CIELOCKS: CITE ELECTRONIC LOCKS

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Abstract

This project observed the needed improvement of security in an age where everything advances. Technological advancements have been made from homes to big industries. The proponents seek to introduce technology when it comes to door locks. The literature and studies included in this project are focused on Internet of Things and home security. In order to meet the needed functions to integrate Internet of Things on a door lock, the proponents bought devices that has the required functions and requirements. To make the security system capable and reliable, the proponents also used a variety of software to code and program the security system.

The proponents made meetings and used Scrum Agile methodology, scrum methodology uses sprints and meetings held by the Scrum Master. Through the said methodology, the proponents have made this project on a required and needed time frame. The security system can be monitored anytime on any given place through the internet.

Keywords: Arduino Uno, Internet of things,

People are currently living in an age where everything will soon be connected to the internet. Gone are the days where sending mail will take months and the only way one can contact someone who is far is via voice calls. Nowadays, calling someone who is in a far place is easier and more advanced than before. In the last decade and a half, the only way cellphones remotely transfer files were via Bluetooth and Infrared.

Nowadays, every smartphone can be connected to the internet, thus transferring files can be done easier and faster. Moreover, even home appliances can also be integrated to be connected to the internet, making controls of the appliances wireless will enable the everyday objects be connected thus, making the owners, remotely control them every time on any given day.

Home security must advance, especially in an age where burglars and thieves are constantly roaming the streets, waiting for an opportunity to find their next victims. By integrating Internet of Things to each and every house, one of the main benefits is security through surveillance. Smart locks can send information through internet to a home owner if a lock is left unlocked, which is unlike before, the only way to know if a lock has been left unlocked is by seeing it personally. Most homes in the country are yet to utilize such security trends and this project is a step forward to Philippine smart homes.

The project sought to integrate a new electronic door lock using an Arduino Uno while maintaining their existing network to lessen the home owner's expenses for their new and automated door locks. The proponents are proposing a door lock that would allow the home owner to lock or unlock a door through the use of the internet.

The proponents are aiming to improve security for homes hence, to implement a new and improved door lock. The network design consists of a router, a mobile device, an Arduino board, and electronic door locks. This project is made to make a smart home security feature available to present traditional homes.

The main objective of this study is to introduce an improved door lock system with network design to the ordinary home, where making access to the lock is easier, more secure, and faster. Security will improve through constant surveillance of the smart locks. The Arduino device,

which is connected to the internet, will control the locks through relays remotely through a web app.

Significance of the Study

Home Owners. From big industries to our home, Internet of Things has a lot of scope. Regarding our homes, Internet of Things will be a great help in terms of security. With this project, the proponents will introduce Internet of Things through door locks, where a home owner can monitor each of their door lock any time on any given place and date. With this project, not only home owners will have a lot of control in their house but also it will improve their sense of safety and security.

Future Researchers. This project will help future researchers in terms of their studies. It will help them broaden their knowledge in Internet of Things and how it can be applied in terms of security. Future researchers can use the knowledge in this project. In this age where almost everything can be connected to the internet, this project can help future researchers know about the implications of Internet of Things on security.

Subdivisions. This project will help subdivisions who sell pre-made houses. Internet of Things can connect almost every object around the world to the internet, where the user can control appliances remotely via a web application or through their smart phones. With this project, not only the houses they sell will have a lot of more available features, but also their buyers may put more attention to the improved sense of security in their homes. CIELocks or CITE Electronic Locks lets home owners monitor their Internet connected locks through a web application anytime on any given day.

Related Literature

From the dawn of modern civilization, our ancestors developed a need to keep their belongings to themselves by using mechanical devices known as locks. Initially, those locks were only simple knots made from rope or other materials (they were used only to detect if someone tried to open them), but as the time went on and new technologies were developed, true locks made from wood and metal started being used across the world.

Modern day historians are unsure which ancient civilization was first to create mechanical locks, and many believe that Egyptians, Greeks, and Romans developed those skins independently from each other. History of mechanical locks started over 6 thousand years ago in Ancient Egypt, where locksmith first managed to create simple but effective pin tumbler lock that was made entirely from wood. It consisted of the wooden post that was affixed to the door, and a horizontal bolt that slid into the post. This bolt had set of openings which were filled with pins. Specially designed large and heavy wooden key was shaped like modern toothbrush with pegs that corresponded to the holes and pins in the lock.

This key could be inserted into opening and lifted, which would move the pins and allow security bolt to be moved. During 1st millennia BC, locks finally started improving with the technologies and designs that were introduced by Greeks and Romans. Greek locks were commonly viewed as unsecure, but they gave inspiration to the Roman innovators who quickly managed to improve upon Greek and Egyptian locks by introducing metals as their primary materials. By utilizing iron locks, Romans were finally able not only to have very strong protection against brute-force attacks, but also keys were for the first time small that they could be worn in pockets, on as a pendant or even infused into rings. During this time wards were also developed, ensuring that only correct key with correct shape of projections can push corresponding pins before lock could rotate and throw the bolt.

After the fall of Roman Empire in 1st century AD, innovation in the field of locks was completely grounded to the halt. Locksmiths in the European dark and middle ages did not have technology or funds to create new protection techniques, but they used this time to try to confuse or compound lockpickers with new tactics. Instead of one simple lock they created multiple key mechanisms, increasingly complicated key designs, they obscured keyholes with detailed ornaments, created fake keyholes (with fake mechanisms inside), and more.

Progress finally came in 18th century, when technological advances finally enabled engineers to create small and sturdy mechanisms. This new wave of lock innovation was led by the inventions of Robert Barronin 1778 (double-acting tumbler lock), Joseph Bramah in 1784 (Bramah lock, unpickable for 67 years), Jeremiah Chubb in 1818 (detector lock with high internal security), Linus Yale, Sr. in 1848 (first pin tumbler lock), James Sargent in 1857 and 1873 (first combination lock and first time lock mechanism), Samuel Segal in 1916 (first jemmy-proof lock) and Harry Soref in 1924 (first padlock).

Today, majority of world's locks are based on the inventions of these engineers, with only a small portion using advanced techniques such as magnetic keys.

Stable wired and wireless network system must be established first to make a smart living space. To support the various application services under the connected environment, a wired or wireless home network is considered as core and basic domain in the smart home.

Homes could be fitted with IoT-driven aspects such as smart meters, sensors and switches; these elements offer more than just energy savings, and extend to smart monitoring of the entire home (Ankit Taparia, 2017). Internet of Things devices can make our homes safer but also it is energy efficient. Internet of Things will help us save money by regulating the time and electricity needed by using smart meters, sensors, and switches. IoT does not only make our homes safer but is also money efficient.

IoT Technologies can be converged in a variety of industry and Smart home is considered as one of the most promising IoT application domains. IoT can be integrated in many forms in the industry but a smart home is one of the most promising applications of it. Home owners will spend less time and effort on tending for their daily chores when a smart living space is implemented in their homes.

IoT connectivity technology studies tend to focus on finding way to interconnect any product in the physical world with the virtual world through the any network (Magdy M. A. Salama, 2014). It is focused on finding a way to connect ordinary things in the physical world to the virtual world through the use of any networks.

The smart lock was designed to improve user convenience by allowing him to check the image of a valid visitor and open or close the door lock remotely (Ha, 2015). The use of electronic door locks will improve our security by alerting the resident if a certain person is a valid visitor or not. Internet of things not only help us lessen the time and effort we put in our chores but also it improves our security and safety of our homes.

Through automated door locks, you can lock your doors from any location. You can also opt to be alerted each time someone enters your home, allowing you to continuously monitor your home (Bastin, 2017). Through Internet of Things, doors on our homes will not only be technologically advanced but it can now alert us if a certain person tries to break in our homes. We can now monitor our homes every time on every given day. With smart locks, we can now be notified if an unwanted person is surveying our homes. The dawn of technology in home security systems have enormously reduced human effort through

sophisticated security tools which have significantly reduced threats (Pulkit Punj, 2017). The advancements in our technology helped security grow and made our homes more secure with less effort than before. Also, Internet of things made living easier and faster, lessening the time and effort to tend to our daily responsibilities.

With the accelerated development of Internet-of-Things (IoT), wireless sensor networks (WSN) are gaining importance in the continued advancement of information and communication technologies and have been connected and integrated with Internet in vast industrial applications. The key approach to enable efficient and reliable management of WSN within such an infrastructure is a cross layer design of lightweight and cloud-based restful web service (Victor C. M., 2015). Wireless internet connections are important for an industry to grow. Vast industries rely on wireless internet connections for their data to be transferred quicker and easier, thus making their progress faster.

A Smart Connected Environment has drawn a lot of attention and the reason for all this buzz is due to the emergence of IoT. The Internet of Things has scope in all walks of life right from smart homes to critical medical examinations. Though RFID based library management system has emerged successfully in the recent past, it has its own limitations (Larsan B., 2014). Smart connected environments are gaining popularity due to the public's interest on Internet of Things. Internet of Things can now be implemented on many appliances in our homes, small or big scale industries, and medical applications.

A smart home incorporates sensors, actuators, middleware. The primary objectives of a smart home are to increase home automation, facilitate energy management, and reduce environmental emissions. Home automation can be improved through an improved communication network that involves a twisted pair power line, radio signals, or fiber optics in a bus-based network or an internet protocol as

standards (Ameena S., 2013). A smart home has sensors, actuators, and middleware, thus making it energy efficient and produces less environmental emission. Through internet, home owners can control their preferable appliances remotely making their daily house responsibilities be automated.
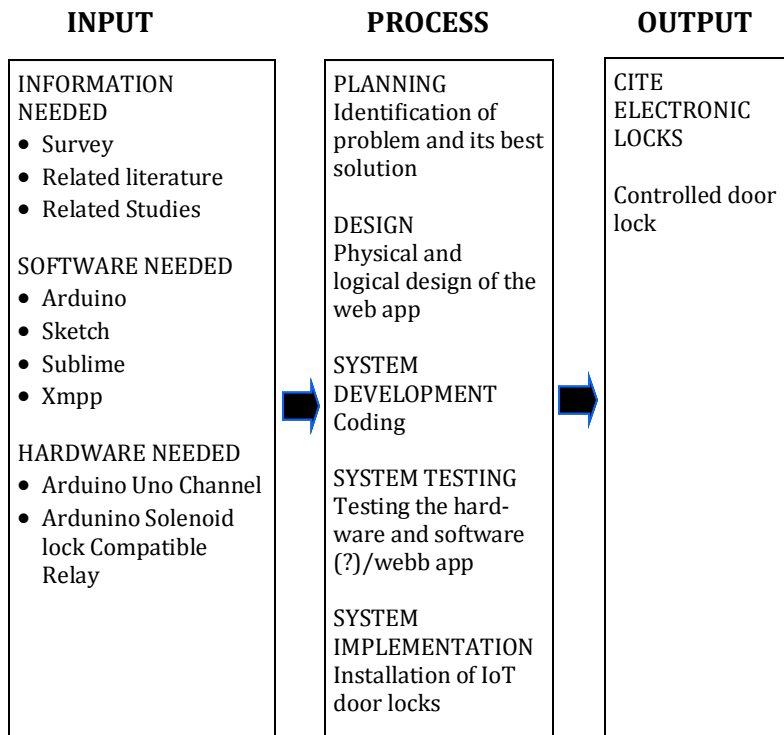
Objectives of the Study

This project's main objective is to introduce a secure and technologically advanced door locks through the use of the Internet. Thereby, allowing the user to monitor and control each of the door locks in a house, lessening the needed time and effort of home owners to check if they left a lock unhinged. One of the main problems with the existing door lock in this age is it is obsolete. As technology advances, security needs to advance too.

The proponents want to introduce a security system that is modern, reliable, and capable for home owners. A door lock in which the owner can monitor any time on any given place and date via the Internet. Internet of Things have been a hot topic today and the proponents made this project to introduce Internet of Things to home owners.

Specific Objectives

The following are the specific objectives of CITE Electronic Locks:

1. To use Arduino Uno to network and improve home security through the use of electronic door locks.
2. To maintain network and electricity connection on the Arduino device and each electronic door lock.
3. To provide a web application to control the Arduino device.

INPUT	PROCESS	OUTPUT
INFORMATION NEEDED • Survey • Related literature • Related Studies **SOFTWARE NEEDED** • Arduino • Sketch • Sublime • Xmpp **HARDWARE NEEDED** • Arduino Uno Channel • Ardunino Solenoid lock Compatible Relay	**PLANNING** Identification of problem and its best solution **DESIGN** Physical and logical design of the web app **SYSTEM DEVELOPMENT** Coding **SYSTEM TESTING** Testing the hardware and software (?)/webb app **SYSTEM IMPLEMENTATION** Installation of IoT door locks	**CITE ELECTRONIC LOCKS** Controlled door lock

Figure 1. Conceptual Framework

In figure 1 shows the input process output of the project in order to provide information in the making of the project entitled CITE Electronic Locks. The information is gathered by surveying the home owners of Milflora. The conceptual framework is composed of three phases: the input, the process, and the output.

In the input, the information needed is gathered by surveys, related studies and related literature. After the process, it is expected that the door locks are now easily controlled by the web app.

Methodology

To successfully implement the proposed project, the proponents have designed and developed a system to determine how to improve safety and security of home owners through Internet of Things.

Project Development Methodology

The proponents used Agile Methodology in implementing and integrating Internet of Things in door locks. In Agile methodology, a project will be divided by phases, these phases need to be done by their respective time frames. These time frames are called sprints, sprints are considered to be complete when the time period expires. There may be disagreements among the members of the team as to whether or not the development is satisfactory; however, there will be no more work on that particular part of the project. Each remaining phases of the project will continue to develop until the end of their respective time frames. The proponents used the processes of concept gathering, inception, iteration or construction, release, production, and retirement.

Concept. Projects are envisioned and prioritized.

Inception. Team members are identified, funding is put in place, and initial environments and requirements are discussed.

Iteration/Construction. The development team works to deliver working software based on iteration requirements and feedback.

Release. QA (Quality Assurance) testing, internal and external training, documentation development, and final release of the iteration into production.

Production. Ongoing support of the software.

**Retirement.** End-of-life activities, including customer notification and migration.

Requirement Specification and Analysis

The new security system can be monitored anytime on any given place through the use of the internet to improve the safety and security of a home. The proponents first determined how to lessen the time and effort of making a house more secure through the use of Internet of Things. The proponents analyzed how a door lock can be integrated to implement Internet of Things on a house.

Proposed Door lock system

The proponents gathered the required information, hardware, data, and documents on how to implement Internet of Things on an ordinary door lock. The proponents used an Arduino device, internet module, relays, and three solenoid door locks.

The Arduino device will be connected to the internet via the internet module, while the said device will be connected to the door locks through relays. The Arduino device can be controlled on smartphones, computers, or laptops connected to the internet via a web page where the home owner can sign-in to monitor, lock, or unlock their door locks.
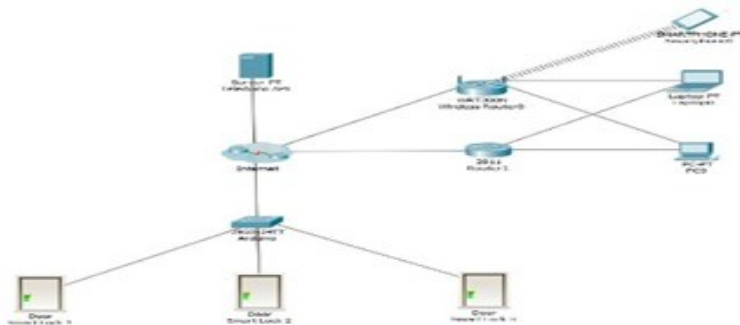
Figure 2. Proposed security system

Results and Discussion

There are 50 respondents from Milflora Homes Subdivision in Sabang, Baliuag, Bulacan. The evaluation for the Likert scale results were computed using the weighted average mean while the comments and suggestions were summarized.

The proponents asked the respondents to rate the system. The following are the ranges used to interpret the results of the computed mean:

Strongly Agree	=	5 points
Agree	=	4 points
Neutral	=	3 points
Disagree	=	2 points
Strongly Disagree	=	1 point

Table 1. System Evaluation in Terms of the Objectivity

Area of Evaluation	Evaluation
Objectivity	Mean
1. Is CIElocks easy to use?	4.3
2. Does CIELocks improve the security?	4.3
Agree	4.3

The evaluation in the area of the objectivity for the CIELocks acquired a mean of 4.3. According to most of the respondents from Milflora Homes Subdivision in Sabang, Baliuag, Bulacan, CIELocks is easy to use and will improve the security of their homes.

Table 2. System Evaluation in Terms of the Design

Area of Evaluation	Evaluation
Design	Mean
1. The design used is not painful to the eyes?	4.2
2. The design is not confusing?	4.14
Agree	4.17

The evaluation in the area of the design got a mean of 4.17. According to the respondents, the design is not confusing, the proponents made sure that the security system will be user friendly.

Table 3. System Evaluation in Terms of the Speed

Area of Evaluation	Evaluation
Speed	Mean
1. Can easily access the door lock?	4.3
2. Does not get interrupted (lag, crash, force stop)?	3.56
Neutral	3.93

The evaluation in the area of speed of the CIELockss acquired a mean of 3.93. According to the respondents, CIELocks: CITE Electronic Locks can be accessed easily by the user via the Internet. Also, according to the respondents, the security system does not get easily interrupted.

Table 3. System Evaluation in Terms of Functionality

Area of Evaluation	Evaluation
Functionality	Mean
1. Does every function of the lock work properly?	4.22
2. Can monitor and control the door lock/s in the house?	4.48
Agree	4.35

The evaluation in the area of the functionality acquired a mean of 4.35. According to the respondents, the door lock does function properly. The proponents' main objective is to improve the sense of security in homes through the use of Internet of Things devices and to make a security system that will function as it is needed. Also, according to the respondents, through this project they can now monitor each IoT door locks in their homes, increasing the sense of security and safety in their homes.

Conclusion

With our project; CIELocks or CITE Electronic Locks, not only will their security system will be improved. Moreover, they can now monitor their locks on any given time in any given day. Thieves and burglars will have a hard time breaking in houses that uses CIELocks.

Recommendations

The proponents would like to recommend future researchers to improve CIELocks: CITE Electronic Locks by adding new features including, but not limited to, notifications. Future researchers are allowed to use and to remodel the CIELocks given that it will improve its system and security features.

We would like to recommend to add a notification to the system, so to the home owner/users will be notified if there are open doors left or there is someone who wants to forcefully opens the door.

Hence forth, we would like to recommend the adding of the history of logins of users, so the home owners/users would know who used last the CIELocks and if someone would like to hack the home owner/users account it can be seen in the history of logins.

Moreover, the proponents allow future researchers to use this project and its references for the purpose of adding knowledge to their future research works.

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