American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-6, Issue-7, pp-146-151
www.ajer.org
Research Paper Open Access

Low Cost Removable (Plug-In) Electronic Password - Based Door Lock

Agbo David Odu[1], Madukwe Chinaza Alice[2], Otengye Jotham Odinya[3]
[123]*Department of Electrical/Electronic Engineering, Federal University of Agriculture, Makurdi, Nigeria*
Corresponding Author: Agbo David Odu

Abstract: *Security has always been an important factor in life. We need our home and offices to be secure. In this paper the plug-in electronic door lock is designed to have two levels of security and it comprises two sections. The first section is mobile section which serves as the key. It contains a matrix keypad, LED, and a microcontroller; it can be carried around in the pocket while the second section, which is stationary, is installed at the door. When the mobile section is plugged into the static section, the two sections have a handshake; without the internal handshake between the two microcontrollers the static section will not accept the mobile section. If the correct password is entered the door lock will open the door for 15 seconds after which it will automatically close the door back. If the wrong password is entered three times, the system will keep the door locked, activate alarm and an SMS will be sent to the authorized personnel to stop the alarm and reset the system so that password can be entered again. This work can be used for access control in homes and offices*
Keywords: *Electronic Access Control, Keypad-based, microcontroller – based, Security Door*

Date of Submission: 14-03-2017 Date of acceptance: 15-07-2017

I. INTRODUCTION

Doors serve as entrances to our homes, offices and many other kinds of enclosure; they may also provide access for strangers, criminals and offenders. Doors are meant to be secured and to prevent intrusions from unwanted persons. Individuals and cooperate bodies are becoming more aware of the dangers associated with relying on keys and padlocks to provide security to exclusive areas of their apartments and organization, because criminals and fraudsters can forge keys or make master keys that can be used to break into such rooms or offices. To eliminate this insecure and old fashioned method, the use of password in doors/gates mechanism evolved.

Security and Access Management is a very important topic therefore a lot of research has been conducted on it, especially in the area of door lock. Video technology was incorporated into the access management system designed by [3]. The camera was used by the appropriate personnel to view the front door to the home. This camera feeds directly to the mobile phone of the home owner using the cellular network. This allowed the owner some form of access control to his/her home. The home owner can then interact with a visitor via alarm systems, chatting with the visitor via video streaming, sending and receiving of messages amongst others. In [4], the researcher connected the digital lock system with the Internet of Things (IoT) technology. The use of IoT strengthened thesecurity as the system transfers recorded images to the user's mobile device when an unauthorized user attempts to access the area being guarded. This system not only sends information to the owner when the lock is being physically damaged, it enables the user to remotely operate the door lock.

Access control using face recognition is the main attribute of the system designed in [5]. The system consists of 3 subsystems: face detection, face recognition and automatic door access control. For a face to be recognized, it must have been stored in the memory of the system. The door automatically opens for a recognized face and activates an alarm for an unrecognized face. Bluetooth technology was used in [6], [7], and [8] to establish connection between the users smart phone and the controller board, while the use of Wi-Fi to connect devices that are used in electronic door look was proposed by [9] and [10]; the users can lock and unlock any door in which their system is embedded in, using an android based app on their smart phone and a Wi-Fi system for communication.

This system designed in [11] is composed of a microcontroller based electronic door lock system which makes use of a matrix keypad & GSM/CDMA network. The password is stored in programmable read only memory (PROM) so it can be changed at any time. When a person enters the code in the matrix keypad, the microcontroller verifies the code. If that code is correct the device will open the door. But if someone enters a wrong code, a red LED will be activated. GSM/CDMA module can be used to operate the device; when anyone makes a call from his mobile to the receiving device which is set in main circuitry, the system checks and confirms that the call was from a desired number then the door will be unlocked. An IPS circuit can be used for giving backup in the case of emergencies resulting from power failure. Palmtop recognition system is the main user recognition system prescribed in [12]. This works by using extensive image processing thereby reducing the error probability encountered in fingerprint recognition system

From the above literature reviews, it was noted that the development of a single secret authentication such as only password entering, is an effective security control, but dual authentication, which has been developed in this work, is a more effective security control. In this paper, the plug-in electronic password door lock is divided into two sections: the first section comprises a matrix keypad and LED connected to a microcontroller [1] which forms the mobile or movable key. The second section comprises of a microcontroller, GSM module, LCD, relay and a motor which are installed on the door (static). The mobile section can be plugged into to the static section before the password entering can grant access. The mobile section makes use of the power from the static section. The keypad is used to enter a password to the system and if the password entered is correct the door will be opened by motor which is used to rotate the handle of the door lock. Three attempts are allowed for password to be entered incorrectly before the system locks up and sends an SMS to authorized personnel to stop the beeping sound of the buzzer and the resetting of the lock. Some features like adding new users and changing old password are configured by the keypad. An LCD module is used to display messages to the user.

II. MATERIALS AND METHODS

This system is designed to prevent the opening of the door by unauthorized persons. The structure of home security system contains a matrix keypad, the door latch opener and a GSM modem for the security dial up interfaced to the microcontroller. The microcontroller receives the input signals from keypads. The keypad interfaced to the controller is used as the password entry system to open/close the door. The block diagram of the system is depicted in Figure 1.

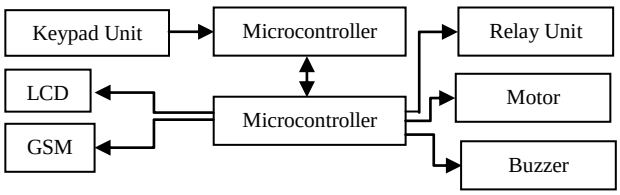


Figure 1: Block diagram of the Electronic Plug-In Password Based Security System.

The schematic diagram of the Electronic Plug-In Password Based Security System is shown in Figure 2. The Electronic Plug-In Password Based Security System consists of two sections; the mobile (keypad) section, and the static section which is installed on the door. The mobile section makes use of the power of the static section when the mobile section is plugged into the static section. The mobile section comes on and the microcontroller in the mobile section synchronizes with the microcontroller at the static section. If there is a handshake between the two microcontrollers, the static section activates the mobile section and displays welcome message, but if there is no handshake between the two microcontrollers, this indicates that the first level of security has not been cleared and the mobile section will not be activated. After activation of the mobile section, static section shows a display for password entering. If the right password is entered from the mobile section the static section will open the door for 15 seconds and the user can unplug the mobile section then the door will close automatic. If a wrong password is entered three times from the mobile section, the static section will activate an alarm continuously and send an SMS to the phone of the authorized personnel. The static section will permanently shut the door and the alarm will continue to beep until the authorized person sends an SMS to trigger the alarm off and another SMS to reset the static section so that password can be entered again.

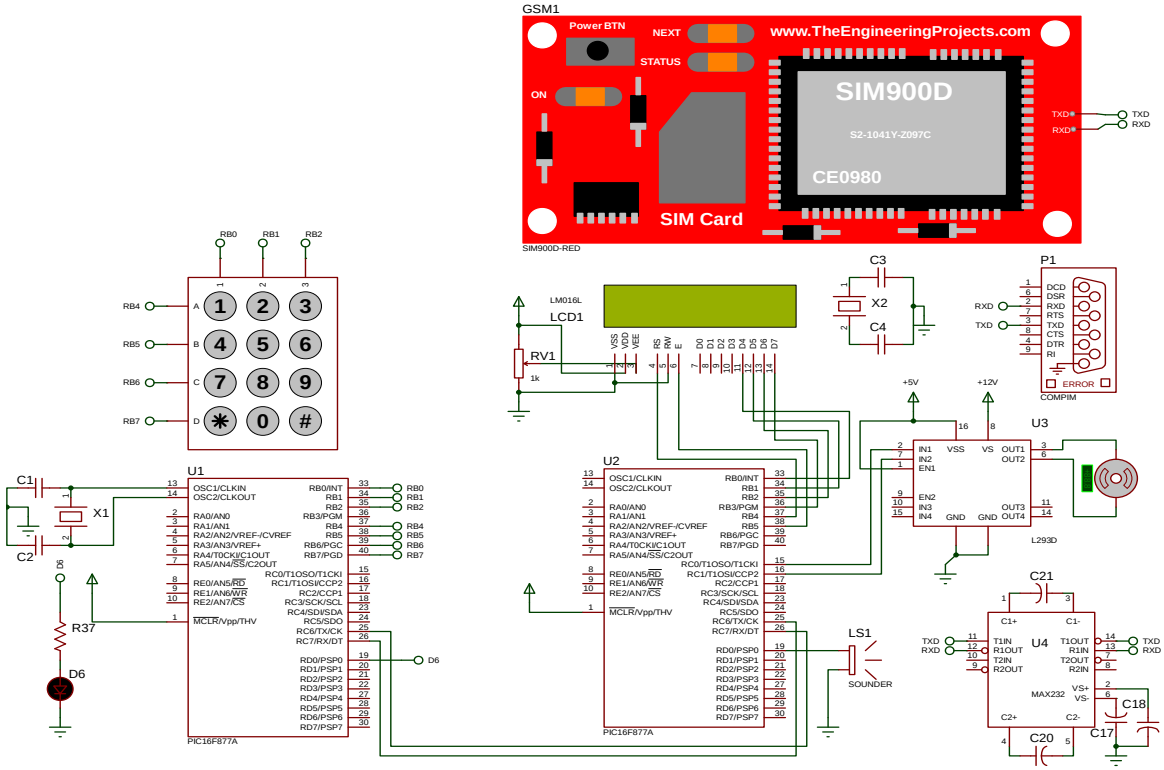


Figure 2: Electronic Plug-In Password Based Security System arrangement unit.

Figure 3 shows the flowchart of the program executed by the microcontroller. As indicated in the flowchart the microcontroller polls the input switches (keypad) after the synchronization of the two microcontrollers. If the password entered is correct the appropriate decision is taken and the system goes back to monitoring the synchronization of the two microcontrollers in a continuous loop. But if the wrong password is entered more than the required time (three times), the system initiates a sound alarm, keeping the door locked and sending SMS to an authorized personal phone. The door will remain closed and the beeping from the buzzer will continue until a SMS is sent from the authorized personnel to stop the beeping and reset the system.

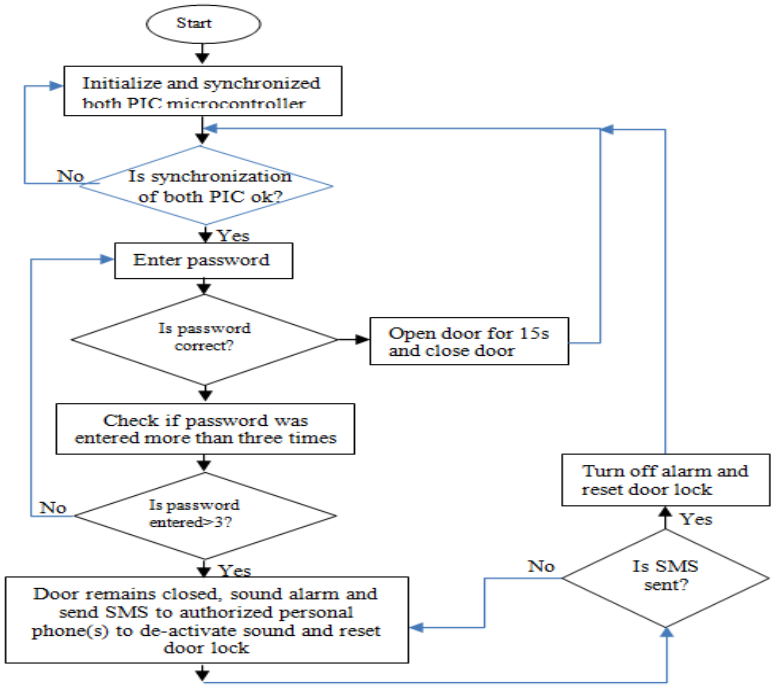
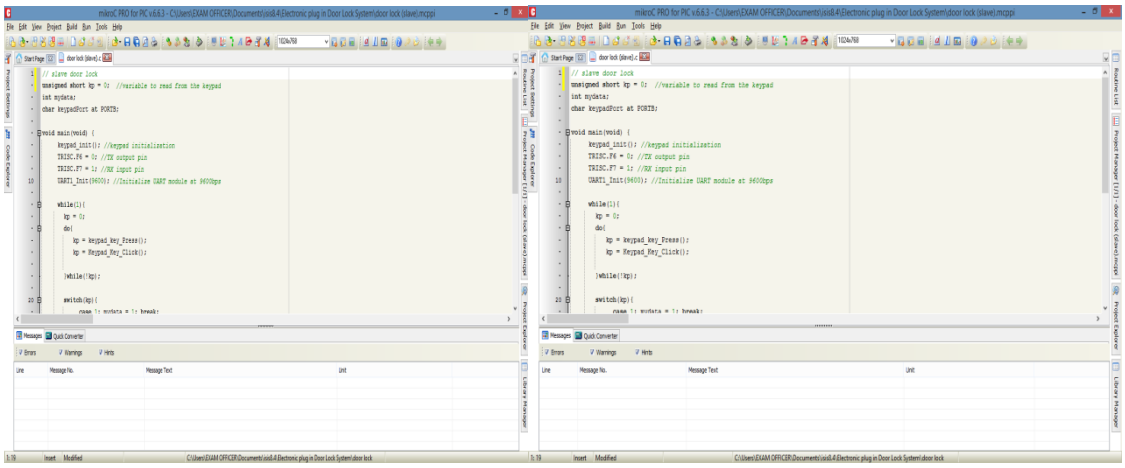


Figure 3: Flowchart of Electronic Plug – In Door Lock.

III. RESULTS AND DISCUSSIONS

The program for the microcontroller was written in C language and was then compiled into an executable file using the mickroC IDE (MikroElectronika, 2013). The executable file was next imported into the Proteus Design Suite IDE (Labcenter Electronics, 2013) where the hardware circuit shown in figure 2 was designed and simulated. The program development in mickroC is shown in figure 4 for both the master and slave programs. Figures 5 to 8 show the simulation results for each process of entering the correct and wrong password respectively. Upon successful completion of the software simulation, the system's hardware was constructed on a vero board and programming of the microcontroller was carried out using PICkit2 programmmer. The hardware construction showing connections and various operations of the system are shown in figure 9.



(a) Master (b) Slave

Figure 4: Program Development using mikroC.

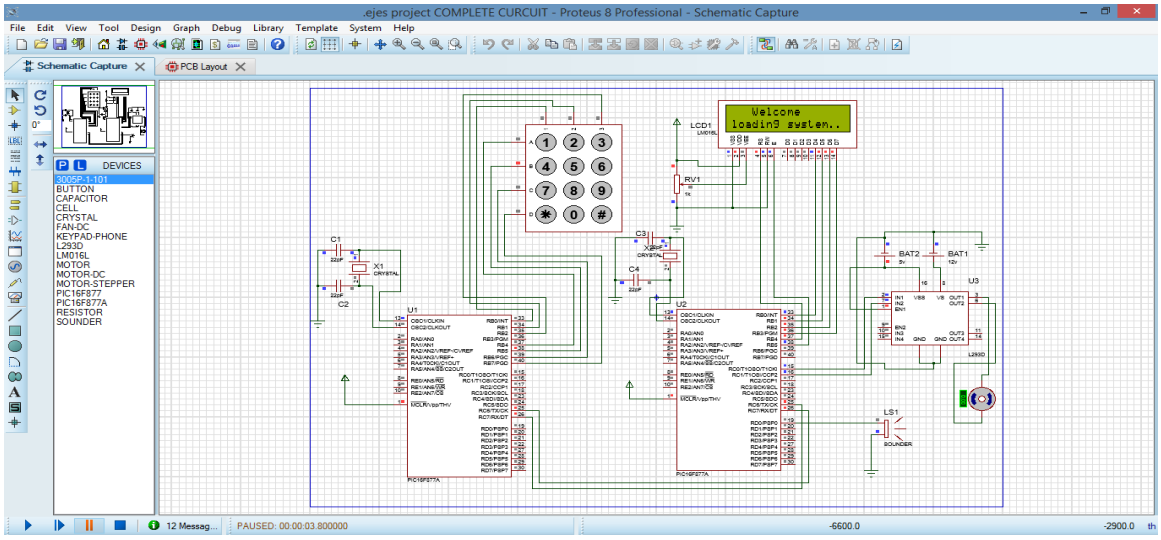


Figure 5: Initialization of the system.

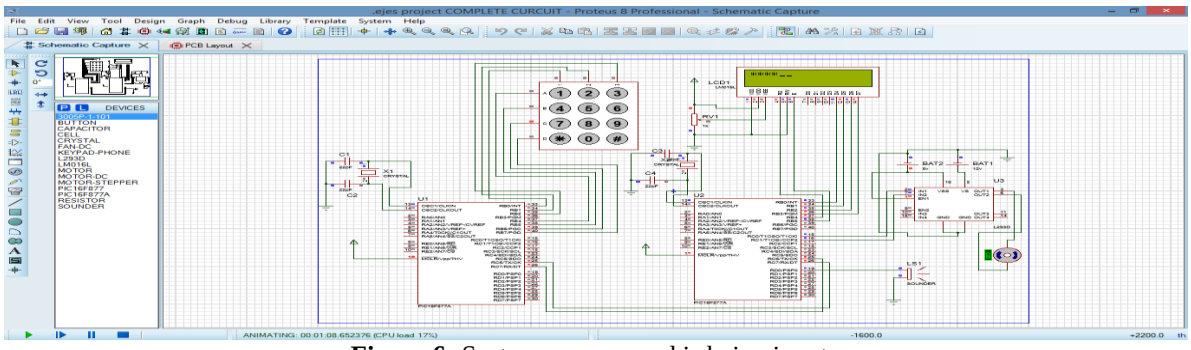


Figure 6: System as password is being input.

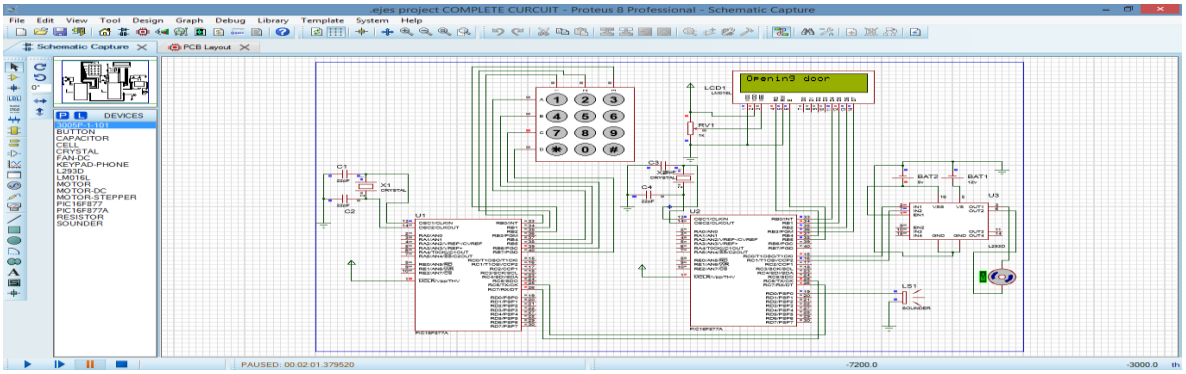


Figure 7: LCD showing system status with correct password input.

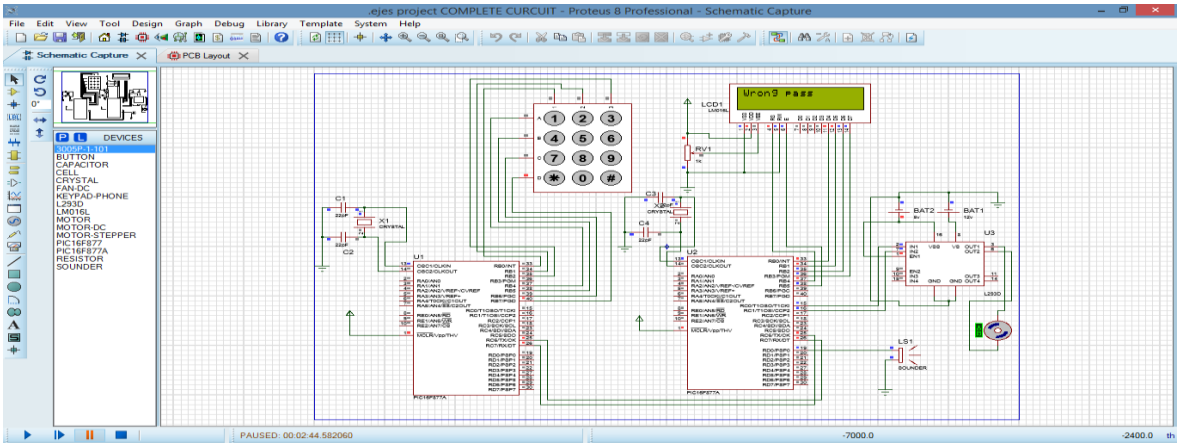


Figure 8: LCD showing system status with wrong password input.

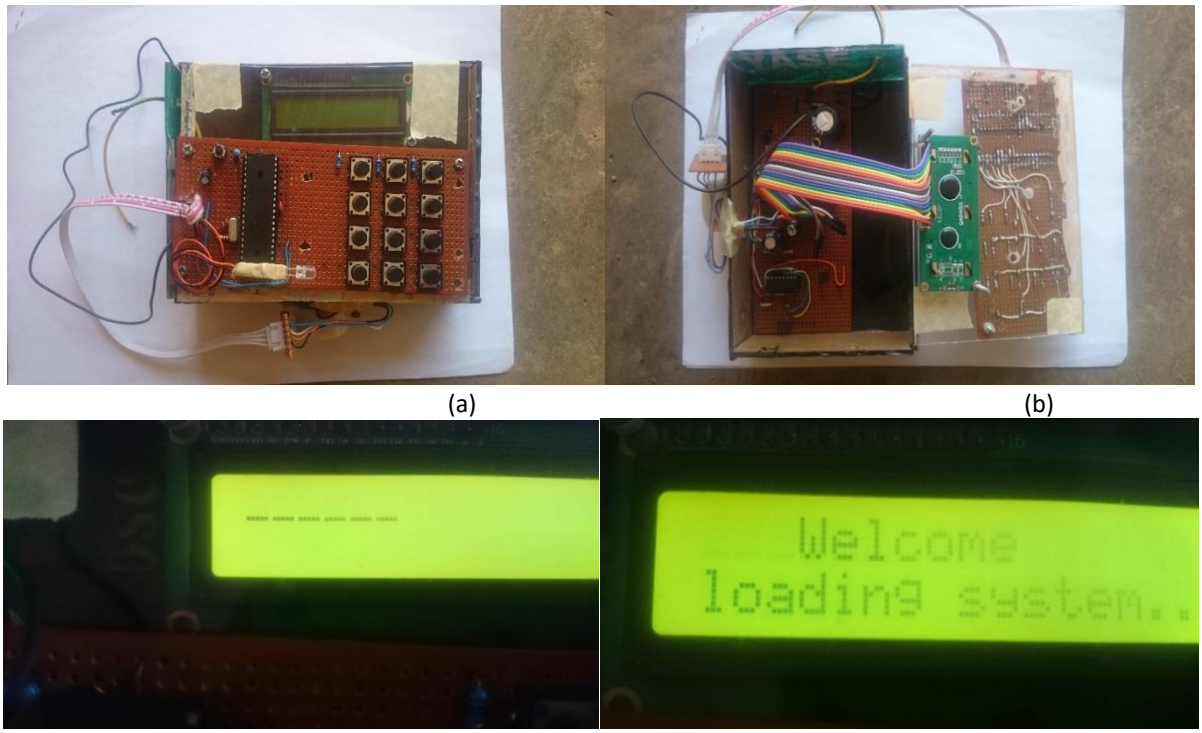


Figure 9: Prototype of the System showing various operations.

IV. CONCLUSION

The plug - in electronic door lock system was design, simulated and implemented using two pic16f877, a 4x4 matrix keypad, LED, LCD, relay and motor. The two microcontrollers are used to increase the level of security. The system can be installed at doors in our houses and offices.

REFERENCES

[1] PIC16F877 datasheet, 2006. Microchip Technology Inc, 2355 West Chandler Blvd., Chandler, Arizona.11-26pp.
[2] Pickit2 Microchip Technology Inc, 2355 West Chandler Blvd., Chandler, Arizona
[3] BurakSarp, TolgaKaralar, HuseyinKusetogullari, "**Real Time Smart Door System for Home Security"**International Journal of Scientific Research in Information Systems and Engineering, vol. 1, no. 2, 2015
[4] I. Ha, "Security and Usability Improvement on a Digital Door Lock System based on Internet of Things", International Journal of Security and Its Applications, vol. 9, no. 8, pp. 45-54, 2015.
[5] H. Lwin, A. Khaing and H. Tun, "Automatic Door Access System Using Face Recognition", International Journal of Scientific & Technology Research, vol. 4, no. 6, 2015.
[6] N. Ismail, Z. Tukiran, N. Shamsuddin and E. Saadon, "Android-based Home Door Locks ApplicationviaBluetooth for Disabled People", in IEEE International Conference on Control System, Computing andEngineering, Penang, Malaysia, 2014.
[7] A. Mishra, S. Sharma, S. Dubey and S.K. Dubey, "PASSWORD BASED SECURITY LOCK SYSTEM", International Journal of Advanced Technology in Engineering and Science, vol. 2, no. 5, 2014.
[8] N. Majgaonkar, R. Hodekar and P. Bandagale, "Automatic Door Locking System", International Journal of Engineering Development and Research, vol. 4, no. 1, 2016.
[9] P. Patel and S. Ajani, "The Digital Locking and Unlocking System Based on Android for Smart Phone", International Journal of Advanced Research in Computer Science and Software Engineering Research, vol. 6, no. 2, 2016.
[10] S. Basu, M. Feeroz, D. PR, N. Raun and F. Alam, "Spark Core Based Wireless Remote Door Lock and Multiple Access Synchronization", International Journal of Advanced Research in Computer Science and Software Engineering Research Paper, vol. 5, no. 4, 2015.
[11] M. Mohammad Amanullah, "Microcontroller Based Reprogrammable Digital Door Lock Security System by Using Keypad & GSM/CDMA Technology", IOSR Journal of Electrical and Electronics Engineering, vol. 4, no. 6, pp. 38-42, 2013.
[12] K. WazedNafi, T. ShekhaKar and S. AnisulHoque, "An Advanced Door Lock Security System using Palmtop Recognition System", International Journal of Computer Applications, vol. 56, no. 17, pp. 18-26, 2012.
[13] MikroElektronika, MikroC, 2013. http://mikroe.com/
[14] Labcenter Electronics, Proteus VSM, 2013. http://www.labcenter.com/

Agbo David Odu. "Low Cost Removable (Plug-In) Electronic Password - Based Door Lock." American Journal of Engineering Research (AJER) 6.7 (2017): 146-51.