

Michigan State University College of Engineering

Smart Gate Security

Design Issues

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INTRODUCTION

While designing, creating a prototype, and testing the Smart Security Gate many design issues were encountered. Of all the issues encountered, the most critical issues were built around product liability, cost, life cycle and safety. Some issues are evident in the prototype, while others are long term concerns that could affect the final product. Since the device will be used hundreds of times in any given day it needs to be strong and robust. While the team worked hard to address any potential issues as early as possible, some specifications were not mentioned until later on. As a result, the team did not give consideration as early as they should have for certain aspects of the design, causing setbacks.

PRODUCT LIFECYCLE MANAGEMENT

During the development and design phase, a lot of time was spent compiling a set of criteria that would optimize the efficiency and functionality of the gate design. The goal was to develop a budget that ArcelorMittal could use against project bids to ensure cost effectiveness. The bulk of time was devoted to these key areas: lifespan of the product, the overall cost, and the size of our design.

The lifespan of the product is extremely important because it will be used multiple times every day, and it needs to function properly every time. If it is not functioning properly every time, then there will be a loss to ArcelorMittal. Failure to function correctly could result in the gate remaining open, or not opening at all. If the gate remains open, extra security staff will be needed to secure the premises, costing extra capital. If the gate remains down no one would be able to gain access to the plant, preventing work from being done. Both scenarios are unacceptable to the sponsor. Therefore, the group considered functionality as a top priority. Reevaluating the current design, all the devices were put on battery backups so, in the case of power failure, personnel are able to gain access to the facility as necessary. Many IT departments place servers and switches on

power backups. The only ones that will be needed in our design are local to the location it is being implemented.

After the initial site visit with ArcelorMittal, cost was one of the forefront factors in designing the new gate. While gathering the crucial components to the designs success, a large effort was focused on integrating with their current systems for the cheapest cost. However, since many of the major components are already implemented around ArcelorMittal, it is hard to keep cost low. This not only included using the RFID reader and central server that was already located at the ArcelorMittal Information Technology Department in Chicago, IL but also using their File Transfer Protocols with Internet Protocol (IP) Cameras. Therefore, the group learned that in order to cut cost, functionality would have to be sacrificed. Since the Matrix System and File server are shared between plant facilities, this would make up for not sacrificing the cost of the IP Cameras. With these decisions being made, the group realized quickly that a balance needed to be created between the necessities and the luxuries to provide the ultimate design.

The last thing that was considered was the overall design of the gate. As stated above, there will be a lot of vehicle traffic going in and out of the gate. Therefore, there will be three entry gates and two exit gates. All gates will track what personal pass through therefore; all gates will need all aspects of the design. This allows for the tracking of personnel in and out of the plant to verify that everyone present is there for business purposes. With these constraints being stated, it is important that everything is small enough to implement the given space. Luckily, we were able to easily solve this since the gate motor housing can be used for storing the processing portion and battery backup. Depending on which facility is being upgraded to the new gate, the overall standards and desired number of gates can be modified.

PRODUCT LIABILITY

When dealing with devices that are used throughout a large company, the contracted company is held liable for any malfunctions that arise after installation. These can be functionality, network or security flaws, which will significantly decrease the overall liability of the product. As a device that is designed to secure premises, the assumptions need to be met with the design. The correct information needs to be read and recorded simultaneously, so a Service Level Agreement (SLA) is not broken between the vendor and the purchaser. One issue that can be faced with using separate devices is them becoming out of sync or one or the other stops working. One example of this is if an authorized Identification Card is scanned by an unauthorized individual, and the camera is not working, a visual of the person is not obtained per something going wrong. In future designs, it would be beneficial to incorporate a central piece that uses both the camera and reader simultaneously. In this case, both would be functional at any given time. Since ArcelorMittal currently uses two separate servers and two separate policies for RFID reading and video recording, the interfacing of both devices together was not built into our design.

Another contributing factor to the overall liability of the device being intercepted is the use of multiple brands and policies. Currently, there is no set model camera that is used across the plants. Though there is no standard model, there are certain brands that are used across the different plants company wide. If ArcelorMittal narrowed down and standardized its cameras not only would the overall gate design be simpler, but more cost effective, due to the larger quantities being ordered. However, the RFID reader and server have become standardized throughout the enterprise which would not change a design update in the future.

Future add-ons that could cause liability issues would be biometrics. This functionality would provide an even more secure entry point for employer use. With

biometrics, there is a learning curve from getting all the employees enrolled to ensuring that it can be used no matter the condition. For example, if a fingerprint reader is implemented in the design, the employee will probably enroll their index finger. If over the weekend an employee cuts their index finger, it now will require a bandage and now that employee's fingerprint cannot be read. In this case, it would be important to enroll multiple fingers that ensure efficient entry. As this biometric feature would be used daily, employees would be more accustomed to it. It would become similar to riding a bike where the more you do it, the easier it becomes. As time passes they would know where to place their finger or look in the case of facial recognition. However, this would not be the only option for entry, but be a backup in the case of forgetting an Identification Card at home.

These higher technology solutions provide a more efficient solution for the company. This is very important in the coming years when the workforce becomes more technology savvy. When designing and developing the project, the group primarily focused on the fundamentals of the project; the RFID reader and activating the motor which controls the gate. Aside from this, the more technological and security focused aspects were focused on when creating a working budget for ArcelorMittal.

PRODUCT SAFETY

After the first meeting with Cliff and other members of ArcelorMittal, it was quickly learned that safety isn't a concern, but a way of life for ArcelorMittal and their employees. They address safety concerns at the end of every meeting if not every day, which is very important in these large steel mills. Therefore, in the gate design we want to ensure that drivers do not need to exit their cars or the gate is not coming down on their car prematurely and damaging it. Some of these issues can be addressed by being categorized as either an electrical or technological issues. These can be encountered on any given day and it is the group's goal to bring these to an all-time minimum after implementation.

ELECTRICAL ISSUES:

When designing a product like this, there are many electrical things that could potentially cause issues. These electrical issues are rare but are very important to monitor. When using a backup battery supply, the battery is cycled to a usage state and then swapped back to a charging state. During this charging state, the battery has potential to overcharge or explode. This explosion could damage the design, or hurt someone.

As it was discussed above in the cost section, this is part of the balance in order to provide the utmost safety to the facility. Therefore, cost does not need to be sacrificed in this step. This being said, a battery backup from a reputable company, like APC, will be purchased for the powered parts of the design. Another option to provide ultimate safety is to build an enclosure that houses only the batteries. This separation will protect any of the other components in the gate housing if something were to happen to the battery.

TECHNOLOGY ISSUES:

The second safety issue of the gate security project is the use of technology. With the complexity of the project, there are many IT platforms being used. These platforms include Ethernet connections, file servers, FTP protocols, and a Matrix Server. When one of these components is not working, it becomes an incident that can be categorized as critical or normal. The critical ones would be the Ethernet connection and Matrix Server not working. An incident is classified as something that impedes the operation or sole purpose of the device. This is because the designs can then not function and operate on a daily basis. However, if the FTP protocol or file server is not working, operation can still continue and the security will be slightly less than if everything was working as it should. This could also occur if one of the devices breaks and a replacement is not on site, but needs to be ordered. If any of these problems are encountered, not only is the entry for employees not safe, but are the grounds of the plant.

In order to increase the safety and ensure that none of these incidents occur technology stack, which is the entire infrastructure that backs a company and enables productivity, must be evaluated. Evaluating each component can ensure that the matrix

system is on backup because of the complexity of the system around the facilities. Many doors are restricted access and only accessible by personnel with a valid identification card. However, we want to make sure that switches (Ethernet and fiber), and the file server are all on backups so in case of an emergency they can still be accessed and are not improperly shut down in the case of a power outage. Looking at the local devices that will be on battery backup, we want to ensure they are rigorous enough to withstand the elements. Therefore, we will want to use a shielded Ethernet cable for the camera and the controller. This shielded Ethernet cable is important since it can not only withstand the elements but temperature change, and is thick enough where if any animals were to gain access to any part of it along the way it would remain unharmed. It is important to pay attention to these technology issues to ensure the premises and employees remain safe.

CONCLUSION

Many of the issues that were discussed above were addressed early in the game, but some of them were not. The issues that were discovered early on could be addressed in the design of a new gate. Then time could be focused on eliminating these risks or failures in a final design or prototype. Due to not having a clearly defined product at the beginning, some of the attention had to be given to the new specs as they came up. As the gate security project was developed, discussion and time went on. The team was able to address some items that could be improved or appended to the design in the future.