Push-Sense-Pull Door

By:
Reed Loose
Calvin Louie
Cuauhtemoc Gutierrez
Jack Spence
Taylor Daoust

S&E Commerce
P.O. Box 58112 Santa Catalina
Santa Barbara, CA 93106

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Matt Richardson
Head of Architecture, Design and Construction at Hilton
6903 Rockledge Drive
Bethesda, Maryland 20817

Dear Mr. Richardson,

We are S&E Commerce, a team of mechanical, chemical, and computer engineering students at the University of California at Santa Barbara. We are asking for your support for our innovative new door design, which includes a flush door handle and a RFID wristband and sensor lock.

The flush door handle and RFID wristband and sensor lock tout one common goal: being hands-free. In an increasingly technology dependent world, people are constantly working through their phones and always on the move. With hands busy, it becomes an inconvenience to take out keys and then twist and turn the door knob to open the door. The flush door handle and RFID wristband and sensor lock simplifies the process of opening the door. A tap of the wristband and a push of the handle by an elbow is all that is needed to open the door - no more need for hands. In addition to convenience, the RFID wristband and sensor lock promotes eco-friendliness by replacing disposable card keys with reusable wristbands.

Enclosed in this report are background behind the product, designs for the flush door handle and RFID wristband and sensor lock, a comparison between other locks, and an overall recommendation for the product.

We hope that you consider our newest innovation to doors and would like to thank you for your time.

Sincerely,

S&E Commerce

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Executive Summary

This report proposes a new door system: a flush door handle and RFID wristband and sensor lock.

The redesign of the traditional door gears the door towards a hands-free environment. The original aim was to find a solution for situations when an individual's hands would be occupied while they were trying to open the door. The simplest solution was to incorporate a sensor that would allow the unlocking of the door to happen by having your wrist near the sensor. The electricity flow would be a problem in households since the whole electromagnetic lock system would deactivate once the power would go out. As a result, we shifted our attention to hotels, dorms, resorts and other facilities that host several people. The reason behind this was due to the fact that all these facilities have backup generators. This provided a solution to what was the only flaw in the design. From there we proceeded to focus on the appearance of the door and decided to make it knobless. Our design team took this idea and came up with a flush door handle that would work with the RFID wristband and sensor lock.

The designs of both the flush door handle and RFID wristband and sensor lock are built into the door. To emphasize hands-free, the flush door handle was built such that a simple push could open the door. Also, to unlock the door, a touch of the key wristband would open the door. All components are built within the door such that the entire door is flush. The traditional door knob requires a twist of the knob before it can be pushed, whereas the the flush door handle requires a simple push. The locking mechanism consists of an RFID wristband, an RFID sensor, and an electromagnetic lock. The electromagnetic lock is run electrically. When the current is being run through the lock, a magnetic pull between the lock and the armature plate on the door keeps the system locked. The wristband allows the user to automatically unlock the door when in proximity to the sensor. This is possible due to the radio frequency identification (RFID).

The intention for this door handle design would be to replace conventional lock systems in environments with backup generators. The leading competitors in this industry would be magnetic card swipe and RFID card locks. These are found primarily in hotels and require guests to have a key card with them at all times. Other competitor locks include electronic combination locks, fingerprint scanners, and keyed door knobs.

Enclosed in this report are background to the project, designs of both the flush door handle and RFID wristband and sensor lock along with how it works and materials, comparison of competitors, and the door system’s potential.

Introduction

This introduction provides background information on the product being sold by S&E Commerce, the purpose of the report, and the inspiration of the design.

Background

The door can be traced back to ancient Egyptian times through paintings in Egyptian tombs that depict single and double wooden doors. Doors have been a main tool of privacy at home, work and even in public facilities. However, one of the more notable redesigns to the door since ancient times has been the addition of locks to increase privacy.

The door has become a universal common good used by the majority of people in the world, regardless of the financial class level. They can be found as wooden slabs placed in front of a hut in a third world country tribe or as a clear glass door in front of a house in Beverly Hills.

Doors have become a necessity to privacy and as a result homeowners tend to invest on making their doors more appealing and secure. Public facilities such as hotels, dorms, and many other buildings are home to several doors and sometimes even hundreds or thousands. For this reason, the security and privacy of doors are details these facilities keep in mind when improving their buildings. For most people, the only object keeping them secure at night and during other private situations is the front door of their home or room. Doors do not usually have a sign posted on them asking to be knocked on before entering but the symbol of security and privacy universally known to be related to the door has made it a norm. Doors have become a crucial part of society in the same way as stoplights, sidewalks, and many other man-made objects. Since Egyptian times the door has been redesigned over and over again but never replaced.

Type of Door	**Year Made**	**Inventor**
Hinged Door	5th to 15th Century [2]	Unknown but first found in ancient societies around the world [2]
Folding Door	Dated back to Pompeii [2]	Unknown but used by many ancient civilizations for their convenience [2]
Rotating Door	1888 [3]	Theophilus van Kannel [3]

Purpose

The purpose of this report is to provide a description of the services and products that S&E Commerce can provide to large facilities with backup energy generators such as hotel, dorms, and business corporates. Our goal is that you, as the buyer, will benefit from our simple, efficient, and eco-friendly designs.

Inspiration

1. **Tackling problem of opening doors without hands for situations when hands are full.**
   We decided that we wanted to make the door more convenient for homeowners when they would arrive hands full and simply at a position where unlocking and turning the doorknob is too much of a hassle. We came up with a door design similar to some public bathroom doors, where a only a simple push is needed, which would fix the hands full problem.

2. **A lock is needed for security but also has to be unlockable without the use of hands.**
   However, since this idea was supposed to be specifically for home front doors they needed to have a lock. The lock would not be able to be a traditional lock since that required access to the knob, but perhaps a sensor lock using a RFID wristband. This would allow for a lock to be unlocked simply by placing your wrist near the sensor while still having your hands full.

3. **RFID sensor idea was thought of but the sensor is fail-safe not fail-secure, thus; homes will be vulnerable during power outages.**
   With further investigation into RFID wristbands and the sensors needed, we found out that the mechanisms were categorized as fail-safe. Fail-safe ment that the sensors relied on electricity circuiting through the house, and as a result would be useless in the case of a power outage. This was a major fault since it meant that houses using these locks would become unlocked in the event of a power outage, and since power outages do occur occasionally this would cause a safety issue.

4. **Power outages are countered with back up generators which are located in hotels, dorms and other big facilities.**
   We then thought of where and how power outages are dealt with. We realized that big facilities such as hotels, dorms, and corporations use backup generators that keep electricity running during a power outage.

5. **Targeted market changed from home doors to doors in large facilities with generators to fix the fail-safe problem.**
   Facilities that had the generators necessary to allow fail-safe equipment to work usually housed many rooms. Every room needs a door and this is what caused us to change our target market from doors for homes to doors for these facilities.

6. **The idea of knobless doors was shared since they seem to get in the way at times.**
   One of our teammates raised the issue of the nuisance a doorknob can be by just sticking out of a flat surface. He brought up a good point that there are times where the knob can hurt or even remove space in certain situations so we decided to incorporate a knobless door handle in our design.

7. **We had to redesign the doorknob in order to prevent it from sticking out.**
   We simply came to the conclusion that if we did not want the knob to stick out then it must be inserted into the door itself. We came up with a design that involves a slab on the surface of the door. Pushing on the slab opens the door.

8. **To finalize our design we had to combine the sensor with the new mechanisms of the redesigned doorknob/lock.**
   Since two designs needed to be made, one for the door handle and one for the RFID sensor, the two designers who were in charge of designing each part had to communicate well in order to prevent design conflicts. At the end they had to come together and take into consideration how both mechanisms worked and what compromises needed to be made to combine them.

Designs

The key features of the door are its keyless and flush designs. A keyless design removes the need to take out keys to unlock a door. We redesigned the lock so that a simple tap of the handle with the compatible wristband, which serves as the key, will unlock the door. In addition, removing the door handle allows the door to be flushed. Rather than a turning motion, the handle becomes only a push and pull motion. This makes the door relatively hands-free.

The Flush Door Handle

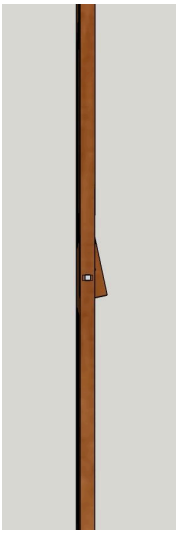
The traditional door handle or door knob requires two distinct motions in order to operate: a turn and a pull or push. First, the handle must be turned to unlock the latch and then a pull or push must be enacted to open the door. In this flush door handle door, we simplified the door opening process to one convenient push or pull. The built-in flush door handle is flush with the wall. This removes the safety hazard posed by an intruding door handle and adds an aesthetic appeal to a room by hiding such intrusion.

NOTE: The two horizontal lines above the handle, the shown curves within the bowl, and the box below the handle SHOULD NOT be visible.

Design

The flush door handle had to satisfy several goals, listed by highest priority:

1) Push and pull motion to lock and unlock the handle
2) Absence of any part protruding from the door itself
3) As compact as possible to ease installation of flush handle within existing doors
4) Aesthetically designed to be hidden and blended in with the door



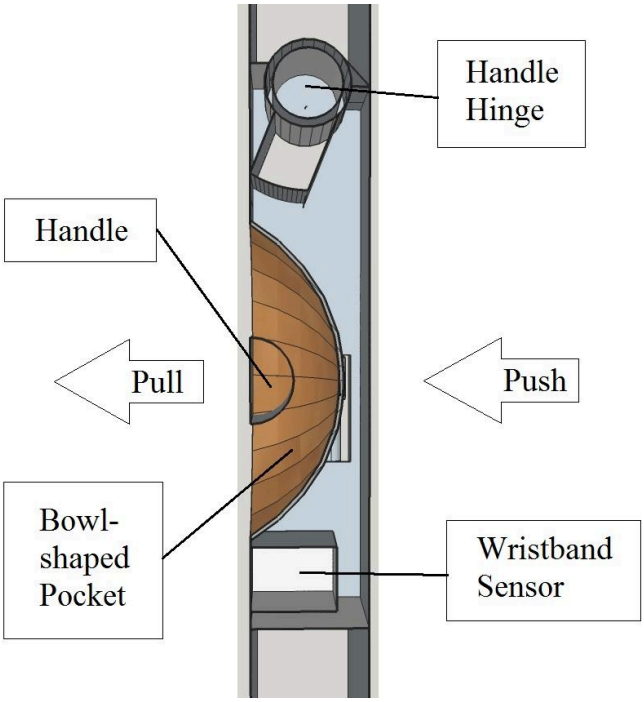
The biggest change from the traditional door handle was simplifying the door opening motion from a twist and pull or push to an ordinary pull or push. The push motion was easy to develop, whereas the pull motion required more thinking. The end result was a lever-like system that rotated back and forth. On the push side of the lever, the flush handle is smooth and wooden. On the pull side, there is an indented bowl laden with a bridge across it to allow users to grip and pull the door open.

The second priority was to avoid any parts from protruding from the flush door handle. Removing the door knob replaced the twisting and turning motion with a push and pull motion to unlock the door latch. The door knob latch mechanism had to be adapted so that it could take in a perpendicular force from the lever to the latch. The handle's streamlined nature gives it a hidden, subtle look unique to other doors with knobs.

All components are built within the thickness of the door, including the pulling bowl. This ensures that the mechanism is as small and compact as possible so any door could easily be refurbished with the flushed handle system. Being small minimizes its aesthetic appearance relative to the door, which allows it to be camouflaged within the door. Being easily replaceable makes it easier to market because consumers would not have to handle the cost of purchasing an entirely new door in order to have the flush handle.

How it Works

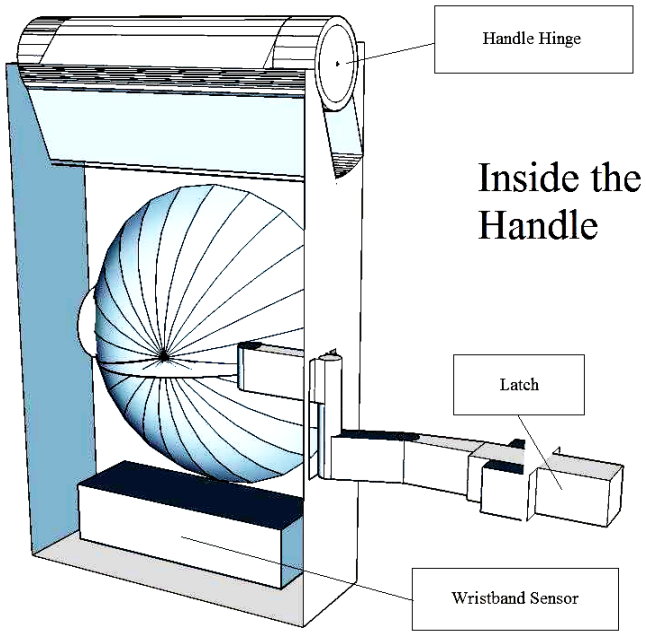
The objective of the redesigned door is to increase efficiency by simplifying the door opening process. In this new flush door handle, a simple push or pull opens the door.



The handle acts as a lever that will unlatch the door when pushed. We will assume a typical door that is single hinged. To pull open the door, insert hand into the bowl-shaped pocket and pull. To push open the door, simply push the opposite side of the bowl-shaped pocket. The need to turn the handle becomes unnecessary. The absence of an initial twisting motion aids users with wrist problems or injuries by only requiring a pull or push.

When a pull or push is applied to the lever-like flush handle, the handle hinge rotates, creating a force applied, according to the diagram below, into the paper. Attached to the side of the bowl is a string of metal components that connect to the latch. This force pulls on the components, causing a chain reaction of sliding and rotating to pull the latch into the door, unlocking the door for entry. This mechanism works for both pulling open the door and pushing open the door.

Compared to the original design of with the pulley system, the metal component bridge system can resist a push or pull to the latch unless the door handle is used. The cord in the pulley system must be taut in order to operate, whereas the metal components are always stiff and taut. This prevents misuse of the handle.



The flush handle mechanism's simplicity and compactness ensures easy repair and installation into doors. With fewer parts, problems can be quickly identified and replaced or fixed.

The sensor below activates the lock built in to the top of the door when touched by a compatible key wristband. This means, however, that the flush door handle will continue to operate, being pushed and pulled, with an incompatible wristband. This is as opposed to a conventional door knob, which will indicate that it is locked by its inability to turn.

Materials

The system itself features a chain of interlocking metal pieces, the door latch, metal handle hinge attachments, and the specially designed block that will serve as the handle.

The hollow block will be made of metal. The block cannot be entirely metal because it would be too heavy of a door handle, which would make using it very difficult. Another option for the block would be to have it completely carved from wood. For aesthetic purposes, the outsides of the block can be covered with wood sheets or painted with a wooden appearance such that the flush handle matches with the door itself. The metal block can also be left the way it is, leaving the flush handle with a nice metal finish.

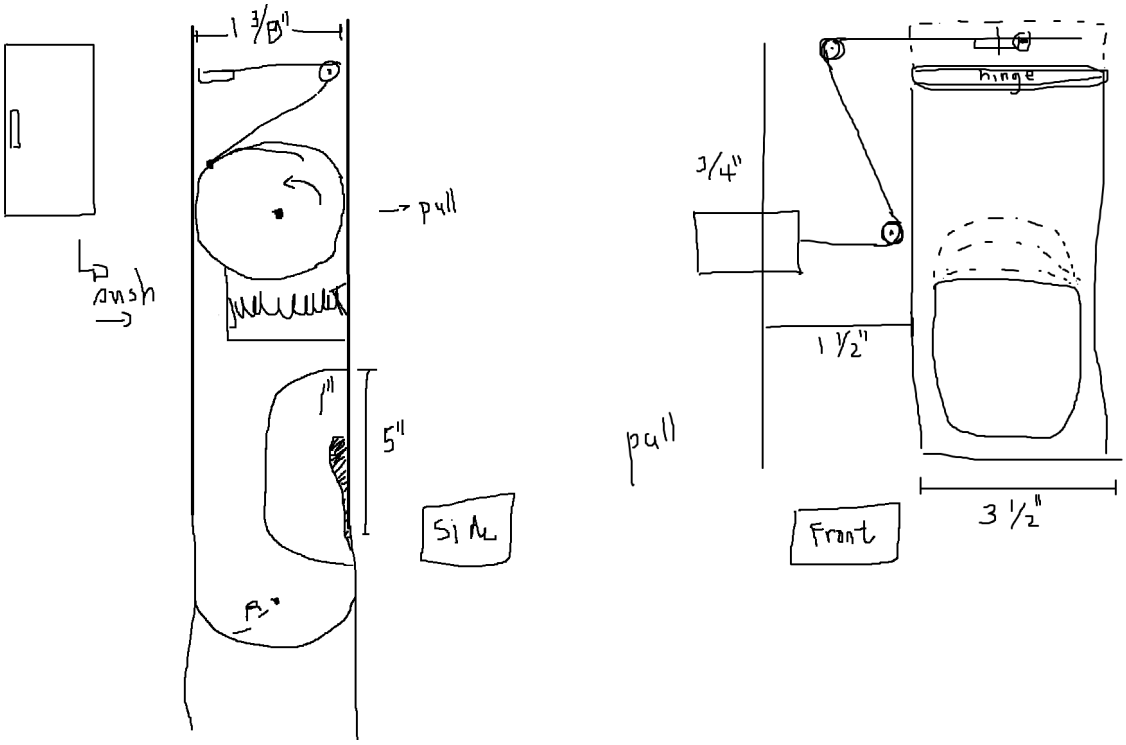
The metal pieces that will serve as the bridge between the door latch and the handle are made from solid steel. This door handle is built for the long term, so a durable material is needed for the mechanism. The metal pieces will also be heavily used, which further enforces the need for a lasting material. Solid steel ensures the longevity of the flush handle mechanism. Solid steel will also be used for the hinge components.

Through a very rough estimate of a potential per unit cost, we have determined the price to be around $20. This final price excludes the price of the door itself, the sensor, the corresponding lock for the sensor, and installation. The price of materials was estimated to be around $5 and the price of manufacturing was estimated to be around $15. Because of different customization options for the handle, the price will vary to account for the different costs of the materials.

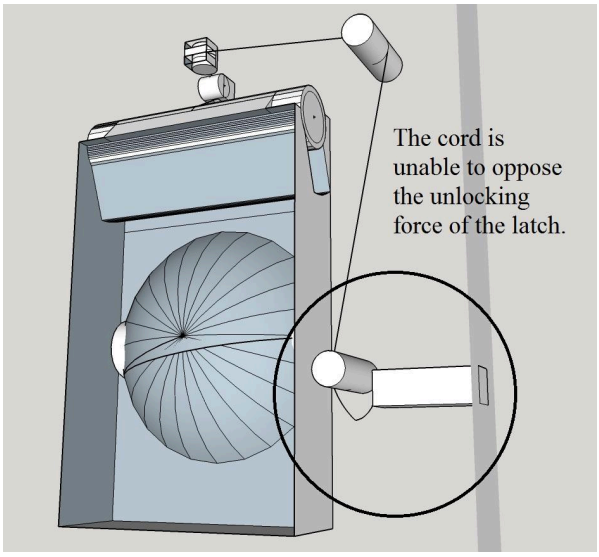
Design History

The size of the redesigned door handle should not deviate greatly from the size of the traditional door handle for the sake of the aesthetic appearance. In fact, the rectangular shape of the handle should be no greater than that of an average hand. We wanted the surface of the handle to be minimally visible. Not only is the door handle flushed, but it is also designed to look as if the handle does not exist, camouflaged within the door. With only a push motion needed in the simplest case, an elbow or tap of the knuckles, whose surface area is much less than a hand, is all that is needed to push open the door. Therefore, the average hand size became the maximum area for the door handle.

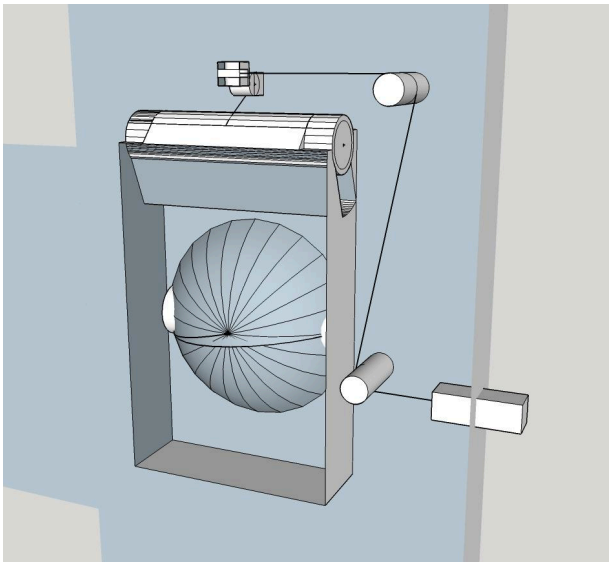
A change from the initial design came from the design of the pulling handle. Initially, the idea was to have a pocket in which the hand could be inserted, as shown in the picture above to the left. The pocket creates a cleanliness concern by having an area for dirt and dust to accumulate over time. The design of the pocket also makes it hard to clean. As a result, the handle was changed to the current design of a bowl-shaped indentation with a strong bridge across it. This enables easier cleaning while maintaining the simple grab and pull function.



Initial designs also called for a pulley system that converted the push or pull to unlock the latch. This pulley system was unnecessarily complex and had a safety flaw. The pulley system could easily be manipulated to open the door without the use of the handle, posing safety risks to owners. The wire in the pulley does not exert a force other than a tension force when it is stretched. In the picture below to the right, the latch is pushed into the door, causing the cord to slack. As a result, the latch could easily be opened without affecting any of the handle operation, defeating the purpose of the latch.



The pulley system was also very complex. The pulley required many parts as compared to an ordinary door knob system, which meant the flushed handle had a greater chance of failure. The design needed to be simplified to increase its compactness for easy installation and reduce chances of failure. To simplify the mechanism, a chain of interlocking metal parts would bridge the handle and door latch. The metal parts are designed to remain in place, rendering the latch stationary, unless the handle is used.



We also incorporated a new key-lock device that would work efficiently with our hands-free door design. Rather than the traditional house keys, we use radio frequency wristbands that will activate the sensor located at the bottom of the handle. The sensor will send a signal to the lock and unlock the door for entry. A wristband and sensor lock make it easier for those with busy hands to easily access the door while also providing a convenient way to prevent the user from losing their key.

RFID Wristband and Sensor/Lock

Design

Traditionally, doors in hotels are unlocked via electronic key card. However, key cards bring negatives. They are easily lost, less reliable, and environmentally unfriendly. However, implementing an RFID wristband and sensor fixes all of these issues. In our survey, 81% of people state that losing a wristband is less likely than losing a key card. Furthermore, our wristband and sensor combination does not need a direct connection in order to unlock the door, whereas a key card needs to be in direct contact with the card reader. This shows not only that the wristband is more reliable, but also more efficient.

Although unknown to the majority of the public (Appendix III), hotels discard key cards after only one use. This method is environmentally unhealthy and a waste of money. Using RFID wristband technology would decrease plastic waste and eventually be more economically viable.

How it Works

The RFID sensor, electromagnetic lock, and RFID wristband all work in harmony to create a simple, intuitive, and efficient door locking mechanism. The sensor will be located at the bottom of the push panel on the outside of the door [21]. This sensor will be connected to our electromagnetic lock, and each customer will be given an RFID wristband. As soon as the wristband is within the proximity of the sensor, the lock, and panel unlock, and the user can easily push to open the door.

This works due to the electromagnetic waves that are transferred between the sensor and the lock. If the correct frequency and wavelength reach the lock, the lock is triggered. Once the lock is triggered, the magnetic field is dropped for a certain period of time. This allows the wearer of the wristband to simply push open the door. If the incorrect RFID wristband is used, then the incorrect frequency is transferred from the sensor to the lock. This would cause the lock's magnetic field to remain up, keeping the door securely locked. (Appendix IV)

Materials

The entire locking system on our doors will consist of an electromagnetic RFID lock with RFID wristband technology as the unlocking mechanism. The electromagnetic lock is extremely safe, and cannot be picked like average bolt locks that require a key.

The lock model that we are using is the Seco-Alarm 1200-lb Maglock [1]. This particular electromagnetic lock has a magnetic force of 1200 lbs. This means that the door will remained locked under 1200 lbs of force or lower. Also, the lock is a fail safe lock as opposed to a fail secure lock. This means that when power is lost, all of the locks become demagnetized and thus unlocked. Disabling the locks when the power is out allows for customers to escape or paramedics to enter during emergencies.

Furthermore, the RFID wristbands are a much more economically and ecologically friendly alternative to the key cards used by most hotels [22]. The key cards used by many hotels and institutions are thrown away after one use, resulting in much plastic waste. With our RFID wristbands, customers will be able to easily access their rooms without the fear of losing a key or a card. The sleek, waterproof silicone wristbands come in nine different colors, and come in four different sizes based upon wrist size.

Design History

The basis for our design came from the thought that we wanted a key-lock combination that would easily mesh with our door design. We thought about using an electronic key card system, but we thought that it was not only outdated and it defeated the point of our door. Our purpose is to make a door that not only is good looking, but is also the epitome of efficiency. This simply cannot be achieved with the standard key card and electromagnetic lock used by most hotels currently.

We then thought of the possibility of using something that would be hands-free. We thought of everything from eye scanners to voice recognition. Some of these alternatives seemed to be valid but were not in the price range that we were looking for. We needed something less expensive that also satisfied the hands-free condition that we wanted. One of our team members mentioned that she is apart of a club on campus that utilizes wristbands for access control. It was the perfect breakthrough that we needed.

We decided that we were going to use the wristbands as the alternatives for key cards. This would allow for the user to be able to unlock the door by having their wristband near the sensor. In comparison to key cards, the user would have to pull out their keycard and swipe it in order to unlock the door. Also, since the wristbands are attached to the bodies of the users, they are less likely to be lost than key cards.

We then had to figure out the locking mechanism. Most hotels have an electrically powered latching system, but we could not use this style of lock because we wanted a flush door. This led us to the idea of a purely electromagnetic lock that would be on the room side of the door. Using this style of lock would allow us to keep a flush door, while also having an effective and secure lock. Electromagnetic locks also have a significant number of advantages than a standard lock. They are more durable, safer, and easier to install

Electromagnetic locks with 1200-lb of holding power are considered the standard [14]. This is due to the fact that anything under 1200-lb of holding force could be considered less secure than 1200-lb, whereas anything above 1200-lb would be unnecessary. With that knowledge, we decided that having a 1200-lb electromagnetic lock would be perfect for our product.

Competition

With our primary audience being hotels and resorts, our product is looking to replace the conventional lock systems being used in each room. This section provides a brief summary of each of the most common locks found in hotel rooms [16].

Magnetic card swipe:

The magnetic card swipe lock is the most common type of lock used to gain access to hotel rooms. Each guest is given a key card that communicates with the front desk computer and is programed with information regarding the guest's stay. The most common complaint with these cards, however, is that they can become demagnetized and lose access to the room. These cards are also easily lost or stolen and the majority of these cards are not reused and end up in landfills instead of being recycled.

RFID card scanners:

Radio frequency identification (RFID) is one of the fastest growing technologies used in lock systems. This is the technology used in our design but it is most commonly seen in hotels and other public places as card scanners. This type of lock provides access to card holders by simply holding their card in close proximity to the scanner. Each RFID card has its own RFID tag that can hold guest information and room numbers, but the cards can be easily lost or stolen. Like the magnetic swipe cards, these cards are often disposed of after one stay by hotel guests.

Electronic number combination locks:

These locks are rarely used on individual hotel rooms but are most commonly found in office buildings. Electronic combination locks require a single combination to gain access, which is usually only known by a small number of individuals. Not only can these combinations be easily hacked, but they are often forgotten by those with access. It is also difficult to give others temporary access because there is not a physical key to lend.

Keyed door knob:

Keyed door knobs are found in just about every type of building, from residential to public, and each have a unique key made to unlock the door. Most higher end hotels have adopted the key card to gain access to their rooms, but there are many smaller hotels and motels that that still use this type of door knob. The greatest downside to these locks is that they are easy to pick and are much less secure than the other locks listed. The key is also easy to lose and and new key must be made to replace it.

Finger print lock:

Fingerprint, or biometric locks, are electronic locks that scan a person's fingertip and use it as a key to unlock the door. Because these locks do not require a physical key, they cannot be picked and there is no risk of one's key being duplicated. This lock is more suitable for businesses than hotels and must be supported by a backup generator in the incident that the power goes out. Biometric locks also make it impossible to give someone else temporary access to that door without programming in their fingerprint.

Comparison of competitors [16]:

Lock	Price	Power supply needed?	Where they are used	Key
Magnetic card swipe	$100-300	yes	hotels, dorms, offices	card
RFID card scanners	$100-400	yes	hotels, dorms, offices	card
Electronic number combination lock	$200-300	yes	offices, homes	no key
Keyed door knob	$10-150	no	hotels, dorms, homes, offices	key
Finger print lock	$100-500	yes	offices, homes	no key

Environmental Impact

One of the primary goals of our design is to create an alternative to the conventional door lock that is sustainable and reduces waste. Most hotel rooms use key cards to unlock their doors, but these cards are often discarded after the duration of the guest's stay. According to our survey, only 35% of people knew that these cards were thrown away (Appendix II). In fact, many hotels even encourage guests to throw away their cards after they are used to prevent identity theft [9].

Our design proposes the use of reusable RFID wristbands that would be worn by each hotel guest. These wristbands are made of silicone, a material that generates energy savings and reduces greenhouse gas emissions when manufactured [7]. This would eliminate the use of plastic RFID and magnetic strip key cards. Plastic (PVC) cards carry a high environmental impact and release harmful dioxins when incinerated. If left in landfills, PVC cards can take centuries to biodegrade [8]. If wristbands were used in place of these cards, they could be reused multiple times before they would be recycled by the hotel.

Potential Market

This door could be installed in any building with an emergency power system. Some examples of buildings with an emergency power system are: schools, dormitories, hotels and resorts, office buildings, hospitals, telecommunication and data centers, prisons, scientific laboratories, and utility power stations.

An emergency power system supports important electrical systems (such as fire safety systems, emergency lighting, critical hospital equipment, power operated doors, communications systems, heating and ventilation) when a loss of power occurs. Most modern buildings use a standby generator for this purpose, with battery power covering the short time it takes for the generator to kick in.

Above left: Dormitories; Above right: Offices: Below: Science laboratories

Conclusion

Our design for a flush door handle is a perfect alternative to the conventional door handle. It not only eliminates the need for one to turn a handle, but it is a simple, modern design that would improve the aesthetic of any hotel or dorm. In addition, a wristband and sensor lock would reduce fumbling for keys to open the door. Eliminating the door handle and hard keys increases convenience of users entering and exiting the door. The use of wristbands rather than PVC magnetic strip cards would have a significant impact on the amount of waste produced by hotels while providing easy access to the corresponding door.

We believe that our new door system will serve our potential customers with its simplicity. In an age of surrounding technology demanding every part of people on their devices, the need for hands-free objects become ever so important. The new door system turns the inconvenience of twisting a door knob to the simplicity of pushing the door open.

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Images:

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http://www.ebay.com/itm/Rods-for-Knife-Making-Crafts-Brass-Copper-Stainless-Aluminum-Various-Sizes-/161466191270

[21] (2015). RFID Proximity Sensor Smart EM ID Card Reader 125KHz Wiegand 26 Waterproof [Online]. Available:
http://www.amazon.com/Proximity-Sensor-Reader-Wiegand-Waterproof/dp/B00T5U8ZN0.

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http://www.rfidwristband.com/custom-rewearable-rfid-wristbands/.

Software:

Google Sketchup 2015

Appendices

I. Team Profiles

Cuauhtemoc Gutierrez

6850 El Colegio Rd, Room 8438 Box 58320, Goleta, CA 93117 – (909) 786-6463 –
cuauhtemoc@umail.ucsb.edu

OBJECTIVE

My objective is to participate in an internship to gain engineering experience while working towards a bachelors degree in Computer Engineering at UCSB.

EDUCATION

University of California, Santa Barbara, Goleta, CA Expected to graduate June 2018
Computer Engineering B.S. , College of Engineering
2.93 GPA

PROGRAMMING LANGUAGE KNOWLEDGE

- **Python**
- **C++**

LEADERSHIP AND VOLUNTEER EXPERIENCE

Co-Crew Leader, Bright Prospect, Pomona, CA 2011-Present
- Supported crew members in athletic and academic situations
- Reminded crew members of important events
- Encouraged Bright Prospect members to take SAT's sooner than later

Volunteer, Science Club, Ontario H.S. 2013
- Beach Cleanup for two hours for organization

Volunteer Tutor, De Anza Middle School, Ontario, CA 2012-2013
- Aided middle school students in math one hour a day, two days a week

EXTRACURRICULAR ACTIVITIES

Vice President, Model UN, Ontario H.S. 2012-2013
- Discussed topics around the world and familiar myself with real world situations
- Participated in Carnival Booth to fundraise for the club

Treasurer, Psychology Club, Ontario H.S. 2012-2013
- Explored the mind and how it works
- Participated in carnival food booth to raise money for club

Co-Founder/Treasurer. Conspiracy Theory Club, Ontario H.S. 2013-2014
- Thought students to analyze articles for credibility and then interpretation

Intramural Co-Ed Soccer, UCSB 2014
- Competed against other Intramural soccer teams at UCSB while working as a team

Taylor Daoust

P.O. BOX 11676 Santa Cruz Hall, Room 1444, Santa Barbara, CA 93106
Phone: (949)-933-4103 E-Mail: taylordaoust@hotmail.com

Education

University of California, Santa Barbara, June 2018

Bachelor of Science in Chemical Engineering, GPA 3.77/4.0

Corona del Mar High School, June 2014

High School Diploma, GPA 4.18/4.0

Interpersonal Skills

- Works well in teams
- Creative
- Highly engaged in community service

Experience

Transparent Solar Cell Research Paper **November 2014**

Wrote a research paper on the applications and technology of transparent luminescent solar concentrators in a Writing 2E course.

Engineers Without Borders **October 2014 - Present**

EWB-USA collaborates with local partners to design and implement sustainable, community driven engineering projects in Rwanda and Mexico.

Society of Women Engineers **October 2014 – Present**

Chemistry Olympiad Nominee **March 2012**

Skills

Software: MATLAB (basic), Microsoft Office
Language: Conversant in French

Honors

Academic Letter with Honor, *Corona del Mar High School* **Grades 11-12**
For achieving a cumulative GPA of 4.0 or higher

CALVIN LOUIE

P.O. Box 58112 Santa Catalina • Santa Barbara, CA 93106
(415)-793-7281 • c_louie@umail.ucsb.edu

Education

Bachelor of Science, Mechanical Engineering Expected Jun 2018
University of California, Santa Barbara Goleta, CA
Regents Scholar, GPA: 4.0/4.0

Working Experience

Architect Intern Summer 2013
Handel Architects LLP San Francisco, CA
Built scaled models of designs, edited CAD documents, compiled site analysis for projects

Facilities Intern Summer 2012
Jawbone San Francisco, CA
Set up and prepared rooms for office meetings, assembled and disassembled furniture

Junior Caddie Summer 2014
The Olympic Club San Francisco, CA
Carried bags weighing up to fifty pounds, assisted golfer with raking sands and polishing golf ball, engaged in friendly conversation for entire round of golf

Projects

Architectural Design Competition Spring 2013
Architectural Foundation of San Francisco San Francisco, CA
Designed a temporary pavilion for the 2013 America's Cup; used Autodesk Revit to create floor plans, elevations, and section drawings; built a ¼-inch scale model of design

Volunteer Experience

Assistant Baseball Coach Fall 2013 – Present
Marina Middle School San Francisco, CA
Worked with players of all levels of experience, teaching baseball fundamentals

Skills

Languages
Advanced level spoken Mandarin, intermediate level spoken Cantonese and written Chinese

Computer Languages
Microsoft Office, MATLAB, Autodesk Revit, Google SketchUp

Jack Spence

San Nicolas Hall, Rm 8234
Box 12473, University of California
Santa Barbara, California 93106
(512) 704-4220
jackspence@umail.ucsb.edu

Education

University of California, Santa Barbara
Major: Chemical Engineering
B.S. expected June 2018 (current freshman)
Anderson High School, Austin, Texas, Class of 2014, Overall GPA: 4.04
International Baccalaureate Diploma
ACT: 34 (composite)

Work Experience

City of Austin, Attendant/Cashier, Emma Long Metropolitan Park and Walsh Boat Landing, Austin, Texas, June 2012 - December 2013

- sold day passes and camping passes
- monitored park/boat launch facilities
- interacted with hundreds of people daily and developed interpersonal skills

Leadership

Club soccer team captain, August 2012 - April 2014

Additional Activities

UCSB Intramural soccer
High school varsity and JV soccer, November 2012 - May 2014

- Academic All-District, 2014

Represented Anderson High at national robotics competition, 2011

Volunteer Work

Capital Area Food Bank of Texas, 2010 - 2012

- sorted and packaged food to be distributed to the homeless in the central Texas area

Operation Turkey, November 2011 - November 2012

- cooked and prepared thanksgiving dinners to be distributed to homeless people in Austin

Other Skills/Experiences

Computer: Matlab, Excel
Travel: UK, Greece, Turkey, Spain, Germany, Austria, Ireland, France, Czech Republic, Hungary, Netherlands, Italy
Other interests: Music, Fantasy sports (football/basketball/soccer)

John Reed Loose

Santa Cruz Hall, Room 1239, Santa Barbara, CA 93106 • (805) 404-0366 • jrloose@umail.ucsb.edu

Profile

Determined chemical engineering student at UCSB with extensive lab experience

Education

University of California, Santa Barbara, Santa Barbara, CA

BS Chemical Engineering, *2014-2018* (Projected)
Cumulative GPA: 3.89

Thousand Oaks High School, Thousand Oaks, CA

High School Diploma, *2010-2014*
Cumulative Weighted GPA: 4.58

Skills

Lab Work

- Three years of lab work
- Real world applications; i.e. creating electromagnets, survival materials, etc.
- Independent labs: Given prompt, created procedure, and carried out experiment

Leadership

Captain of Varsity Basketball Team *2013-2014*

- Had to motivate the team
- Heavy load of responsibility; i.e. Keeping track of teammates, relaying information, etc.

Captain of Varsity Volleyball Team *2012-2013*

- Originally inexperienced, but moved up in ranks
- Increased management and communication skills

Work Experience

Thousand Oaks High School, Thousand Oaks, CA
Architectural Designer, Oct-Dec, 2013

- Created floor plan for school's metal shop that is currently being built
- Budgeting, team cooperation, utilizing resources efficiently

Redwood Middle School, Thousand Oaks, CA
Head 7th Grade Basketball Coach, Sept-Dec 2012

- Communication skills
- Patience/tolerance level increased

Activities

Bones 18u Volleyball Club, Thousand Oaks, CA

- Adapted quickly to new team

Volunteer at First Church of Christ Scientist, Thousand Oaks, CA

- Filed important bills and documents

II. Survey Questions

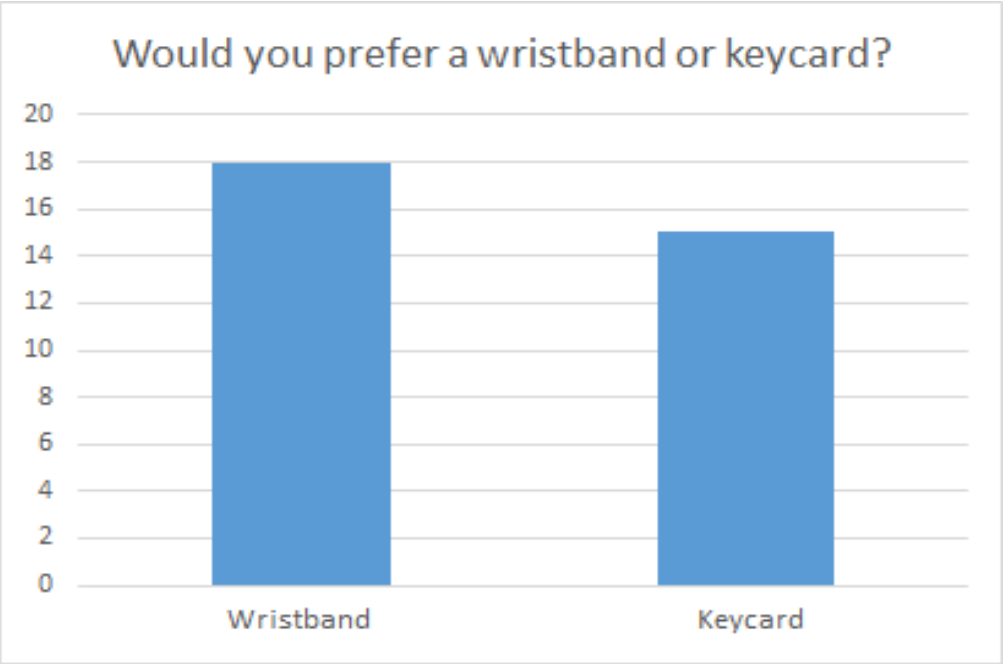
Question 1	Wristband	Keycard	No Preference
Which would you prefer?	18	15	1

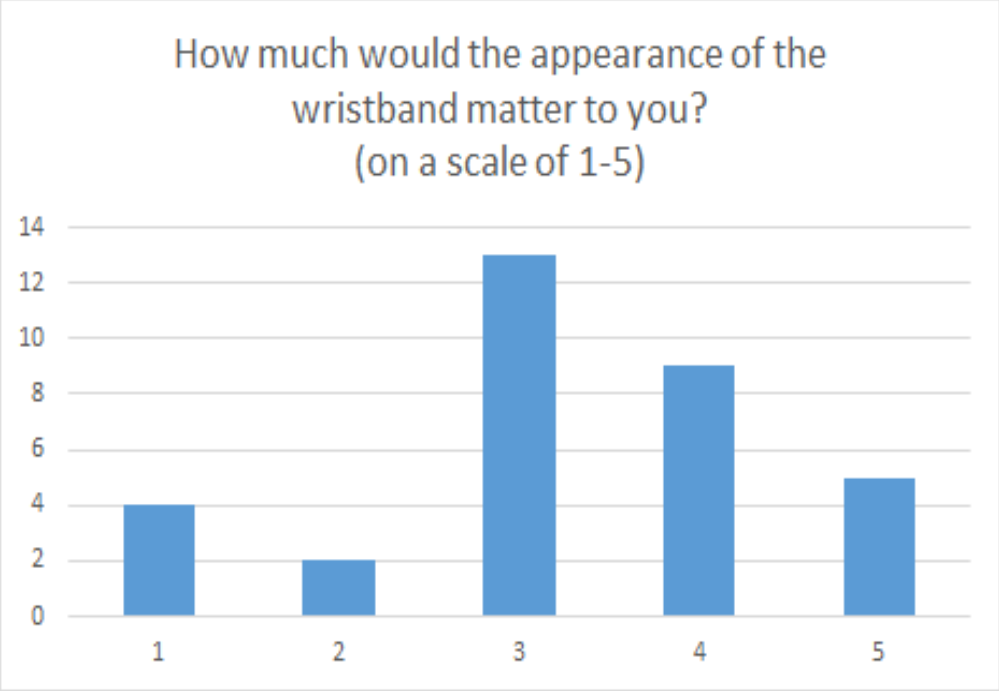
Question 2	1	2	3	4	5
If you had a wristband, how much would appearance matter to you? Scale of 1 to 5	4	2	13	9	5

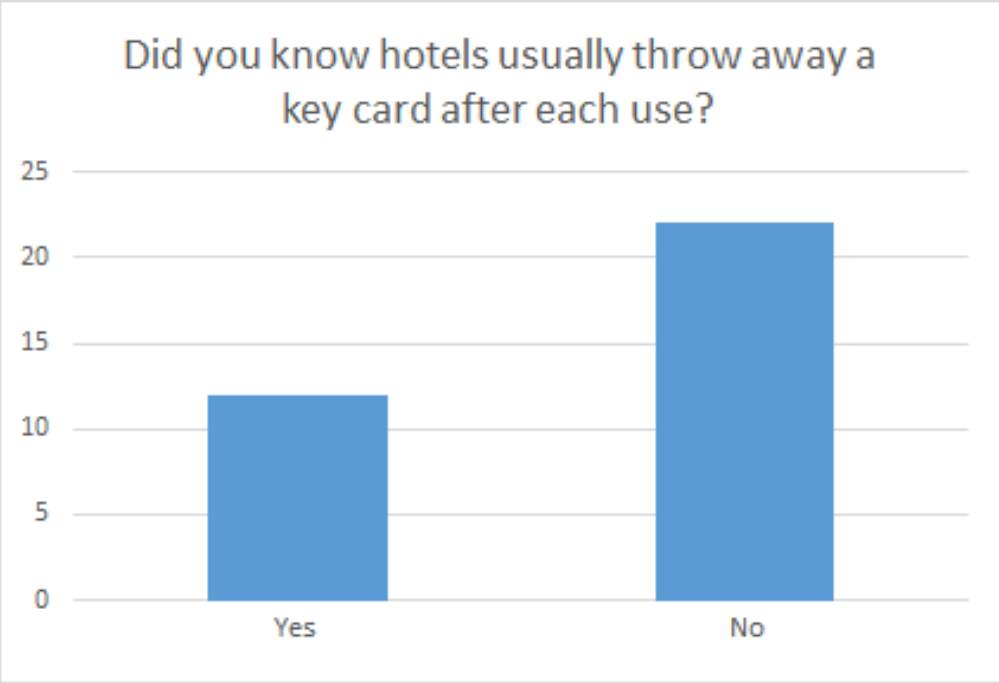
Question 3	Yes	No
Did you know hotels usually throw away a key card after each use?	12	22
Question 4	Yes	No
Would a wristband be more convenient than a card in terms of not losing it?	26	6
Question 5	Yes	No
Do you believe that a wristband key would improve the rating of your stay?	18	16

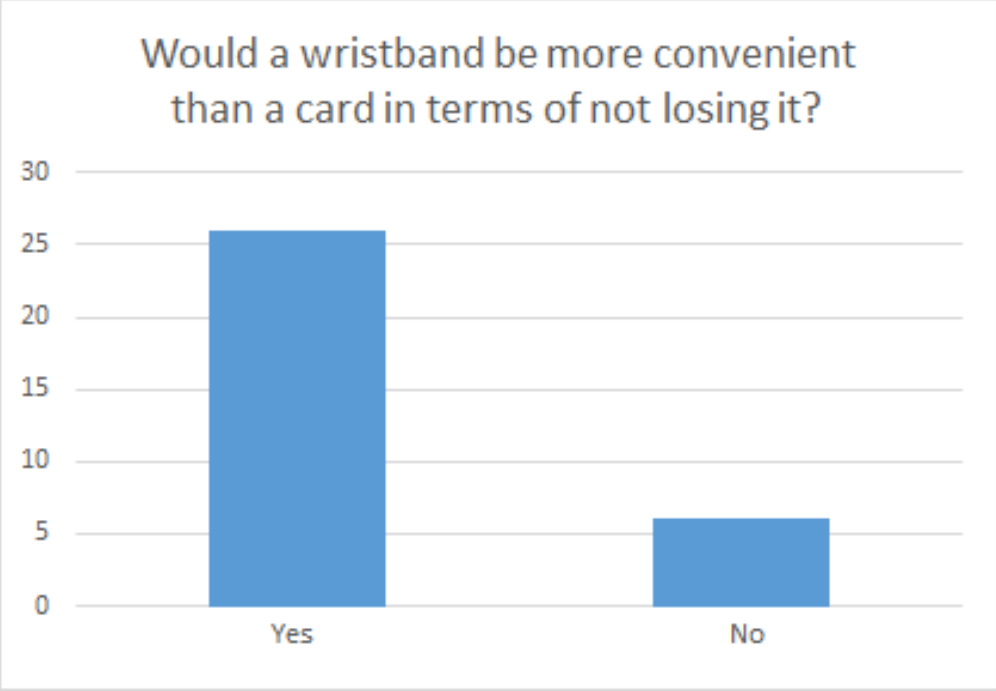
Question 6	Very Negative	Negative	Neutral	Positive	Very Positive
What's your first reaction to this new product idea?	0	4	6	13	9

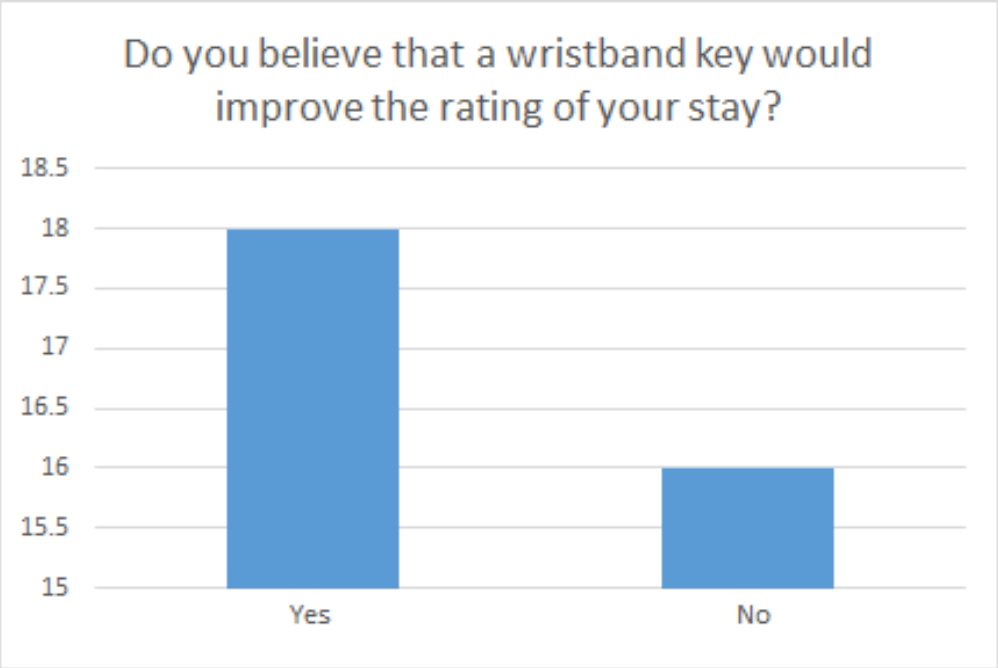
III. Survey Data

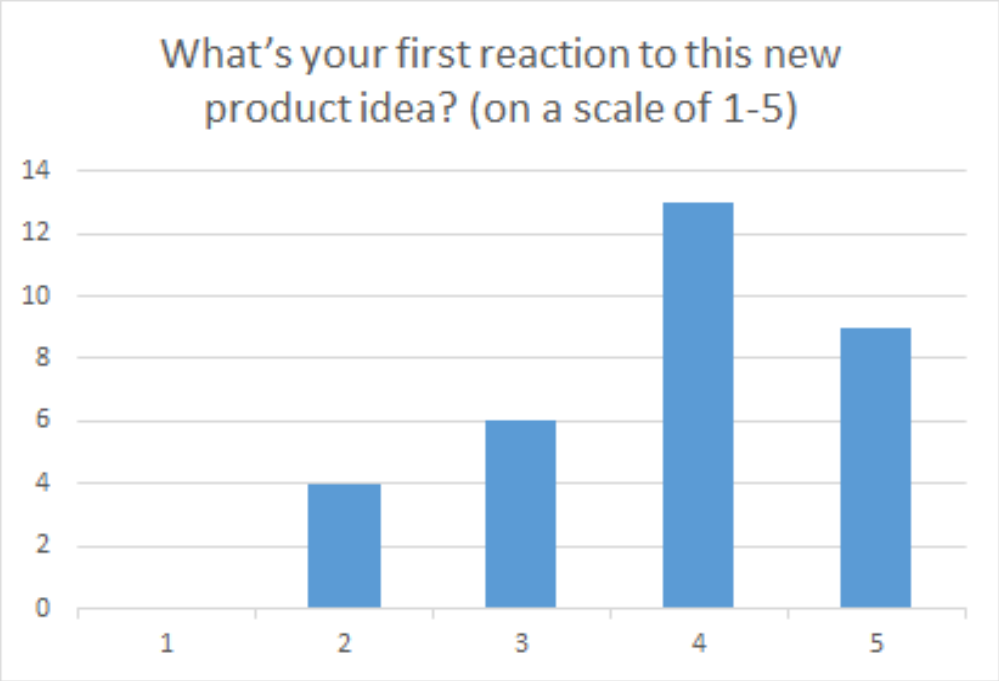





Did you know hotels usually throw away a key card after each use?
25
20
15
10
5
0
Yes
No


Would a wristband be more convenient than a card in terms of not losing it?
30
25
20
15
10
5
0
Yes
No


Do you believe that a wristband key would improve the rating of your stay?
18.5
18
17.5
17
16.5
16
15.5
15
Yes
No


What's your first reaction to this new product idea? (on a scale of 1-5)
14
12
10
8
6
4
2
0
1
2
3
4
5

IV. How Electromagnetic Locks Work

The following information was gathered from three online sites regarding electromagnetic locks and RFID [13,14,15].

"An electromagnetic lock, also known as a maglock, is a locking device that consists of an electromagnetic and an armature plate." "The first modern direct-pull electromagnetic lock was designed by Sumner 'Irving' Saphirstein in 1969 for initial installation on doors at the Montreal Forum." This started an era of new lock systems. Soon large institutions began promoting the use of electromagnetic locks as they were more efficient than standard bolt locks.

As previously stated, the electromagnetic lock is made of two pieces: an electromagnet and an armature plate. The electromagnet is located on the door frame and is attached to an electrical energy source, while the armature is located on the door itself and is not connected to a power source. Within the electromagnet is a system of wires in loops called a solenoid. When the appropriate current is run through the solenoid, a magnetic field is created. The magnetic field then creates an attraction between a conductor within the armature plate and the electromagnet. This attraction creates a holding force that keeps the door shut up to various conditions.

The holding force created by the electromagnet and the armature plate can vary depending on the size of the solenoid. Essentially, the more loops within the solenoid, the stronger the magnetic field. Standard electromagnetic locks have a holding force of 1200 lbs, but certain electromagnetic locks can have a holding force of 300 lbs.

It has been established that electromagnetic locks need to be energized in order to work, but how does one unlock an electromagnetic lock? The answer lies within Radio Frequency IDentification (RFID). A vital part of any electromagnetic lock is a corresponding RFID sensor. These sensors are used as the connection between the key and the lock itself. When the sensor is triggered by a tag (keycard, wristband, etc), a connection is made between the sensor and the receiver connected to the electromagnet. If the correct tag is used to trigger the sensor, then the current within the electromagnet is cut and the door is free to be opened.