AUTOMATIC DOOR LOCKING SYSTEM

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ABSTRACT

In this paper, we propose a smart digital door lock system which can be an integral part of home automation. The digital door lock uses the digital information such as a secret code, smart card and fingerprints for authentication instead of the traditional key system.
The days of looking for your keys in the house or forgetting to lock the door getting are thing of the past, thanks to the variety of the electronic door locks in the market. However media has reported electronics door lock being opened by invalid users to invade homes and offices. In this paper we have proposed a digital door lock with enhanced security by providing authentication using user's smart phone. The proposed system can work with both Wi-Fi and Bluetooth environment.

KEYWORDS: *Wi-Fi Module, Microcontroller, Android Application and Knock Detector.*

1. Introduction

Wi-Fi is a technology that allows electronic devices to connect to a wireless LAN (WLAN) network. Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency (RF) technology - a frequency within the electromagnetic spectrum associated with radio wave propagation. Wi-Fi is supported by many applications and devices including video game consoles, home networks, PDAs, mobile phones, major operating systems, and other types of consumer electronics. Any products that are tested and approved as "Wi-Fi Certified" by the Wi-Fi Alliance are certified as interoperable with each other, even if they are from different manufacturers.
Recently, digital door locks have been widely used in households and offices. However, in many cases, an intruder has tried to penetrate a private area by circumventing the lock. In this paper, we have proposed a Wi-Fi-based digital door lock to reduce the damage of digital door lock tampering and to enhance the various security and monitoring functions using Wi-Fi technologies. Wi-Fi technology over IoT technology results in cost efficient door lock.

2. Literature Review

Bhalekar Pandurang et.al. 1: This paper gives basic idea of how to control security using digital keys. In this paper they used door lock system as a model for indoor and outdoor key lock system. The system is designed such that the motion of the user will be captured from the camera and the user will be detected and then only he will be given a key to lock or unlock. It also offer security and ease for Android phone. This project is based on Android platform which is Free Open Source Software. So the achievement rate is easy on the pocket and it is reasonable by a common person. Accomplishment of wireless Bluetooth connection in microcontroller permits the system installation in more easy way. The system has been successfully designed to control the door condition using an Android Bluetooth-enabled phone and Bluetooth modules via Bluetooth HC-05. The mobile device needs a password to increase the security of the system. The hardware on the door uses a microcontroller to control a linear actuator that acts as the locking mechanism. The Bluetooth protocol was selected as a communications method because it is already incorporated into many Android devices and is secured through the set of

rules itself. It also fit well into the design necessities of the project for a short range, wireless connection method. The system is proposed such that the motion of the user will be captured from the camera and the user will be detected and then only he will be given a key to lock or unlock. A digital door lock system is an equipment that uses the digital information as smart card, and finger prints as the process for authentication as a substitute of the legacy key system. In our proposed system, a Bluetooth module is set in digital door lock and the door lock acts as a central main controller of the overall system. Technically, our proposed system is the group of sensor nodes and actuators with digital door lock as base station. A door lock system proposed at this point consists of Bluetooth module and smart phone for user verification, motor module for opening and closing of the door, sensor modules, communication module, and control module for controlling other modules.

The project idea is to design an automated device for locking and unlocking of the door as nowadays an automated device can replace good amount of human working force, moreover humans are more prone to errors and in intensive conditions the probability of error increases whereas, an automated device can work with diligence, versatility and with almost zero error. . The system is designed such that the motion of the user will be captured from the camera and the user will be detected and then only he will be given a key to lock or unlock. The application was designed to allow the user to also check the status of the door. The mobile device requires a password to increase the security of the system. The hardware on the door uses a microcontroller to control a linear actuator that acts as the locking mechanism. The Bluetooth protocol was chosen as a communications method because it is already integrated into many Android devices and is secured through the protocol itself. It also fit well into the design requirements of the project for a short range, wireless connection method. Our smart lock system will operate over wireless network like Bluetooth. The aim of our project is to design a door lock system which will perform authentication of the user as well as opening and closing of the door. Entering and exiting without using those traditional keys is the main aim of the project. The system is designed such that the motion of the user will be captured from the camera and the user will be detected and then only he will be given a key to lock or unlock.

Ohsung Doh et.al. 2: In this paper, a digital door lock with enhanced security functions was designed to work with the Internet of Things. The designed digital door lock senses the physical impact of an invalid visitor and notifies the user's mobile device. If an incorrect pass- code is repeated more than a certain number of times, the lock captures an image of the invalid user and transfers it to the mobile device, thus, strengthening the security function. The 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. Another efficient system function is that when a valid user approaches the door, the door lock system opens or closes the door without additional operations. They expected that if the problems mentioned previously are resolved, the proposed system can be commercialized into a useful product, such as a secure security system with enhanced convenience, especially when compared to existing digital door lock systems.

The Internet of Things (IoT) can be defined as a global infrastructure which combines intelligent services with situational awareness, and allows mutual communication between one thing and another, and between people and intelligent things over a network. Machine to Machine (M2M) communication is different from IoT because a person does not directly control the equipment or intelligent instruments, they are responsible for communicating on behalf of people. More recently, a variety of communication technologies have been fused to receive and provide information about things. Especially, IoT technologies have been enabled to communicate by the fusion of home appliances and mobile devices.

Anuradha.R.S et.al. 3: Through this they had successfully resulted with both unlock and lock capability of door by an android application. The Wi-Fi allows the user to interact with the Board from longer range when compared to Bluetooth. The major advantage here is the usage of an Arduino Yun Board which is in under research for future purpose by many scholars. Further the overall system is more attractive which allows us to interact with the environment. The purpose of the system is to create convenient and easy-to-use system for users. Smart Home Automation System plays a major role in helping reduce the work by using some Technologies especially for children, old aged people and physically challenged. The proposed work is to send a signal to door from a Computer or Tablet or mobile devices by using wireless system. This allows the user to lock and unlock a door from inside or outside a house with a Wi-Fi range available. The ideal purpose of the work is, if the door is not locked in First floor or in any other floor, the user from ground floor they can open the door or unlock the door from mobile phone or Laptop, which makes a person to reduce its energy or save time. The major

components of the system are Latest Arduino Board, Servo Motor and Wi-Fi (IEEE 802.11b/g/n) standard protocol for wireless communication which combines and forms an activity. The open source Software and Hardware with embedded device is used to give a complete task

Neelam Majgaonkar et.al. 4: This paper gives basic idea of how to control home security for smart home, especially for door key locks. It also provides a security and easy for Android phone users. This project based on Android platform which is Free Open Source Software. So the implementation rate is inexpensive and it is reasonable by a common person. With the wireless Bluetooth connection in microcontroller permits the system installation in more easy way. The system has been successfully designed and aimed to control the door condition using an Android Bluetooth-enabled phone and Bluetooth modules via Bluetooth HC-05.

Their main objective is to utilize the different electronic parts available in the market and build an integrated home security system by using Bluetooth device and Microcontroller technology. This system gives service at low cost compared to the cost of the available security system. By using registered password in this system they had unlock the door by which it increases the security level to prevent an unauthorized unlocking. If the user forgets the combination of password this system gives the flexibility to the user to change or reset the password. Security measure is very high as provided in two ways. First we have to enter password for blue-tooth connection and second is for unlocking the door in application. Both passwords can be changed as and when required. This automatic password based lock system will give user more secure and low cost way of locking-unlocking system.

Literature survey is carried out to gain information and knowledge. Before starting with the analysis and design of project, we referred many research papers, manuals, documents related to the concept of the project. Their summarized features are shown in Table 1.

Table 1. Features of previous digital door lock system

Study (Year)	Main function	Networking
[5] (2011)	Diffusion of alarm using door lock	Interconnection of door locks
[6] (2012)	Controlling door lock in a short range with mobile application	Communication via Bluetooth
[7] (2012)	Door opening and closing by speech recognition	-
[8] (2014)	Image transfer	Connection of mobile devices
[9] (2015)	Connecting to mobile devices Key Sharing Access notification	Connection to a mobile device via Bluetooth
[2] (2015)	Impact detection Recording access information	Connection to a mobile device
This paper	Knock detector / Vibration sensor Fire Notification Recognition of user proximity and automatic opening	Communication via Wi-Fi

3. Design of the Proposed Digital Door Lock System

3.1 Main features of the proposed system

The main features of the proposed system are as follows.

First, it has temperature sensor which send a notification to the registered user of the rising temperature and opens the door on user's demand. Second, it has knock detection that opens the door itself after a particular knock gesture applied on the door. Third, it has impact detection and an alarm function. This is to detect an intruder who tries to invade by applying physical force on the lock. Fourth, it has an image transfer function. Generally, an attacker who does not know the password will make a variety of attempts. Therefore, if an attacker mistypes the password more than a given number of times, the system

obtains images of the intruder and transfers them to the mobile device, the user can query the records of typed passwords and all incoming and outgoing records that are stored in the database. Fifth, the system can open the door lock in real-time after recognizing a visitor's image.

3.2 Overall structure of the proposed system

The overall structure of the proposed system is shown in Figure 1. The proposed system consists of a digital door lock and the end-user's mobile device.

The sensors like temperature and vibration sensor generates an alert notification on the user's mobile phone through controller. Knock detector equipped in digital door lock opens the gate if a particular knock pattern is applied by the user. The controller detects physical impacts applied by a visitor, and notifies the user's mobile device. The controller detects if a password error occurs more than a certain number of times, and uses the camera to capture an image of the visitor. It then transfers the image to the user's mobile device. All of the access records are stored in the controller's database, which can be queried via the user's mobile device. If a visitor has lost his key, his image is captured and transferred to the user's mobile device by pressing a specific key; the user can then control the door lock remotely after verifying whether the visitor is valid. Another important function of the controller is automatically opening or closing the door when a valid user comes near. When a valid user accesses the gate holding an object, because it is difficult to operate the door lock, the controller communicates with the user's mobile device via Bluetooth and opens the door lock automatically.

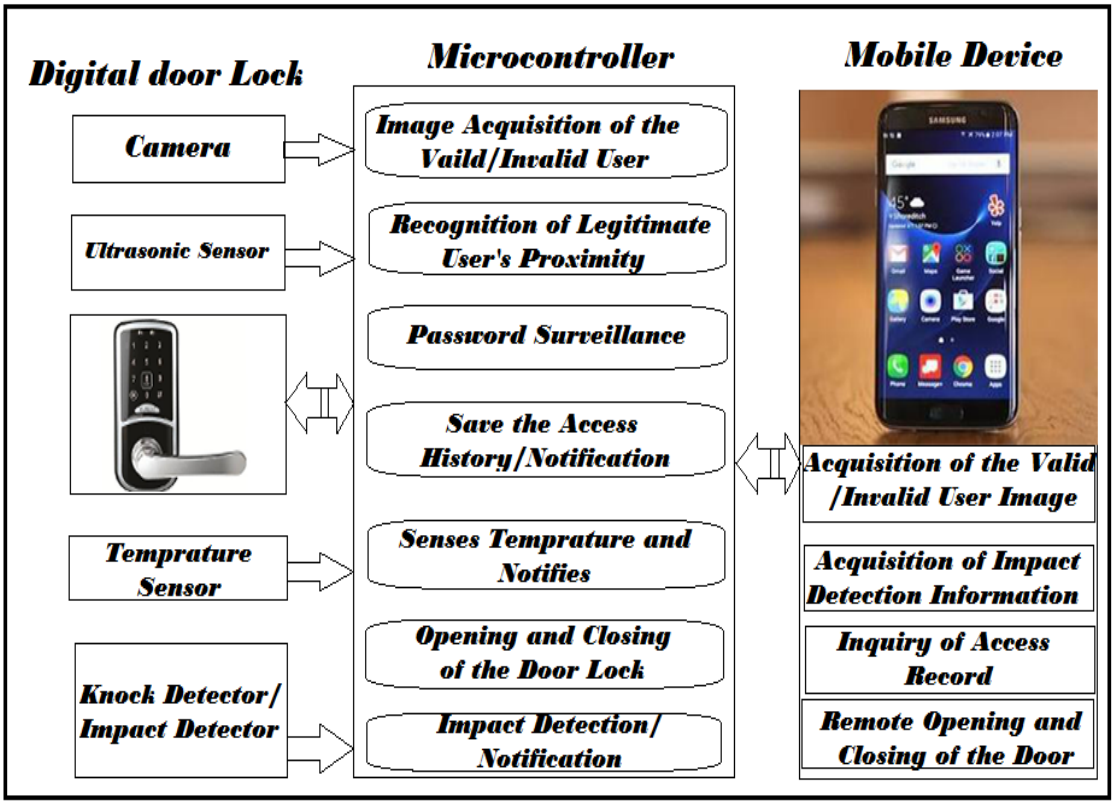

Fig.1. Structure of the proposed door lock system

The mobile device acquires the impact detection information and the invalid visitor image information from the controller, and then the user can take appropriate action. Further, if the user acquires image information for a valid visitor, it is possible to open or close the door lock remotely. It is also possible to query the incoming and outgoing records.

4. Conclusion

Emphasizing security as a crucial part in today's hacking world, up gradations are done for locking devices. Making use of recent and advanced technologies has given a new dimension to the stated purpose. The most trending Smartphone technology is been brought in use for one more purpose apart from the one always being used. Besides entertainment and information utility aspect of Smartphone

.devices, they can also serve the purpose of unlocking the door. Wi-Fi technology will be adding an additional feature to the proposed module. The price of chipset for Wi-Fi continues to drop, making it an economical option included in even more devices. Computers and many other devices, including smart phones and PDAs, can be connected to the wireless Wi-Fi device. Having least limitations and more superior level of safety attribute makes it more reliable. It provides an overall satisfaction to the user.

5. Future Scope

A rechargeable battery can be provided which can give power backup of 3-4hrs in case of power failure. Use of camera can also be done for surveillance. For further security, finger scanner, face recognizer etc. can be used. To avoid opening of door every time, voice conversation can also be done with the person on the other side of the door. This system can be used in hotels, banks, motels, or any other place as an alternative lock for additional security.

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