopefully encase the glyph and keep it from turning over. The conveyor belt will be a little lower than originally planned, that way sidebars can be added that will keep the glyphs from falling off. While stacking the glyphs, when they reach the top two in a column, the elevator will be able to lift itself so the glyphs can reach the height of the others. Instead of using REV extrusion, custom parts will be used, so there will be a lot leeway when it comes to mounting. The team would like to send the CAD files to Huntsville STEAMWorks, who have graciously offered to help print or laser cut anything the team needs. To start off with, the team would like to laser cut the elevator out of wood, just to make sure everything fits. If they find they actually like the wood better because it's lighter or for whatever other reasons, they will print much thicker wood and go with that. At the moment, though they are thinking they will CNC it at Calhoun Community College.

Drive Train	Ian built the frames for the other three Swerve modules, as the team had received the rest of the CNC parts during the week. Using PowerPoint, Ian gave a presentation which explained exactly how swerve drive works with all of the advantages and disadvantages. It described in great depth how we could handle changing parts out if something were to malfunction. There are many advantages to this design, for example it has holonomic capabilities with full traction and full speed in any direction. Some of the disadvantages are the number of servos, the complexity of the design, and a few points of failure. Ian has quite a few ideas on how we can solve most of these issues.
Relic Arm	Rosie showed a prototype of a relic grabber that was which was made from a plastic faucet insulator which happened to fit around the body of the relic perfectly. This was significant for a couple of reasons: 1) An example of the new Andy Mark competition field was seen at the Mississippi scrimmage--they include a diagonal cross brace at the corners which will interfere with mechanisms that try to approach the relic from the top; 2) Gripping the body potentially gives us the opportunity to pick up the relic if it falls over; and 3) The 'claw' of the gripper is large enough that it could pick up a glyph block--good in case the elevator fails or moving glyphs in positions that the elevator cannot reach (like in a corner, or blocking a relic). At the conclusion of her demonstration, Rosie was asked to consider incorporating the spring-loaded, bicycle 'caliper'-style actuator to her gripper as was previously described by Anthony. That mechanism potentially offers some weight savings, since the servo does not necessarily need to be located on the end of the arm. Megan then demonstrated her relic arm which had been improved with a rack and pinion along with REV extrusion. The advantages to this design is that it's very fast and requires only one motor with no spools. A disadvantage is that in the back, the rack and pinion isn't very stable, which makes the whole arm wobble. One solution she's looking into is a 3D printed part that will keep the arm in place without interrupting the rack and pinion's movement.
Chassis	Megan demonstrated the chassis–which she and Rosie worked on together. The chassis is a basic box, with ninety degree brackets keeping it together, along with triangular beams. The whole thing is made of REV extrusion and so far, the design has worked well to mount everything to it. The design is very rigid, which helps keep everything in place.

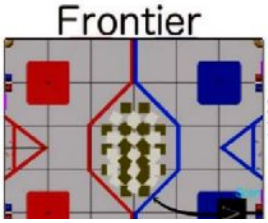
Autonomous Navigation	Joseph and Ian both discussed software ideas on how to use Vuforia to scan the cryptobox, and then change to OpenCV which will read the colors of the glyphs so we know which colors to pick up for the cipher. They'd both done a lot of research on how Vuforia will work with OpenCV and have both found that Vuforia doesn't play well with other software programs. The two of them will be working together to find a solution to all of the problems.
Strategy	Joseph put together a presentation about strategy and what our best route in autonomous will be. So far our goal is to knock the correct jewel off right away, find a way to scan the cryptobox while still on the balance board, and then go to the pile of glyphs to collect another one, followed by scoring the one we just picked up along with the one originally in our robot at the beginning of the match. Joseph is looking into a way to include some kind of timer that will tell us if we have enough time to collect two more glyphs and score them before the end of autonomous.
Administrative	The team lost a team member this week--Andrew has chosen to resign. The team is very saddened by Andrew's decision and will miss him and his contributions.



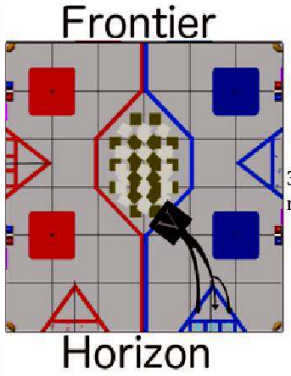
Joseph's Strategy for Autonomous Navigation Presentation



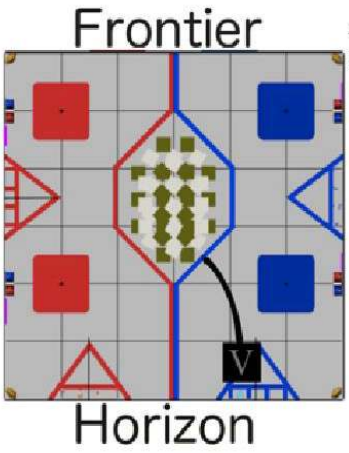
1.The V represents our robot Vera in a possible starting position.



2. Vera simultaneously triggers the jewel and scans the Vumark. It then heads toward the center to pick up an additional cube.

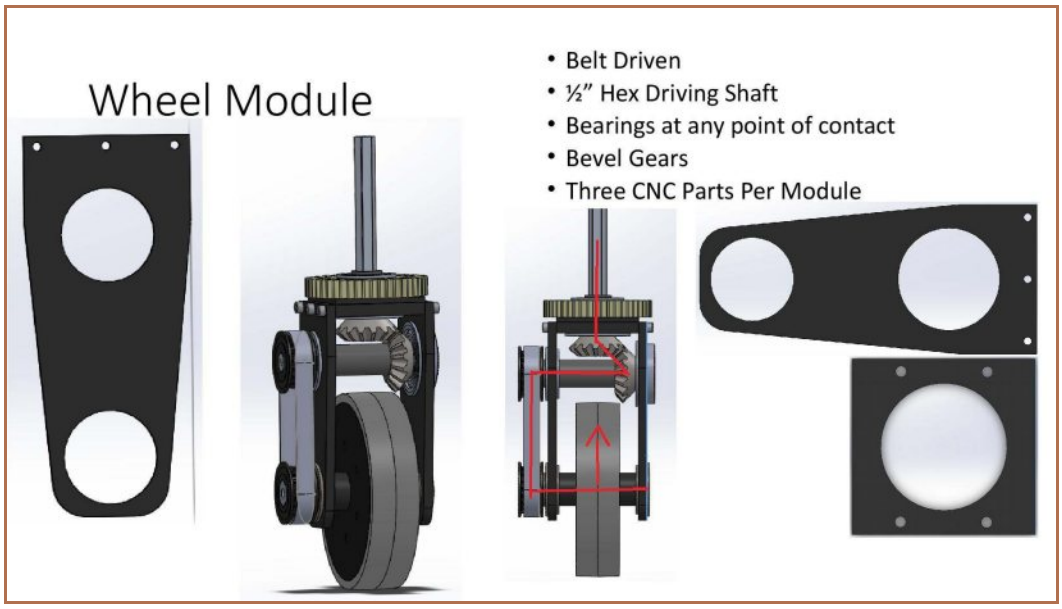


3. Depending on what the scan said, Vera places the cubes in the right, center, or left column in the criptobox.



4, Vera decides whether it has enough time, then if it does, it collects 2 more cubes. Then go back to step 3.

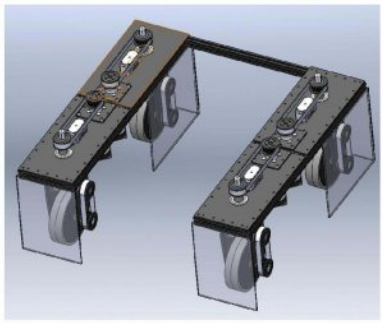
Ian's Swerve Drive Presentation



Drive Half

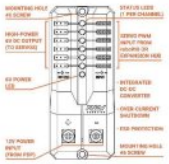
- Driven by Orbital 20's
- Servos control wheel angle, as if they were powered castor wheels
- Belts drive the whole system
- Module is held in by a single screw, for modularity, allowing easy replacement of a module
- Motor assemblies are also modular. They are held in by four screws, making it very easy to replace the entire assembly, or the motor itself.

Drive Train



- Very Modular
- Relatively Narrow Housings (~9" of free space between the housings)
-

Concerns



- Servos might not have enough power.
- Possible Solution: REV Servo Power Module (Boosts servo current to 6V)
- Lack of freedom with angular servos, and lack of position data with continuous servos
- Possible Solution: Absolute Encoders

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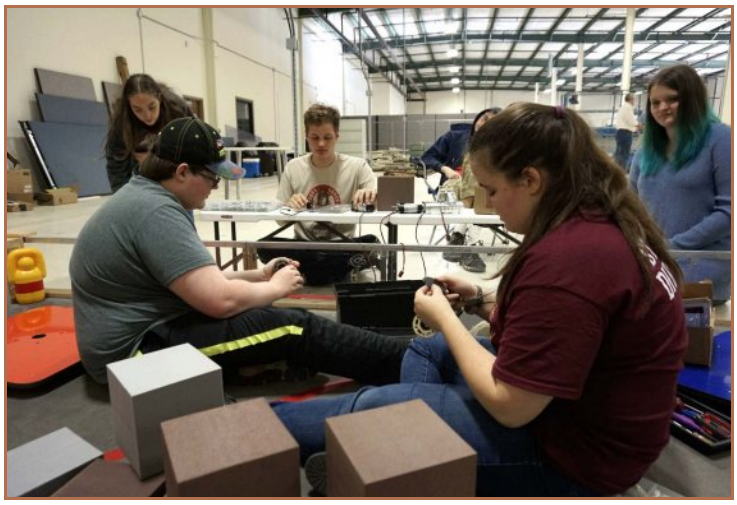
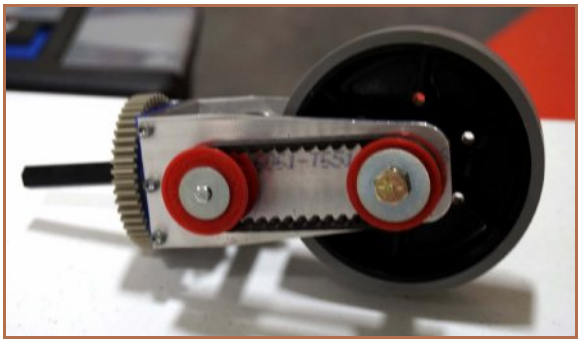
Date	Location	Start Time	End Time	Week #
November 17, 2017	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	11
Meeting Goals: Swerve Drive				

Team Members in Attendance:
Ian, Megan, Joseph, Patrick, Rosie

Tasks	Reflections
Glyph Collection System	Ian walked the team through the CAD drawings of the latest elevator design. This was significant, for he and Megan plan on gathering parts and beginning the assembly over the next couple of weeks.
Drive Train	Ian and Megan began assembling the swerve drive parts. The build team divided the drive train workload up between the members, allowing for more tasks to get done within the meeting time. First they put together the wheel modules and housings using the metal plates which had been cut at Calhoun. The two longer pieces connected to the shorter one with Tetrix screws. After that, the bearings and hex axles were added, attaching the stealth wheels on the bottom axle. On the top axle, a bevel gear that meshes with a second bevel gear was attached to the bearing at the top of the shortest plate. These steps were repeated for all four housings.
Autonomous Navigation	Joseph realized that getting autonomous working and making sure Vuforia works is more of a priority than OpenCV. So he worked on both his state machine and his presentation.





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Team 7842 Engineering Notebook - *FIRST* Relic Recovery

Date	Location	Start Time	End Time	Week #
November 21, 2017	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	12
Meeting Goals: Swerve Drive				

Team Members in Attendance:
Ian, Megan, Rosie, Brooklynn

Tasks	Reflections
Drive Train	Ian and Megan continued to work on completing the swerve drive train. Megan put together four different servo horns, using a gear with a 3D printed plate, which she attached to the gear using Tetrix screws and bolts to keep in place. Then, she put on the REV servo horn to the 3D printed part, using REV screws to hold it on. She repeated this four times. After that, she took two pieces of REV extrusion to attach our metal plates for the servos and motors. She placed two plates on the top of the extrusion and two on the bottom. Then added the REV servos. When she attached the servo horn, however, the screws would catch on the plate, so she had to add spacers to the servo to raise it a little higher to add clearance, allowing it to spin freely Once Ian put the motors, pulleys, and timing belts on, she took two Tetrix beams to keep the system together as a temporary solution, as we didn't have the correct size extrusion at the moment. After the drive train was finished, Ian started working on some rudimentary code for it. He is excited to really dive in with the Swerve coding and thinks it'll be a fun challenge.
Jewel System	Brooklynn's original idea was to put a color sensor on the end of a metal beam that is raised and lowered by a servo. This week, John suggested that we could simplify the robot and save a servo if the relic arm was used in the place of a dedicated jewel arm.