Access Solutions Check-In Station

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Background

Power turbines are large, complicated pieces of machinery that require regular maintenance. Every 18 months the turbine is taken offline, disassembled, and meticulously checked to make sure all parts are in working condition and to replace parts as needed. When maintenance is completed, the turbine is reassembled and put online. Dismantling parts of a turbine requires the use of many tools, some of which include small parts, such as springs or screws. Rags are also used to keep things clean and plug pipes where small parts could enter. If any foreign material is left inside the turbine when it is reassembled and put online, then the entire unit will likely be severly damaged in an instant.

Access Solutions' serves the power industry by providing foreign material exclusion (FME) accountability. FME is the process of preventing or removing all unwanted materials from an area of interest. Currently, Access Solutions performs FME by sending trained personnel to each site to record all tools and gear entering and leaving the worksite. To reduce costs and expedite that process, Access Solutions proposed a self-check-in station where a worker can log their own tools and gear using a computer program.

Figure 1. Power Turbine During Maintenance

Figure 2. Access Solution's Current Method for FME

Objectives

Create a compact, weatherproof system that allows workers to complete the FME process on their own. This would consist of a check-in station that would track users and tools, as well as take pictures to record tool conditions before and after entering the work site. The design must include:

- A computer to run Access Solutions' FME software (FME STARtrac), and the security camera software (Milestone)
- Two IP security cameras to monitor workers and picture area
- An RFID reader to scan workers' helmets and check in tools, rags, and barriers
- A microphone, speaker, and help button to communicate with a remote help desk
- An uninterrupted power supply to allow the system to perform a proper shutdown in the event of a power loss
- A large hard drive to store data from the security cameras for each work project

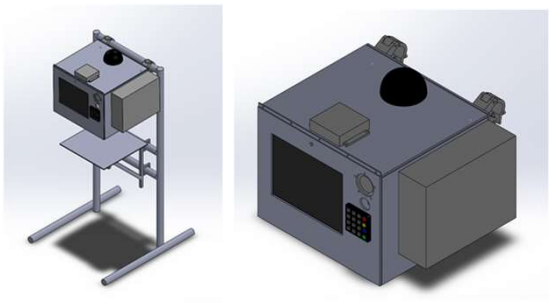

Figure 3. SolidWorks models of the final design

Prototype Design

After brainstorming and designing several different conceptual solutions, the final design consists of a box-like waterproof housing that can be attached to pre-assembled scaffolding on-site. The electrical components such as the computer, RFID reader, and wireless router are housed inside the box, while the screen, keypad, and RFID antennas are attached externally.

The computer runs two programs. The first is used to keep track of all tools and workers entering and exiting the worksite, and the second controls the security cameras which are connected to an online database. The keypad will be used to interface with the software. Each tool, rag and barrier will have an RFID tag attached to it so that it can be quickly scanned in by the RFID antennas and recorded by the computer.

Worker Check-in Operation

1. Scan RFID tag on helmet
2. Confirm sign-in information
3. Scan a tool/rag/other piece of equipment
4. Take picture(s) if needed
5. Repeat steps 3 and 4 until all gear has been recorded by the system
6. Exit the check-in menu and enter worksite

The checking-out process is essentially identical to checking in: scan helmet, sign in, scan and take pictures of all equipment, and then exit the menu when finished. If all items that entered the worksite with the worker are checked out, then they are free to go. But if any items are still checked in, the worker must go find the missing item before leaving the worksite. This is the crucial part of the FME process. Site supervisors will be available for assistance if a worker is missing tools or equipment.

At any time during the check-in/out process, the worker may press the help button to pause the program and be connected to a remote help desk for assistance. Communication will occur using the built-in speaker and microphone in the station.

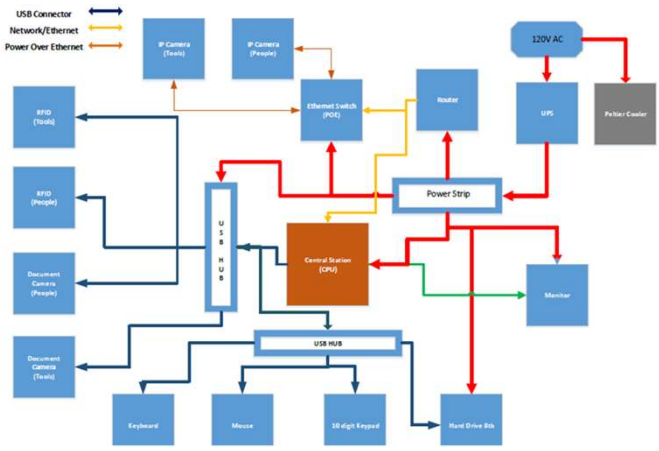

Figure 4. Check-in station connections

Future Improvements

Figure 5. Home Screen of FME STARtrac Program

Suggestions for Production:

- Order some custom-made parts for this project, specifically the keypad and speaker unit. For mass production, this could be more cost-efficient as well as the parts designed would be a better fit for the product.
- Change the material used in the outer casing. The prototype is aluminum, but it is heavy and bulky. Something like injection-molded plastic would not only be lighter and easier for transport, but also cheaper for mass production.
- Integrate a removable RFID reader and camera to enable the check-in of items too large to fit under the current system.
- Modify the table used to set tools on for photographing. This prototype has just a single sheet of HDPE plastic (the same used in many kinds of cutting boards). In the future, it would be optimal to create a table that can integrate trash cans for dirty rags and other disposable items.

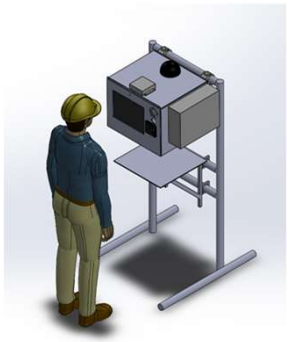

Figure 6. Final Prototype SolidWorks Assembly with 6 foot tall worker

From L to R: Matt Montgomery, Keenan Louis, Fabian Jimenez, Ryan Hance, Caleb Moss

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