I. Introduction

During a school shooting security is the first object to slowing and preventing deaths and injures of students and staff members. The first step in this process is to have the teachers run lock the door and gather any students that are standing near the door to clear the halls before the shooter can take any lives. After this they are informed to turn off the lights and block any vision into the room from the hall.

The problem with this is that in recent school shootings that the shooter is blowing out the window and unlocking the door giving him access to the room. Also if a student or staff member is found to be trapped outside the room that they have no secure place to go. How do we protect students can staff trapped out of the room and from the shooter from not blowing out the window and gaining access to the room?

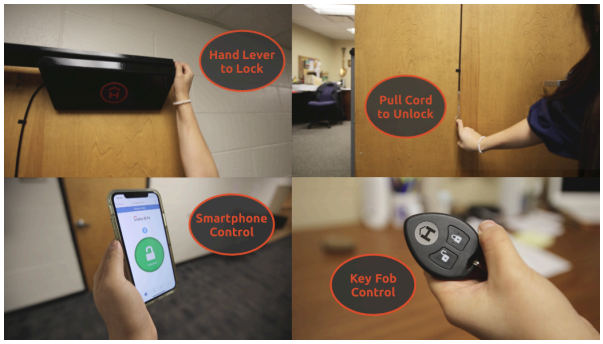
The prototype was made from an aluminum block that was 3 inches wide by 1 inch tall by 1 inch thick. I then had to cut this into a wedge shape that on the short end was 1⁄2 inch tall and the tall end to be a 1 1⁄2 inches. After this I milled the piece to get them as close as possible so that they would not have more force on one side than the other. This then had to have a frame that would be able to hold two of the three piece parallel to each other. This then was mounted by 4 screws and the third wedge piece was fitted with a 1⁄4 inch thread so that I could attach a 6 inch long rod to it and run it to the other side of the frame. After this the threaded nut would be screwed down to force the wedge under the door and cause more friction with the ground to not allow the door to be opened or even moved.

Through the first round of testing where I took two college students and a teacher and gave them the prototype with no instructions on how to use or apply it only that they had to find a way to lock and stop the door from moving within a 5 minute time limit. Student one started off by applying the door jam correctly but struggled to attach and get door closed before his time expired. Student two started off my not knowing how to apply the prototype. After about two minutes of messing around and trying to understand he was able to get it under the door and apply the prototype but had a hard time getting the tightness of the nut to be able to stop the door from moving. As for the teacher the understanding and application of the prototype seemed to confuse and just frustrate and was also unable to be able to apply and control the door within the 5 minute time limit.

The group then was given a short walkthrough of how the product was to be applied and used within this short time frame. This short walkthrough was useful for the understanding and application of this. Student one was then able to apply and tighten the wedge to a point that the door would not open. This was also true for student two but the teacher was not able to tighten the wedge to the point that the door would not open.

Section II

As the active shooter is walking around the halls trying to get into rooms. While students and staff have locked the doors and now people are hiding and waiting until the police can stop the shooter and clear the building. But, are locks enough? What if you are in a room where the room cannot be locked from your side of the door or the shooter breaks through a window on the door and unlocks it. Is there a way to stop the shooter from gaining access to the room can we make something that will be able to stop the movement of the door no matter what side of the door you are on?



The existing technologies for this problem are key fob door locks that will close and lock the door with a click of a button. But, the problem with this technology is that only the teacher has the key fob and if she is not in the room to use this then this product is not able to be used. This also fails because of the fact that is only is able to be used on doors that have this on it and is not able to control both sides of the door only the side that does not have the product installed on.

With this second product this is something that has to have modification done to the floor and is also useless unless the teacher is there to be able to apply this product. With this it only controls one side of the door and if the shooter is on the side that has this product on attached to the door that product is made useless and not able to be used effectively.

The stakeholder groups that would be affected by this product are students, teachers, and first responders. These students would be from any range from kindergarten all the way to

college students. As for teacher this would be any teacher or even any staff member that would be in a room during an active shooter situation.

The group that I will be focusing on the most is teachers because the teacher is the leader of the classroom and that leader is the one tasked to lock down the room so that students will be save during these shooting or lock downs.

Section III

Stakeholder Personas

Some of the important characteristics of the users in the system is that the door needs to be locked and that the number of students in the classes could be all the ones you have on your roster and that are here. (coming from a teacher in Connecticut)

Eli a Hough high school student talked about the drills that they go through during an active shooter situation. This has came up after a recent shooting in charlotte happened and a high school. He says that the drill is very similar to just a lockdown but it is never done during a lunch time of during class changes. He explains that he thinks it is do planned to have this kind of drill and needs to be done at random times to get people better experience.

Local berry police talk about the ability to escape the room in case of a fire that the shooter has started. This is something that can be very unsafe if not done correctly and could cost people their lives. But, that it is key to be able to secure a door for a long time period so that police are able to be capture that shooter and stop the event.

Task Analysis

The most important task that is happening in this problem space is that the door gets locked and know who is in the classroom. For most is it a very close to being the same but some doors are locked by fob and other ways of locking the doors which has to be unlocked when there is an all clear.

Some of the strengths of this is being able to see who is in your room after you have locked the door also that the people in the room know the door has been locked.

Some of the weaknesses of this is that students can get locked out of the room in which they will not be able to get back into the room and they will be stuck closer to the shooter and have nowhere to hide also that the assumption that the shoot doesn't know how to make a door down with a deadbolt on it.

Opportunities that are shown is to find a stronger or more effective way of keeping the shooter on the other side of the door. Find a way to be able to stop the shooter from getting into doors where the he/she has the control of the lock.

This task is in a high stress environment because this would be taking place during an active shooter. This mean that it is very time-sensitive because you have a very short amount of time before the shooter could be at your door. Some of the surrounding infrastructure is that you do have deadbolts on the doors. Some of the technology that is out right now is key fob door locking, door jams, and piston driven locks. This would be just students and staff members that would be in the environment that I am focusing on.

Hierarchal Task Analysis-

-Step 1: Id that a shooter is on campus or coming to campus.

-Step 2: Sound the alarm so that teacher and students know to get to safety because of a shooter

-Step 3: Lock doors, block the view into the room, and turn of lights

-Step 4: everyone move away from windows and door and be as quiet as you can.

Social Impact

Having another way to keep people safe in a time of need and fear is something most people agree with. It is a way to feel a little safer in this crazy unbelievable time that these people are going through.

This does threaten other technologies such as door stops because this prototype is something that is different and that it works on both sides of the door and not to just focus on the one side of the door. But this does not threaten the technology of what a normal door has on it as in a dead bolt and then also a knob lock. This does cause for a change in standardization not for how a door is made or how big the gap would have to be on all doors but it would change the standardization of the way teachers are to lock down a door this is something that seems like it have not changed in a long time and with this prototype you could have to change the fact that you have to slide a part around the outside of the door so that you can lock the door down using the double sided door jam.

Problem Conclusions

Through my finding I found that fear is a very big factor in all of this. So something that could be made need to be something that can be in very quickly done and then be also done is someone is very scared and fearing. I will have to find something that could also be done by anyone just in case of a situation where a teacher is no longer able to perform that action.

IV. Design

Design Alternatives

Double Side Door Jam

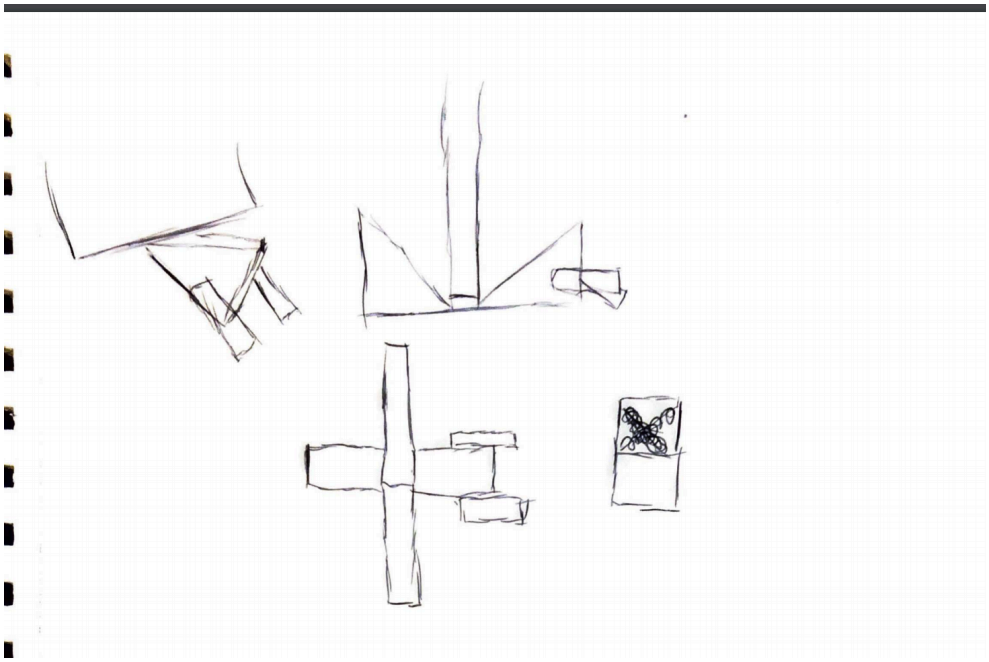
System information

With this Hardware based Design Alternative the user would be able to control the door and convert it into something that would not be able to move (like a wall). By doing this it could

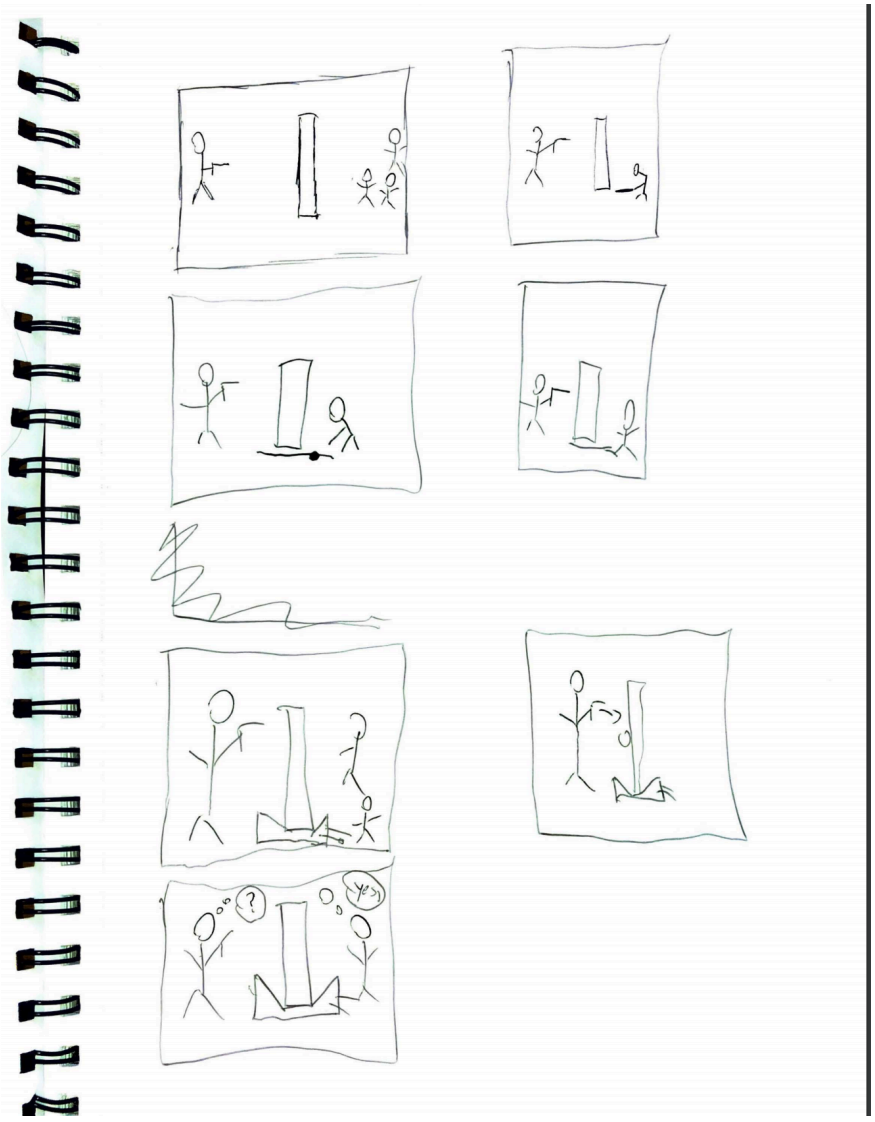
slow or even provent a shooter from entering a room. Also, it would allow the user to be able to turn any kind of room that had a door into a safer place.

The hardware needed for this are:

- Heavy Springs
- 6 Overlapping Metal pieces
- Metal base piece
- Foot Lever to activate Springs to move Metal Pieces
- Release Lever to allow springs to be undone



Storyboard



How the design meets usability Heuristics

This design would meet the design Heuristics of Aesthetic and Minimalist because it would over very few input and only be able to be used in one way. By having only to inputs and a visional information that it is active and working. This would also work as the clasificacion of Flexibility and Effectiveness because, it would allow for more than just classrooms to be turned into safe spaces and would allow for a speedy set up. It would also allow for user to be creative in the places that they are able to set up shop and project themselves.

Strengths

- Adaptable
- Quick

- Useable
- Easy to use
- Able to be undone quickly if needed

Weaknesses

- Shows that someone is in room
- Still be able to be see in room if there is a window
- Could get stuck or locked up if spring are to powerful

Key Fob Door Shield

System information

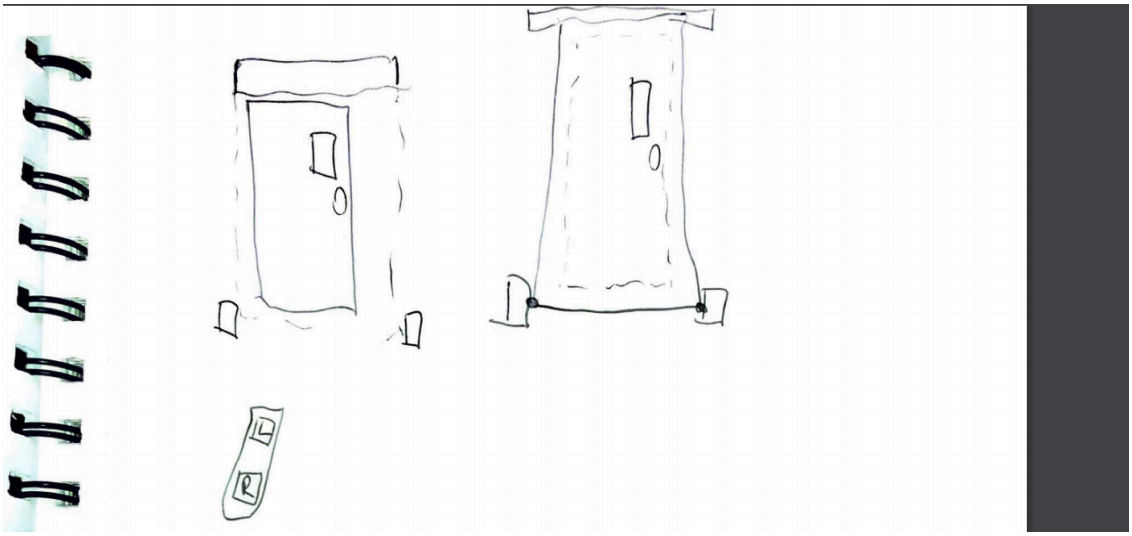
With this Hardware and Software Design Alternative it would allow staff to control their Door Shields and only theirs in an active shooter situation. This would allow for metal panels to slide down in front of the doors and block visibility and turn this door into a non movable object (like a wall). This could be released by and allow to be opened by the staff member or by the police once active shooter is caught or no longer a threat. It would allow the teachers to be able to unlock and be able to escape incase of a fire.

The hardware needed for this are:

- Metal sliding door
- Key fob
- Locks
- Handle
- Manual release

The software needed for this are:

- Alert system
- Key fob
- Two buttons
- Lock code
- Police master key fob



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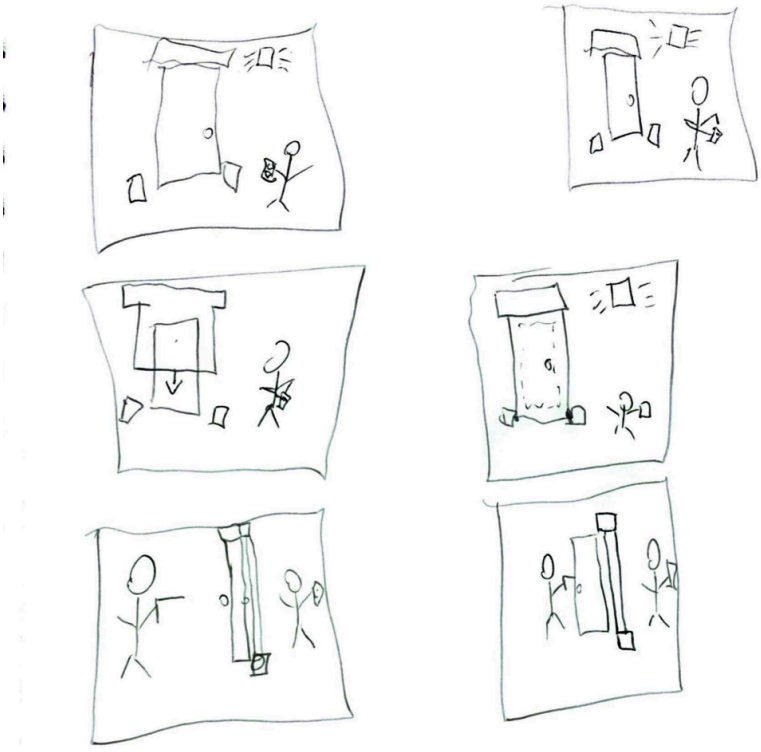


How the design meets usability Heuristics

The design Heuristics of Aesthetic and Minimalist would be meet by only allowing for two buttons to be pushed one to lock and one to release. Also, the design Heuristics of Flexibility and Effectiveness would be meet by being quick and fast and would allow for someone to unlock

and run if the chance is there. This would both teachers and students to be able to use this key fob in the right situation.

Strengths

- Speed
- Easy to use by all users
- No visibility
- Extra wall
- Releasable

Weaknesses

- If locks fail would be able to lifted up
- Could trap someone if user cannot lift open door
- If could trap shooter in room if it is a staff member

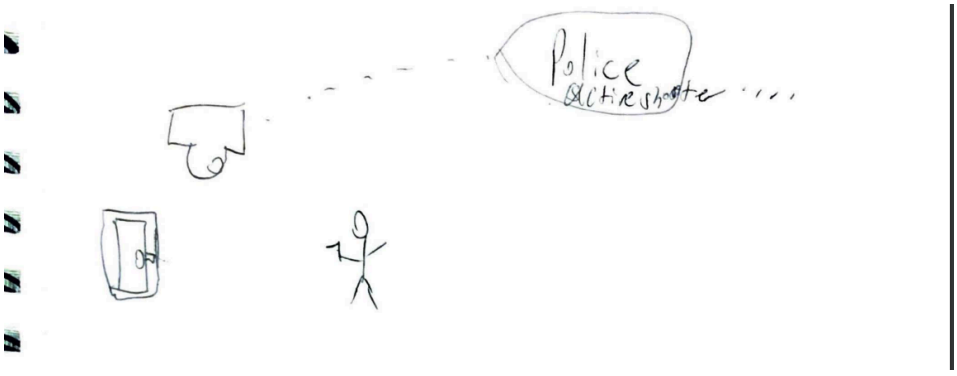
AI Based Camera

System information

With this software based Design Alternative would be able to look and see if someone had a gun in hand and would be connected to all the doors and be able to lock and tell police member where the shooter is. This would be also allow for it to take a photo of him and be able to give a image of what he/she looks like and what kind of weapon the have in hand. This would allow for fast and speedy lock down times.

The software needed for this are:

- ***AI***
- ***Image capture***
- ***Connectivity to doors***
- ***Connection to police communication***
- ***Knowledge of where in the school each camera is***



Storyboard

How the design meets usability Heuristics

This would meet the design Heuristics of Aesthetic and Minimalist because it would have no human input into it and would allow for user to focus of getting to safety. It would also allow for Flexibility and Effectiveness because the more it learns the faster it would be able to understand what is happening. It also allows for users to adapt it be able to allow other to understand where the shooter is. This would allow for people in the danger area near the shooter to be able to know not to run but people not in the danger area that they can make a run and what way to run to safety.

Strengths

- ***No user***
- ***Speed of police notification***
- ***Speed of locking down school***
- ***Locating shooter***

- ***Allowing users to know where to move to for safety***

Weaknesses

- ***Could lock students and staff members out of room***
- ***Could trap shooter in room with students and staff members***
- ***Could trap students and staff member in case of fire***

Design Considerations

From my design consideration I am going with the double side door jam. With this design consideration after talking with Zane I will be adding a clap to this so that the user will be able to tighten the two door jams closer together and increase the tension strength of the jams. I am also going to explore the idea of not having something that slides under and pops up but that it is places on the door when it is still opened and before it is locked.

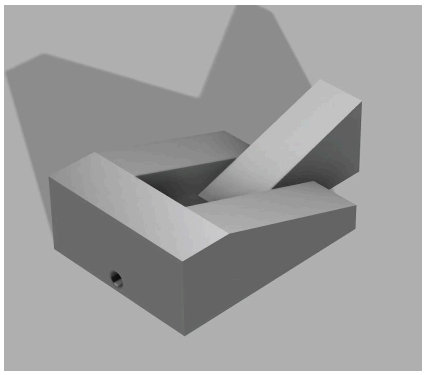
Work Plan

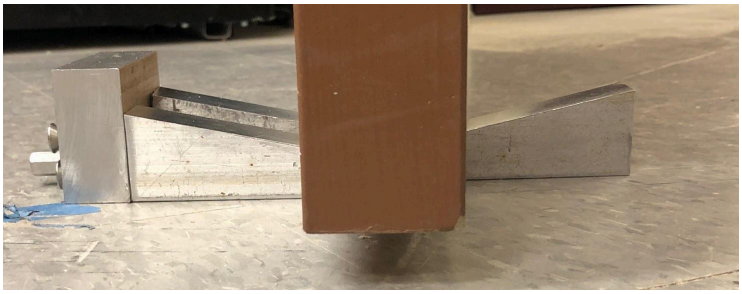
- Week one
    - Finalize design
- Week two
    - Order parts needed
    - Start to build and work on putting design together
- Week three
    - Test prototype V1
    - Gather feedback and then redesign what needs to be changed
- Week four
    - Order new parts
    - Rebuild what needs to be redone for V2
- Week five
    - User testing
    - Get feedback
    - See what needs to be fixed
    - Maybe see if I can redesign

V. Prototype

Design Specifications

Hardware renderings:



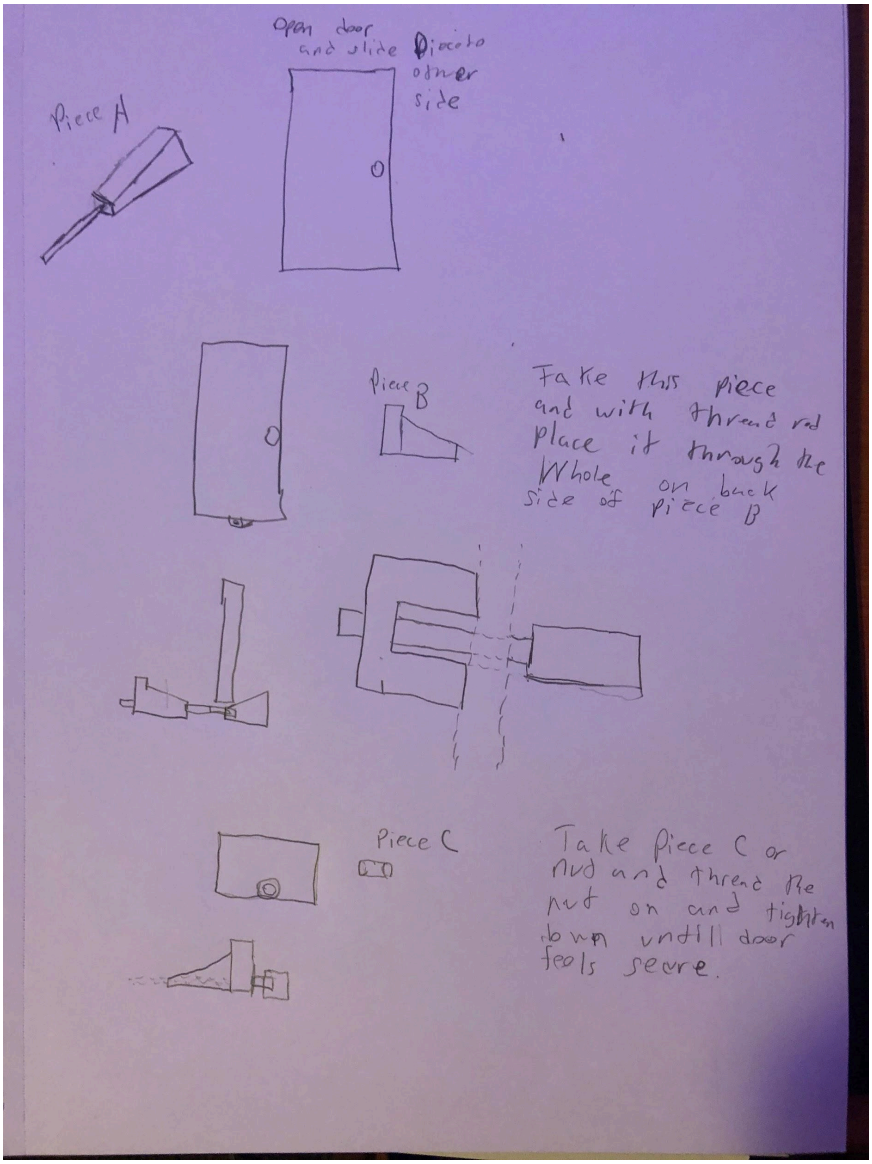


Prototype

The doubled sided door jam is made up of 5 pieces of metal to make a wedge that has a threaded rod on the lower end of the wedge. This rod is then ran to the other side where there are two wedges that are attached to by a single piece of metal to hold the two wedges together. The threaded rod is then placed through the hole that is through the piece that attaches the two wedges that are on the side that is on your side of the door. After that, the nut is then placed on the rod that is sticking out of the hole and then tightened down bring the the 3 wedges together and then causing the wedge to be pushed down and then causing the wedges to increase in the amount of frictions and causing the door not to be able to move or limit the movement of the door.

The Heuristics of Aesthetic and Minimalist was used in this to make it less confusing for users to us but it had to be demoed to me effective in the use of this. Once someone was able to understand that process in which they are to use this product they were able to attach the piece within a minute and then was able to screw the nut of the back in depending on the height of the gap at the bottom of the door. The Flexibility and Effectiveness of this prototype was also tested in this being able to have it fix on many door and not have a problem was something that I wanted to solve but sadly there are some door that the gap was to tall or too small to allow the door jam to be able to be applied. This came up within the user testing that I did and found that I need to make a few changes to the design so that the I would be able to meet the design heuristics that I gave myself.

User Manual



VI. Evaluation

Through the first round of testing where I took two college students and a teacher and gave them the prototype with no instructions on how to use or apply it only that they had to find a way to lock and stop the door from moving within a 5 minute time limit. Student one started off by applying the door jam correctly but struggled to attach and get door closed before his time expired. Student two started off my not knowing how to apply the prototype. After about two minutes of messing around and trying to understand he was able to get it under the door and apply the prototype but had a hard time getting the tightness of the nut to be able to stop the door from moving. As for the teacher the understanding and application of the prototype seemed to confuse and just frustrate and was also unable to be able to apply and control the door within the 5 minute time limit.

The group then was given a short walkthrough of how the product was to be applied and used within this short time frame. This short walkthrough was useful for the understanding and application of this. Student one was then able to apply and tighten the wedge to a point that the door would not open. This was also true for student two but the teacher was not able to tighten the wedge to the point that the door would not open.

Some of the feedback that I received was that the threaded rod need to be longer and that it would be easier if a motor was the source of tightening of the nut at the end.

VII. Conclusion

Reflection

Reflect on your initial design goals, understanding of the problem space, and evaluation of your prototype. How did your perceptions change over time? How did you understanding of the problem mature? What unexpected encounters occurred?

Future Work

The largest improvement would be a longer threaded rod so that the application would be easier for the user and that they did not have to fidget with trying to get the holes to line up. Next it would be faster to have a motor that would tighten to the perfect tension force so that user error would be taken out of the equation. Also that it would be better if it would fit under the door and not have to have to door open to apply the prototype.