Wahl Clipper Assembly Optimization

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Abstract- To streamline production for Wahl Clipper Corporation, a testing mechanism is to be developed that can encompass a wide variety of different quality assurance tests. These tests include internal testing on the charging station current, the motor current and the motor voltage. The tests also include external testing the battery indicator light brightness. The testing mechanism will need to be adaptable to fit a wide variety of products from Wahl. It will also need to have a built-in mechanism that can quickly change the parameter tolerances. For example, larger units will require a larger charging current, so an assembly line worker will need to be able to change the set tolerance for the current test in real time, to avoid downtime in the production process. This testing will be done by modifying the charging station provided by Wahl in conjunction with an Arduino Mega to run these tests concurrently or in quick succession. The user will be able to see whether the unit passes all the quality assurance tests or needs to be discarded.

I. Introduction

In order to keep all units produced by Wahl Clipper corporation to the level of quality that the company has cultivated over decades of production, a unit will need to be produced that can run a wide variety of tests concurrently, or in some cases in quick succession. To match production outputs of larger clipper producers, a method is to be developed that will allow for workers to assemble units as quickly as possible, all while adding more quality assurance. In order to ensure all units are working perfectly, tests that were previously only done in the testing lab will be added to test all units to have even more checks and balances for the unit.

The unit testing will be best understood as internal and external testing procedures. Internally, the motor current, the motor voltage and the current produced from the charging mechanism. This will all ensure that the unit is properly receiving power, charging appropriately, and then being able to store this power for an output voltage. All of these are tested internally and have output parameters that can be changed or narrowed down as shop floor usage gives the users a greater idea of the proper tolerances. The unit also has a variety of external testing procedures, and this system will incorporate one and have infrastructure for more. The unit will test the brightness of the battery indicator light. The battery indicator light test will confirm that when the eventual customer has the unit, they will be able to see how much battery is remaining, or when it is time to charge the unit. The unit will also need to be able to effectively adapt to fit different models on the assembly line. This means not only being able to adjust testing tolerances, but also having adaptable units that can fit different sized clippers.

II. Mechanical Design

One of the main goals of the system is to remain modular while creating infrastructure that can house current tests, while making it possible to add tests for units created in the future. The best approach to that will be making every component of the system removable and adjustable to fit any size clipper.

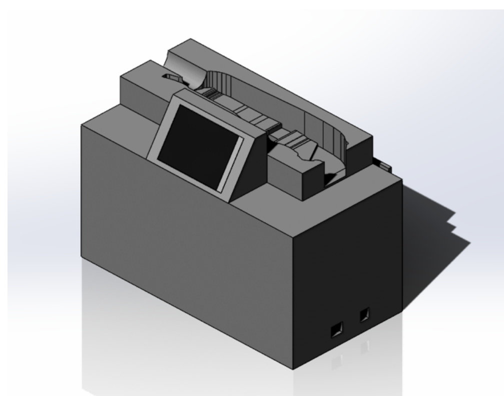

Figure 1: Testing Station Model

The mechanical design can be broken into two main components, the stationary part and the removable portion. The main box and the Arduino screen are stationary and can't be removed. These will be the same for each system, so it will save space and money for Wahl to be able to keep one main base unit and just adjust for different models. The other part of the system is the removable clipper holder. The clipper holder is built for form fit the clipper geometry, while leaving access to the charging port. The clipper holder has four vertical locaters that drop on to the stationary portion of the unit, that has extruded poles that will keep the clippers in place will in use. By making this component of the testing mechanism modular, it allows for all different sized units to fit on the top of the testing dock, as well as allowing for future models developed by Wahl to work with the testing mechanism.

III. Electrical Design

All components of the electrical portion of this design run through an Arduino Mega that is placed within the box portion of the unit. The Arduino Mega is connected to an LED shield monitor through a combination of jumper cables, that allow for the output screen to be easily viewed by the user. The Arduino allows for all of the tests to be run, collect the data and then produce a pass or fail output to the user.

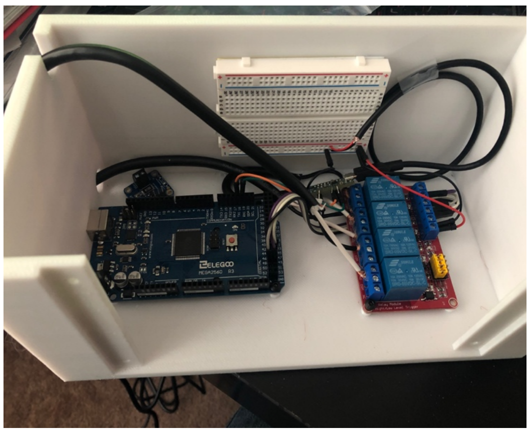

Figure 2: Internal Arduino, Relays and Bread Board

The system utilizes a modular relay to start the testing process. This is accessible by simply pressing a button on the box once the clipper is plugged in and sitting in the holder. The start button activates a code that is intentionally built to have the proper amount of time between tests, that allow for the tests to be cycled through as quickly as possible without causing an error for overlapping or conflicting tests.

Three tests are done through the internal computer in the clipper. The charge current, motor current, and motor voltage can all be found using the MCU and coding program TerraTerm. The code will pull information on all of those internal tests and confirm that they are within the predetermined tolerance range, and then giving an output to the user on if that particular test was passed.

The light sensor test is built into the top of the testing unit, but with all of the connections to the Arduino system within the box as well. The system will activate the unit to move the blades and to activate the blue indicator light located on the base of the unit. Both individual sensors will collect the information and confirm with the system that the values produced are within the spec.

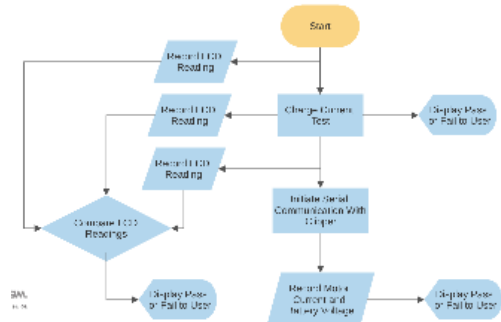

Figure 3: Program Flowchart

Above, in Figure 3, is a program flowchart that explains the logic of the system and all of the checks and balances in place to make sure all processes are done in the correct order and how the results compound on themselves.

Finally, one of the most important parts of the system is a failsafe for users who are prone to error. The testing mechanism is built to be able to have the unit prematurely removed without ruining the testing station. The unit will simply cycle through and be able to start up again with testing with the next unit. This is critical so offset the possibility of errors ruining the entire internal component of the design.

IV. Conclusion

The optimization system will save a considerable amount of time for Wahl, all while increasing the quality control of each product. The worker will be given immediate feedback on the unit they just put together and can confidently set aside functioning units for shipping. The system will continue to be optimized as continued shop floor testing will help the users become more familiar with the process, and more data will allow for tolerance ranges to narrow down. The testing mechanism is also purpose built to allow for engineers to continue to add quality tests. New tests can be ran through the same Arduino board, taking advantage of the infrastructure in place and the modular nature of the testing unit.

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