VDR3: Prototype

Team 506

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EML4551C: Senior Design I

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Current State of Design

The team's sponsor, Corning, is an original equipment manufacturing company that specializes in materials. The issue they are experiencing is that the short ceramic cylinders are falling off of the conveyor and breaking. The current device being used to mitigate this problem is an upside-down T-shaped piece of plexiglass. These Ts are placed on both sides of the ceramic cylinder to prevent it from tipping off of the chucks that it rests on. This design solves the damage issue but requires extra manual labor. The design is also too tall to fit in the return system and allow for proper imaging. This means that employees must be stationed to remove and add the T's as needed.

The team is tasked with producing a solution that not only prevents damage, but also minimizes the required work from the plant employees. The design uses a revamped barrier system that functions similar to the Ts. In order to comply with the conveyor constraints, specifically height, the device is collapsible to reveal the ceramic faces for an imaging station. This also allows for the device to fit into the return feedback conveyor system. This collapsing motion is done by the use of a scissor lift mechanism. The design includes switches on the pallet that will actuate the motion of the device. Four overhanging triggers will be installed on the edge of the conveyor; one on each side, for both raising the device at the beginning of the conveyor and lowering the device before the imaging station. This design allows the ceramics to be scanned during imaging and allows the pallet to fit into the return system. This will eliminate the need for the two employees to be stationed along the conveyor line.

Forecast of Future Work

The team has already begun working to select materials that are known to work in the conditions of the Corning manufacturing plant. The chosen materials will be verified with the project sponsors. Once the materials have been finalized, the team will begin the ordering process of the needed materials. It is planned to start this upon the return to class in January 2023. Once materials have been received, the team will begin working with the College of Engineering machine shop to manufacture the design and build the first one-to-one scale model.

While the machine shop manufactures the parts, the team will be working to create methods of testing the design against vibrations, dust, and acceleration forces. The team would like to simulate the vibrations of the conveyor that the ceramics experience. The team currently

has accelerometer data that can be used to ensure the simulated testing conditions are sufficient. In order to test the durability of the team's design, the team will be crushing up the ceramics from the previous Corning team and spreading them on the device. The prototype will then be operated and observed to see how it will behave and react to the dust. The final two tests the team will be performing is a tests of the amount of force the prototype can withstand. This will be validated by leaning weights on the device to measure the load capacity. The team will also validate that the device can withstand the ceramics suddenly hitting it from a stop or from vibrations. This will be performed similarly to the leaning force test but the team will jostle the pallet in order to simulate the pallet stop.

After evaluating these tests, the team will make necessary changes to the design or the materials. It is expected that this process will be repeated a few times, in order to improve the design as needed and validate that the design is capable of completing the desired tasks.

Identify Problem Areas

After considering the future work the team has ahead, notes have been made of areas that may cause issues with the design. These will be examined and resolved before the final prototype is presented on Senior Design Day. The first possible problem, of the scissor lift mechanism, is the force needed to lift itself to the appropriate height. The issue stems from the need to counteract gravitational forces and the mass of the components.

Another challenge the team’s design will face is resistivity under dusty conditions. The ceramic dust can wear away softer materials used in the design. This dust can also cause an issue by getting into any openings in the device, possibly obstructing moving parts. A third problem area is the force required to flip the switch that actuates the design. The trigger for the switch must be able to actuate the design without causing any damage or impeding the movement of the pallet.

The final possible source of issues identified was the team’s need to verify measurements regarding the height of the mechanism. As stated in previous sections, the mechanism is meant to be collapsible, in order to not interfere with the conveyor feedback system. The conveyor cannot be accessed by a team member, so the team is dependent on the sponsor to give accurate measurements of the conveyor.