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AUTOMATIC DOOR LOCK OPENER FOR HOSTEL STUDENTS IN AN ATTEMPT TO IMPROVE THE SECURITY OF THEIR VALUABLES

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Abstract

The goal of this research project was to examine the effectiveness of an automatic lock which might help hostel students secure their valuables and privacy by preventing their lockers from being broken into. This lock could be unlocked through a mobile app by embedding the device with a specifically designed system consisting of Arduino Uno, Bluetooth HC-06, and

servomotor. Most students who stayed at school hostels had the experience of losing their locker keys due to misplacement, recklessness, and sometimes theft. This posed an issue for them as losing the physical keys might put their lockers at the risk of being broken into by anyone and it also made it difficult for them to retrieve their belongings. Hence, this project was developed in order to help hostel students avoid this type of incident. 20 students were involved in this study. They tested the innovation and rated their feedback on it. The findings showed that the device gained approval from the students. This indicated that this device has the potential to be introduced across schools and colleges in the state.

Keywords

Arduino Uno, Bluetooth HC-06, Servomotor, Locker, Physical Keys, Dormitories

1. Introduction

Bluetooth Door Lock Opener System was a device built from the combination of Arduino Uno, Bluetooth HC-06, and servomotor. It was created to help school students who stayed at dormitories secure their valuables, protect their lockers, and access them easily with an automatic lock opener that could be activated through a mobile phone. This might also decrease the rate of thefts that occurred frequently at schools. Juliff (2018) proposed several ways of how to protect belongings at dormitories and one of her suggestions was for people to purchase lock protectors that could be activated from any distance including alerting the owner if there was any attempt of breaking into his or her locker. Thus, this innovation was built to enable students to secure their belongings and have quick access to their lockers through an automatic lock opener that is connected to their mobile devices instead of relying on easily misplaced or stolen physical keys. This study specifically focused on a school located in the interior region of Sabah, an Island state in Malaysia in which almost half of the students stayed at its dormitories.

2. Problem Statement

Keningau Vocational College was a school with nearly 1000 students. Almost half of the students stayed at the school hostel blocks. Each student who stayed at its dormitories had a locker that they constantly locked and unlocked to store and retrieve their belongings. The major problem that the students usually faced was losing or misplacing their physical keys which could put them as easy targets for victims of theft as someone could easily access their lockers. In addition, relying on a physical key could be a hassle for the students as they sometimes had difficulties opening their lockers due to the manual and mechanical routine of using physical keys.

According to Maxfield (1987), school students or college students were easy prey for thief due to their predictable and repetitive daily routines. Fisher and Sloan (2013) argued that students' lack of awareness of how their daily routines could make them vulnerable targets for theft and property victimization was one of the main reasons why theft and breaking. This suggested that students needed to take precautions in making sure their belongings were safe. This further necessitated research and innovation that could prevent students from becoming victims of theft, property damage, and invasion of privacy.

3. Objective

The purpose of this study was to examine the functionality of this device known as Bluetooth Door Lock Opener System. There are three main objectives of this study:

1. Build the device based on the proposed concept of the Bluetooth project door lock opener system.
2. Examine to which degree the Bluetooth door lock opener system can function properly.
3. Explore the replicability and scalability of this concept as a security measure.

4. The Application of Arduino

Kaswan, Singh, and Sagar (2020) described Arduino as an open-source programmable board that comprises Integrated Development Environment (IDE) which allows people to write and run programming that enables it to decipher inputs (e.g. sensor, button, message) and turn them into outputs (e.g. activated motor, turning on a light). It can be used for various applications. David et al. (2015) highlighted the application of Arduino in the concept of Smart Homes which encompasses various home activities like motion sensors, outlet control, temperature sensors, blower control, garage door control, airflow control, sprinkler control and bill of materials. This research project utilized Arduino Uno as its main component and attempted to study its potential in creating a device that is in line with industry 4.0.

Louis (2016) explained that there are two main aspects of Arduino; hardware and software. The hardware comprises a microcontroller, external power supply, USB plug, reset button, internet programmer, analog pins, digital pins, and power GND pins. The microcontroller is the most important part of the development board of any Arduino since it functions as a mini-computer that can receive and send information or command to any devices that it is connected to. The microcontroller varies between boards due to its various specifications. The software is based on a program code known as a sketch and it consists of multiple parts: text editor, message area, text, and console toolbar.

Arduino Introduction (2015) highlighted several factors that made Arduino a feasible and desirable system. It has an active user community that can support each other in sharing their experiences or solving problems. Arduino was designed to be economical, cheap, and trouble-free which drew more people to use it. It has a high degree of versatility and flexibility that can be used on many platforms.

This project examined the potential use of Arduino as a cheap, convenient, and efficient type of technology that can be used to upgrade conventional items so these items can operate automatically.

5. The Integration of Bluetooth

Bluetooth is a networking technology designed for low-powered and short-range applications of wireless communication. It is considered as wire replacement technology that can link several gadgets including mobile phones, electronic devices, laptops, and personal computers without any cord, cable, wire, or any physical connection between these machines. However, Bluetooth can be more than just a wire replacement technology due to its low power consumption and low cost which turned it into one of the most appealing solutions to digital technology (Singh, Sharma & Agrawal, 2011). Since this study utilized Arduino Uno, the Bluetooth was a complementary aspect of this project.

6. The Usage of Servomotor

This research explored the potential usage of servomotor. The servomotor is a motor that is often utilized for position or speed control in closed-loop control systems. The main operations that a servomotor executes are to turn over a wide range of speeds and to perform position and speed instructions that it receives (Kenjo, 1990). Servomotors can be used in various industries and processes: processing of wood, textile, printing, conveying technology, plastic industry, fold and packaging industry, and machineries (Bateson, 1996). According to Morris (1996), there were not many studies that were done on the role of servomotor in revolutionizing technology. Thus, this research project examined the potential of this device in automatons.

7. Risk of Theft at Schools and Colleges

Students are prone to becoming victims of theft due to their tendency of leaving their belongings unattended and being reckless once they become engrossed in social events like parties (Lee & Hilinski-Rosick, 2012, Fisher et al., 1997). Clark and Eck (2013) categorized

crime facilitators (situations that motivate people of criminal behaviours to commit illegal acts): physical, social, and chemical. Physical facilitators are the most common factors for theft of personal belonging to occur in schools or colleges. This could be largely attributed to the poor physical layout of the campus as well as lack of security which would motivate offenders to commit crimes such as breaking into someone's locker and took his or her belongings. In most Malaysian schools and colleges, there were no security cameras or surveillance systems and most dormitories housed over 20 to 30 students whose lockers and beds were situated close to each other.

8. Human Controlled Automaton

Koskela and Väänänen-Vainio-Mattila (2004) explained how the concept of a smart home that is increasingly becoming more popular derives from the use of mobile devices that can remotely control any feature or appliance of a home. However, this technology relies heavily on the network connection that should be standardized and interconnection. Yang et al. (2018) argued that people want advanced features that are close to intelligent control but not to the extent of fully automated. Thus, this project attempted to explore the use of an automated lock that still required human control.

9. Methodology

The main methods of data collection for this research project were a rating scale and an observation checklist. There were 20 students who were staying at dormitories that volunteered to become the subjects in this study. They were allowed to test the prototype of this innovation. They filled in a rating scale of how feasible and practical this innovation could be and complete an observation checklist on whether the features of the innovation functioned accordingly. The data from these instruments were analyzed in order to identify the potential use of this innovation.

10. Findings

The findings were used to address the three objectives of this project. The first one was to turn the concept of the Bluetooth project door lock opener system into practice and determine how practical it was. The second one was to examine whether the Bluetooth door lock opener system could function properly and to which degree that it could be used as a security measure. The third and final one was to explore the replicability and scalability of this concept as a

security measure. The findings would be used to deduce whether this device had the potential to be turned into an actual product or system that could be used at a large scale across schools and probably beyond campuses.

Table 1.0: Results of the Respondents' Self Rating Perception

No	Items	1	2	3	4	5
1	The device functioned properly	-	-	-	30%	70%
2	The time taken to use the device was brief	-	-	-	50%	50%
3	The device could help us secure our belongings	-	-	-	44%	56%

The rating scale illustrated the respondents' level of approval on each of the items from strongly disagree (1) to strongly agree (5). All of the respondents agreed that the Bluetooth Door Lock Opener System functioned properly. They believed that there was less time taken to lock and unlock a locker in comparison with physical keys. They also felt that the device could help improve the safety of their belongings since the tendency for offenders to attempt to break into their lockers was low. This finding was consistent with what Yang et al. (2018) have discovered that people desired something that has the features of intelligence but it is fully automatic as humans still have control in it. This device is considered an upgraded version of the conventional lock with advanced features yet it is still dependent on human control.

Table 2.0: Results of Respondents' Observation

No	Items	Functioning	Non Functioning
1	Arduino Uno r3	100%	-
2	Bluetooth Module HC-06	100%	-
3	Servo motor	100%	-
4	Jumper	100%	-
5	Touch sensor	100%	-

The 20 respondents were students who had completed the fundamental topics in electronics and electricity. They were required to inspect the device and examined each of its main components to determine whether they functioned properly. Based on their responses from the observation checklist, they could confirm that every main component of the device was functioning well. There was no malfunction discovered by the respondents. It is crucial for a thorough inspection to be conducted on this device to ensure that it can function properly. Clark and Eck (2013) cited physical facilitators as the most common factor for theft of personal

belonging to occur in schools or colleges. Flawed security measures can encourage people of criminal tendencies to take advantage of it.

11. Conclusion

It could be deduced that this device had great potential advantages in protecting students' personal belongings and improving their access to their lockers. This device can substitute conventional physical keys that can easily get stolen or misplaced. In addition, the application of this device is in line with the increasing influence of Industry 4.0. It is recommended that the device could be promoted across schools and colleges in Malaysia especially campuses that provide lockers or dormitories to the students.

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