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ENGR 1182

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A18-Project Managements

1.R&D plan

Urban sprawl has created many problems for modern society. One of the most significant problems is moving people from suburbs to downtown cores in a manner that is safe, efficient, and minimizes the effect on the environment. And our team agree smart rail could be a good selection.

In order to build a perfect railway system, we must carry out a series of researches to create a scientific model. Our research and development of prototype would be based on our prototype requirements. In the procedure of this, we would try to satisfy all of the requirements. And our goal is to create a high-speed,efficient,safe,environmentally friendly and modern railway system model.

The first requirement is a high chip processing speed because it perfectly cater to our conception of "smart railway system".To satisfy this requirement, we would purchase an arduino Due chip. Then, we pull the testing code from github: https://github.com/PaulStoffregen/CoreMark. We would use a wire to connect our Arduino chip with our PC. Then, we would follow the instructions specified in the website to run the code and come out with a final benchmark score. The Arduino

Due chip would be possible to reach our goal. To be more specific, we will use the chip to connect the cabin with the " command center" and handling various instructions.

Besides the processor, we need to design our cabin. The requirements related to the cabin is the weight. The fact is that lower weight usually means higher speed under the same safety factor. After comparing the ratio of cabin's weight and volume,we set our goal of cabin's weight is 0.8kg. To reach this goals, we will use some aluminum alloys, such as 1060 Alloy, to make our cabin. According to *AZO Materials,* 1060 Alloy has a low density of 2.7g/cm^3, which is optimal for constructing our train cabin. [1] In addition, the shape of our cabin will be more aerodynamic for a higher speed.

The wheel, however, would be constructed using plastic materials. This is due to the consideration of reducing wheels' weight to increase acceleration. Also, the wheels are detachable so we can change the wheel as soon as it breaks, which is another reason for choosing a softer but lighter material. Plus, since our train may run on the ground, using metals may damage the floor or table. In our design, the wheel is in a weird shape that enable the model train to run both on track and on ground, which simulates our track-style real-world model. We would design the wheel using SolidWorks. Then, we would utilize the 3D printer in Hitchcock Hall to print out our train wheel. The reason why we use 3D printer instead of traditional way is that 3D printer can perform the task faster.

After constructing cabin and wheel, we would begin to assemble the model train. The electric motor, backup battery and transmission shaft would be be purchased, and we would install all of these onto our model train cabin. We would

choose a smaller motor because it is far from enough to power the model train. For handling some emergency issue, the backup battery system is a essential part in the cabin. As soon as power supply ceases, the chip on the cabin would take over the responsibility, and the backup battery would begin functioning.

In addition, a complete braking system is also necessary for a model rail system. Braking system will be designed to reduce danger.

Besides the movable parts of our system, we also have a static part of system, including the rail track, power supply and the processor controlling electric power.

For the track, we gave up the loop design. The underlying reason is that a train would derail if the bending part of rail does not have an enough tilt, but making such an tilt part and perfectly connect it with horizontal parts is extremely difficult, according to the manufacturer Andrew Wilhelm. Basically, the track would be made with a heavier material in order to increase its stability, and sticky glue would be applied at the bottom to fix it on the ground.

2. Testing schedule

*The result column would be filled after completing each of the objectives.

Date	Class	Objective	Time	Point person	Result
11/1	Project 19: R&D 1	Testing 2 Arduino chips	24 min	Chenjie Wu	...
11/4	Project 20: R&D 2	Assembling train cabin, transmission shaft and wheels.	30 min	Chenjie Wu	...
11/8	Project 21: Detailed Design 1	Assemble other components onto cabin.	35 min	Aaron Cox	...
11/12	Project 22: Detailed Design 2	Testing electric motor and transmission shaft.	25 min	Andrew Wilhelm	...
11/15	Project 23: Social and Economic Value	Assembling track and testing on-track performance of motor & transmission.	30 min	Siwei Zhang	...
11/18	Project 24: Prototype Vaildation.	Testing power supply, backup power and braking system.	25 min	Andrew Wilhelm	...
			Total: 169 min		

In these testing, we would invite members in other groups to see our test, and potentially we could get some feedbacks from them. We hope that they could recommend us another processor testing software after the first test, because we could not find another one. If they did provide it, we can run both our software and their software to build up more confidence of our chip's capabilities. For the train
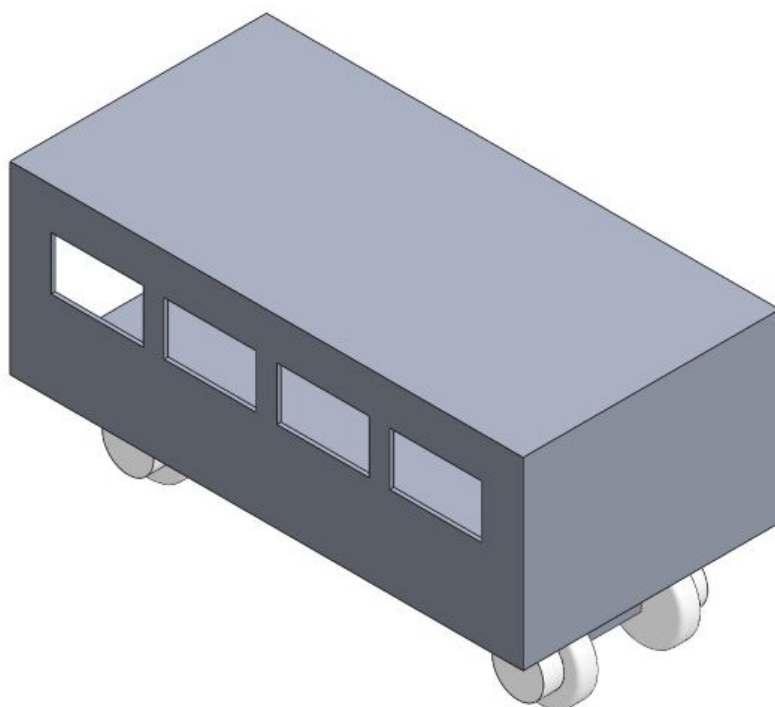
cabin assembling that would be done in Project 20, we hope that other groups' members can suggest a better design of transmission shaft and wheels, because Andrew said that the present design requires too much precision that he just managed to produce it on the machine tool after 2 failures.

3. conclusion

Our main conclusion that we hope to get from this prototype is to calculate the efficiency of our system. The equation that our team came up with is efficiency equals the distance on the track traveled divided by the power used. We hope to in turn determine an efficient amount of time for our system to travel time wise while not using an absurd amount of power.

Appendix

Model train:

Orthographic drawing:

| The Ohio State University First Year Engineering | Dwg. Title: TRAIN_ASSEMBLY | Scale: 1:1 | Section: 8:00 AM | Units: INCH | Dwg. No.:N/A |
| | Drawn By: GROUP B | Mass: 0.02 | Volume: 0.30 | Seat: 05-08 | Date: 11/1/2019 |