

Smart Door Lock System: Improving Home Security using Bluetooth Technology

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ABSTRACT

In today's world, smart home control system is necessary in daily life. As the technology is emerging a lot it's time for us to be more technical related to home secure security and easy access to the user. This technique basically deals with key less door lock system using smart phone in which SMS, E-mail, Image, anti-burglar will be used and for guest users it will generate b-id. This will allow the guest user key to access the door for a given particular time only. The system also includes motion detectors that will help to determine the user. If an unauthorized person is trying to access the door, then camera will take snaps of user at the door. These snaps will be sent to owner. Furthermore, this approach can be applied and extended to different institutions like banks and offices.

Keywords

Bluetooth, sensors, home networking, Human detection module, PIR motion detector

1. INTRODUCTION

Today technology has become important part of human life. It has great influence in many aspects in our day to day life and also have improved our environment. The creation of mobile phones and computer have caused many people to rely on technology to improve their way of working and also provide easy way to use various applications.

Home automation system is a computerized and intelligent network of electronic devices designed to monitor and control the home appliances. Home automation is the emerging field that has tried to get the attraction of most of commercial and research fields. Although wired home networks were given importance in the earlier stages of home automation but now as technology is emerging a lot people have started adopting technology to a greater aspects. Wired system requires proper planning and construction works is also messy. It is the reason wireless communication has replaced the wired ones. Furthermore wireless system provides more flexibility and extensibility that is its installation is free from construction works as it requires no cabling cost.

Door lock system has been one of the most popular consumer devices replacing many of the conventional locks because of the user convenience and affordable price.

Many of the wireless network solution such as Bluetooth, ultra wide band (UWB), wireless Ethernet and many more are in the area of home networking [1]. From among these Bluetooth has become the most attraction technique in the research and commercial domain. Bluetooth enables to develop various kind of wireless system via handsets or smartphones. Research by using handset and actuator by remote operation of various

electrical devices at home. By pressing a single button on the handset, a signal is sent to the actuator and subsequently switches On /Off the intended device [3].

Since Bluetooth has become so prevalent in mobile devices, it was seen as simple, low cost, secure solution for wireless network connecting a mobile device to home network system.

This paper proposes a novel system for the access monitoring and control on digital door lock that uses Bluetooth technology. By adopting the system, users can be provided with safe and convenient life. The objective is to develop a prototype system with a wireless module and a digital door lock providing one of the practical applications of Bluetooth network. Implementation of the prototype system would be good solution of access monitoring and control system.

2. RELATED WORK

There are various systems for remote control and monitoring designed as commercial products or some for research platforms. Experts in the field of wireless technologies have conducted research on these aspects and have achieved results. Some commendable research work is mentioned below.

Zigbee, bluetooth and WiFi are the most widely used technologies when it comes to wireless networking. A system is proposed with Zigbee as main module of the system. System also includes various modules like human detection module (HDM) to detect the user at the door, camera, relay module, video phone. Then zigbee module fetches zigbee tag for user verification. If the user verification fails, user at the door can interact with the owner using speaker phone [1]. Digital door lock in home automation system provides convenient control and home environment monitoring to the user and condition all at once before entering or leaving the house. Some system proposed RFID as the main technology of system. The system involves use of touch LCD monitor [2].

The prototype supports controlling and microcontroller to lock and unlock the door. Connection of circuit with relay board and also to the arduino board can be monitored by bluetooth to provide access from smartphones or tablets [3]. Internet of Things is used for monitoring and controlling home appliances via World Wide Web. It can communicate with home automation system through zigbee, wifi etc. User can directly interface with the web and control the home appliances [4]. As bluetooth has become widespread there are various vulnerabilities in the security protocols of bluetooth. It also mentions some tips to the end user so that they become more cautious about their private information [5]. Smart home domain is a new trendy way of home automation and energy conservation. It reviews various technologies that are used in home automation and also compare and contrast their results [6].

Another system consists of a build in NFC capabilities of a smart phone which would eventually be the key to open the door by means of logical link control protocol, which then matches the user's own set of password to verify that user should be given permission or not [7]. It uses near field communication (NFC) reader of a smart phone device with the door lock control system to provide a convenient single button operation. The design offers three operation modes to the user to match the user password which indirectly enhances the security. The system also includes sleep and standby state to save power consumption [8].

This system is based on face recognition technology to confirm visitor's identity so as to allow the user to access the door. Use of zigbee and image processing technique make the security system better [9]. Design of GSM based digital door lock system using PIC platform.5 digit password is used to lock/unlock the door. If the user enters the wrong password the system sends a warning message to the owner that user validation has failed [10].

3. SYSTEM STRUCTURE

In this section, the brief description of proposed system followed by the operation of the bluetooth module, the digital door lock, and the sensor module has been provided. The term Bluetooth will be the main component of the system.

Smart digital door lock is a system to monitor and control several devices in the home. Our smart digital door lock system operates over wireless sensor network. It is a network of sensor nodes with digital door lock as sink node. The smart digital door lock system can be divided into five parts: the control module (PC app), the sensor module, the communication module (server) and the I/O module, Android application. The control module is the brain of the system. The locking operation is controlled by the microcontroller. The communication module is used to connect the devices and micro controller. The user can access to the door lock system through I/O module. The I/O module is connected to micro controller that will fetch the B-id from the user or visitor



Figure 1: System Structure

3.1 Communication module

In this proposed smart digital door lock system the setup works in two communication modes: central and emergency mode. The centralized mode involves digital door which takes control of all the communications in the sensor nodes and network and accordingly act as system instructs. This is generally the type of communication occurring in normal authorized access. This communication mode reduces unnecessary communication between sensor nodes and central controller thereby reducing energy consumption.

Secondly, for certain scenarios such as fire or robbery, the communication occurs in emergency mode. As the emergency mode is detected by the sensor node, appropriate actions are taken such as triggering the alarm.

3.2 Sensor Module

Sensor module includes vibration and motion detector sensors. The motion sensor used in this system is PIR sensor. PIR Sensor uses electronic semiconductor to measure infrared light radiating from objects thus the name PIR (Passive Infra-Red) sensor. When there is any motion by a heat radiating object this module detects the motion and gives a trigger. This is a passive sensor as it doesn't radiate or emit any energy for motion detection. Objects that are above absolute zero radiate heat, this heat signature cannot be seen by naked eye and is in Infrared wavelength, but can be measured by various infrared devices. Fresnel Lenses are used in the sensor module, which widens angle of detection and also filters noise. The PIR requires a 4.5V-20V power and gives a digital signal output (3.3V) high, 0V low. This sensor module can sense up to 7 meters in a 100 degree cone

3.3 Input and Output module

The input to the control module is b-id of the user or visitor smart phone. Control module then start the camera recording and send the file to the database. Sensors like vibration and motion detector are used as another input which will try to detect any motion in the specified area near the door and vibration sensor will detect vibration at the door knob which is done by the user.

The output basically include access to the door for the user at the door. It also includes triggering alarm and also sending proper live feed to the owner and notify the owner about the user when he/she enters and leave the house

3.4 Control Module

It controls camera, alarm and communication between server and all the important processes are done by this module. The control module is the center of the door lock system where all the process cycle start. This module connects the server for verification of the user b-id and to the microcontroller. Camera is connected to control module for surveillance purposes. All the operations are done by the control module which includes sending SMS, triggering alarm, send notification to the owner, check that the door is open and if it is open then it will accordingly close the door.

4. OPERATION OF SYSTEM

4.1 Door lock/Unlocking for guest and owner

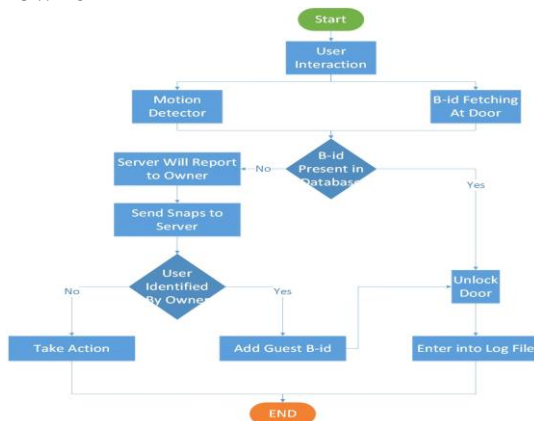


Figure 4.1

PIR which is the motion detection module detects the movements at the door. It then sends signal to control module which then establish connection with the guest and fetch b-id. Control module then sends the fetched B-id to the server for verification. Server then searches for guest b-id and if the b-id exists in the database then server sends signal back to control

module as a response. Control module then rotates the motor which is connected to microcontroller and unlocks the door. If the server does not find b-id then server sends signal to control module which further sends command to activate camera and take snaps of the user at the door. Simultaneously the server notifies the owner that guest has appeared at the door. Then later owner can see snaps of guest and send signal to server to register b-id of that user and update the log. Otherwise owner can take appropriate action. Fig 4.1 shows user trying to access the door with b-id.

4.2 Emergency Mode

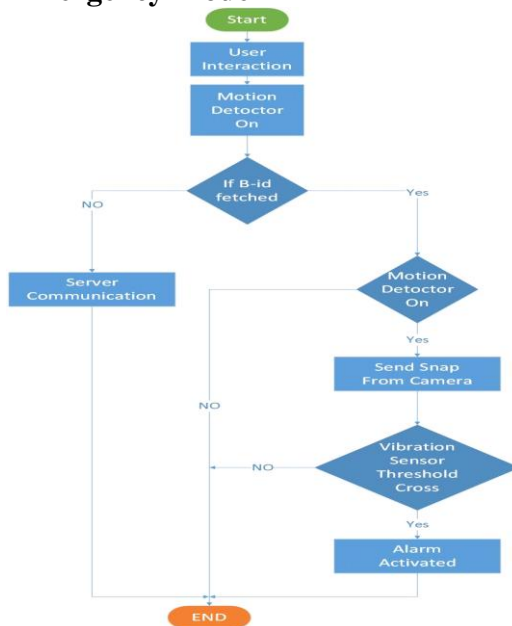


Figure 4.2

Motion detector will detect the guest at the door. Control module then fetches b-id from guest and communicates with server to verify the user and if bi-d does not exist then camera

will be activated to take snaps of the guest. If guest tries to access the door by using some equipment or if sensor threshold limit has been crossed, then alarm is triggered and the owner is notified that unauthorized user is trying to access. Fig 4.2 shows user trying to unauthorized access to the door.

4.3 First Phase GUIs

Figure 4.3 shows a tentative admin application appearance, that is the graphics user interface. It involves the operations like adding user data, managing the user data, opening the door camera etc.

It is a premature level GUI and is still under development. Entire admin application structure will be developed using Java and other utilities like servlet.

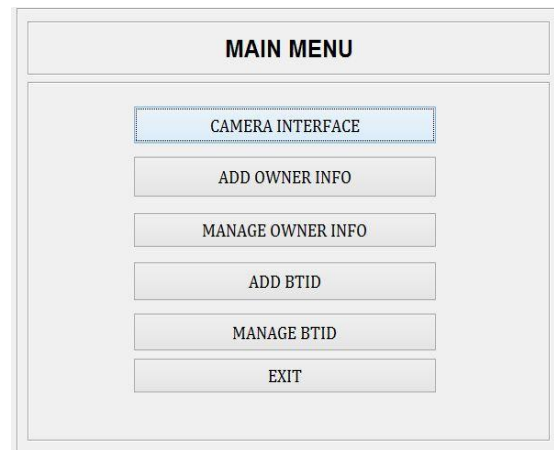


Figure 4.3

5. CONCLUSION

Digital door lock is one of the most popular digital consumer devices because of the user convenience and affordable price. In actuality, it is replacing a lot of conventional types of locks. This report tries to propose a novel wireless access and monitoring control system which consist of different phases :

- 1) Detecting user
- 2) Fetching b-id
- 3) Verification
- 4) Notifications
- 5) Process according to request
- 6) Performing actions in case of emergency.

A low cost authentication system based on bluetooth technology, making home automation more secure and cost efficient. This technology can surely make change in the society to drop the percentage of crime. Both NFC, RFID can be used in securing home but implementation cost and availability of supply to hardware requirements is not up to the mark. So bluetooth technology has been considered.

5 FUTURE SCOPE

In future, the android application should offer assistance in controlling more doors, windows and basic home electronic appliances. Battery backup system should also be considered to ensure the completeness of the system. An auto trigger report of the attempt to theft can be sent to nearest police station along with residential address. This idea can be considered to make the proposed system better.

6 REFERENCES

- [1] Il-Kyu Hwang, Member, IEEE and Jin-Wook Baek."Wireless Access Monitoring and Control System based on Digital Door Lock", IEEE Transactions on Consumer Electronics, Vol. 53, No. 4, NOVEMBER 2007. 0098 3063/07/20.00 © 2007 IEEE.R. Caves, Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge, 1982. (book style)
- [2] Yong Tae Park, Pranesh Sthapit,Jae-Young Pyun."Smart Digital Door Lock for the Home Automation", Department of Information and Communication Engineering, Chosun University Gwangju, South Korea,978-1-4244-4547-9/09/26.00 ©2009 IEEE.
- [3] N.H. Ismail, Zarina Tukiran,N.N. Shamsuddin, E.I.S saadon,"Android-based Home Door Lock(s Application via Bluetooth for Disabled People", 2014 IEEE International Conference on Control System, Computing and Engineering, 28 - 30 November 2014, Penang, Malaysia.978-1-4799-5686-9/14/31.00 ©2014 IEEE.
- [4] Pavithra.D,Ranjith Balakrishnan,"IoT based Monitoring and Control System for Home Automation ", 978-1-4799-8553-1/15/31.00 © 2015 IEEE.
- [5] Nateq Be-Nazir Ibn Minar and Mohammed Tarique, "BLUETOOTH SECURITY THREATS AND SOLUTIONS: A SURVEY", International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.1, January 2012 .DOI : 10.5121/ijdps.2012.3110.
- [6] Shruthi Suresh, Sruthi P V, "A Review on Smart Home Technology",2015 Online International Conference on Green Engineering and Technologies (IC-GET 2015),978-1-4673-9781-0/15/31.00 © 2015 IEEE
- [7] Chi-Huang Hung, Ying-Wen Bai, Je-Hong Ren,"Design and Implementation of a Door Lock Control Based on a Near Field Communication of a Smartphone", 978-1-4799-8745-0/15/31.00©2015 IEEE.
- [8] Chi-Huang Hung,Ying-Wen Bai, Je-Hong Ren,"Design and Implementation of a Single Button Operation for a Door Lock Control System Based on a Near Field Communication of a Smartphone", 978-1-4799-8748-1/15/31.00©2015IEEE.
- [9] Mrutyunjaya Sahani, Chiranjiv Nanda, Abhijeet Kumar Sahu and Biswajeet Pattnaik, "Web-Based Online Embedded Door Access Control and Home Security System Based on Face Recognition",2015 International Conference on Circuit, Power and Computing Technologies [ICCPCT], 978-1-4799-7075-9/15/31.00©2015 IEEE
- [10] Adnan Ibrahim, Afhal Paravath, Aswin P. K., Shijin Mohammed Iqbal and Shaez Usman Abdulla, "GSM Based Digital DoorLock Security System", 2015 IEEE International Conference on Power, Instrumentation, Control and Computing (PICC),978-1-4673-8072-0/15/31.00 ©2015 IEEE.
- [11] <http://rees52.com/67-pir-motion-detector-module.html>