**VDR3: Written Report**

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**Current State of Selected Design**

The prototype consists of a physical scaled replica of the selected concept and a digital twin created in SolidWorks. The SolidWorks model used some parts from the previous senior design team 522 to construct a simple assembly of the current state. T522 did not provide a full, accurate folder of SolidWorks parts, so many parts for the digital twin had to be created until the assembly was accurate of the current state. The major changes were then implemented, starting with mates between parts and the assignment of materials. Each part was ensured to be accurate in size, material, and placement. The implemented new components have appropriate materials but are marked in noticeable colors for simple viewing. The new assembly has a redesigned conveyor motor mount, new storage silos, an automated die alignment switch, a user-controlled claw for the output of the final product, and a new exit platform, as well as a Human Machine Interface (HMI) and Programmable Logic Controller (PLC). The physical prototype gives cardboard replicas of these changes clearly marked for viewing. The aspect of the selected design that has been fully implemented already is the redesigned conveyor motor mount.

**Forecast of Future Work**

Regarding upcoming work, the team expects to have all major mechanical improvements done by the end of March. This includes reinforcing the frame to avoid displacement in the bars, an updated gravity-fed storage system, any necessary material changes, and implementing the extraction claw. The Bill of Materials will be finalized with Rockwell Automation by mid-January so all ordering can be done as soon as possible. The major change to the design is the implementation of a PLC, which will require full demolition and reconstruction of the wiring and all electronic components that make the product automated. Each present electrical component must be evaluated to ensure it is industrially hardened and compatible with the PLC. A concise design must be present for the storage of the PLC and all wiring on the final product, as the present microcontroller is much smaller than the future one. The PLC will have optimal code by mid-March, and the code will be finalized by April. It is expected that extensive final testing on the PLC will endure through March and April. All wiring of electronic components will be completed by April, with an organized wiring diagram provided, as well as a simple user manual.

**Problem Areas**

The most notable problem area is the implementation of a PLC. The team consists of four mechanical engineers with limited education in electronics and no formal education in PLCs. There is significant progress to be made in understanding the language and implementation of the PLC. All electronic components must also be mounted on the machine in a way that does not detract from the aesthetic and transportability of the machine. The team's small size also poses a challenge in dividing the tasks to be done, as both the mechanical and electrical aspects of the design are significant. The user-controlled claw and automated die alignment switch are two systems of their own that must be fully designed and implemented by the team. The entire product must be visually appealing to the young audience, including the HMI, and should be easily digestible. HMIs are typically processed by users with some level of technical knowledge of the process being performed. In the case of the K-12 audience, it must portray the process in a simple enough way to be understood.