Automatic Door/Gate Lock Application based on Android App using Bluetooth

Shivaprasad B. K.[1] Vishwanath Muddi[2]
[1,2]P.E.S. Institute of Technology and Management, Shivamogga, Karnataka, India

Abstract— Today, the security system has moved to a next level where the control lies in the hand of the owners. In order to overcome the modern day security problems we are developing an embedded system where the person inside the home/industry can see who is outside the door or gate on their cell phone and open the door through an android app. currently the door locking and unlocking system is made automated. The features includes unlocking the door wirelessly by using Bluetooth from a distance where the vicinity of the connection.

Key words: Bluetooth, Arduino Controller

I. INTRODUCTION

Home security is becoming necessary nowadays as the possibilities of intrusion are increasing day by day. Lot of Security companies are available towards protecting house from getting vandalized or so. But still there is no much guarantee that the house be safe or even if the house vandalized. There are lots of threats to human life in cities. Among those now days there is always a threat involved in home security issues. There are more than 8000 cases registered per month regarding the home security issue in India and home robberies are exponentially increasing in the current situation. There are practical instances noticed now a days on the home robbery cases where an unknown person enter the house premises and they approach them in way to ask the water or address or in the get up of a postman and they loot or exploit them. Today, the home security system has moved to a next level where the control lies in the hand of the house owner. In order to overcome this modern day problem we are developing an embedded system where the person inside the home can see who is outside the door or gate on their cell phone and open the door through an android app.

The system can be applied in the home, in industries and mainly for disabled people. The home security issues can be solved by application of this system. This is very useful in industry. For an example consider the industry is having multiple entry points, for each point instead of having security guards. This security system can be used and centralized and a security guard will be monitoring the system. The security guard will watch the person through the camera and then the access to entry is provided for the person from that main center. For the disabled people this system is boon. As the person can sit in on the wheel chair or lie on the bed or from where they are. They can see the person outside the door and open the door.

Currently the door locking and unlocking system will be automated. The features includes unlocking the door wirelessly by using Wi-Fi or Bluetooth from a distance where the vicinity of the connection. Here the security is not major concern. For example they cannot know who is outside the door. This is the major problem if we observe carefully. This issue has to be taken into count and has to be resolved.

To resolve this real time problem we are making use of android and Arduino platforms and accomplishing the task in a desired model. For this task we are going to use Bluetooth as a mediator for the wireless communication. Most of the common applications now a day use Wi-Fi because of its long range transmission and its speed. Here the Bluetooth is sufficient as we are making our system to work in home itself. As the Bluetooth range is 30 feet (around 10 meters), this will be more than sufficient for the home purpose.

II. SYSTEM DEVELOPMENT

The block diagram of the proposed door locks application via Bluetooth technology is depicted in Fig. 1.

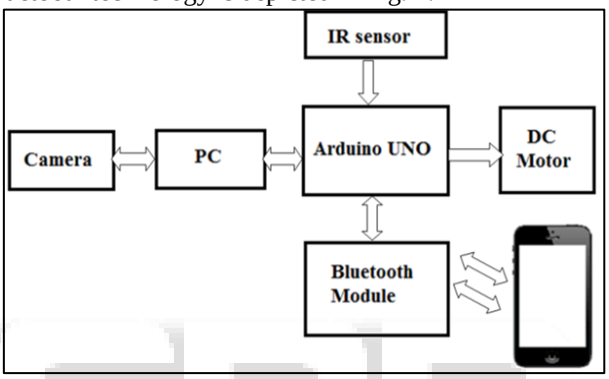

Fig. 1: Block Diagram of Monitoring & Controlling of Door Lock System

The above Block diagram describes the complete system which involves a camera, Bluetooth module, IR Sensor and a DC motor. They are connected to the Arduino. Here Arduino serves as a processing hub for the system. The camera module is used as a sensor which is fixed outside the door. The camera module captures who is standing outside. Based on the human detection through IR sensor the system turns on the camera. The camera is connected to a PC or laptop and by using MATLAB's image acquisition tool captured image is loaded to the system whenever there is intruder detection. And that image is transferred to the user email. The user is alerted about the intruder and by using the image user can see who is outside the door and open the door using Bluetooth command on the cell phone.

The Arduino is the heart of whole system which is interfaced with the devices such as camera module, Bluetooth module, IR sensor and DC motor. Based on the user's input the Arduino will decide what type of response it has to generate. Response may be to turn on the Bluetooth module to the user. Collecting the user's response through Bluetooth and if the user wants to open the door, Arduino will initiate a triggering to dc motor to rotate. If the user wants to close the door, Arduino will rotate the motor in anti-clockwise direction. Thus, acts as a control unit which controls the process.

Camera module is present outside the door. Based on the sensor's response it will turn on and turn off. It will turn on and send the captured image to MATLAB. Further those images are sent to user mail.

Bluetooth is a connecting medium through which the information about the activities outside the door is transferred to the user. The user who wants to interact with that system will be connecting to that Bluetooth module with the unique password. The Bluetooth module is always be in a receive mode. It will wait for the user's response. When the user request to open the door it will send that signals to Arduino. When Arduino sends the image, Bluetooth module will communicate with the cell phone and sends that signal to the user.

The dc motor is directly connected to the door lock and is controlled by Arduino. When Arduino sends open as a request, the door unlocks by the clockwise rotation of the servo motor. It rotates in anticlockwise direction to lock the door when it receives request as close.

Android application will be installed on android phone where that android app will be able to connect Bluetooth device. Through this android app user can receive images over Bluetooth communication. In the android app the user is provided with an option to see who is outside the door and take decisions to unlock the door.

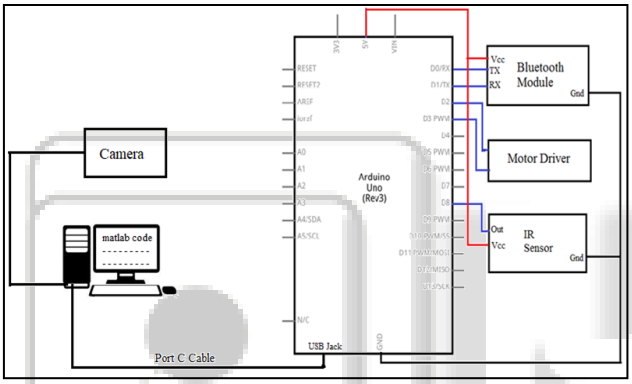

Fig. 2: Circuit Implementation

The project includes both hardware and software part implementation. Hardware modules such as camera and Bluetooth are connected to the base board. The software part will control the whole system. Whenever the system senses the human presence through IR sensor it triggers the system and turn on the camera using MATLAB image acquisition tool. Through that it will send the image to the user mail box using MATLAB. User is informed about the intruder to the mail and he has all privilege to open the door or not.

To find person who is outside the door the IR sensor is used and is connected to pin no. 8 of Arduino UNO. The supply VCC and GND for IR sensor are given by the Arduino.

Bluetooth module has a pair of transmitter and receiver, in which the transmitter is connected to the receiver of the Arduino and receiver, is connected to the transmitter of the Arduino. Receiver and transmitter of Arduino are designed at the pin number 0 and 1 respectively. Supply VCC of 5v and GND for Bluetooth module is given by the Arduino itself.

The motor driver is connected to the Arduino pin number 2 and 3. Which interns connected to the driver and used to lock and unlock the door.

A. Flow Chart

Fig.3. shows the flowchart of overall system operation. When someone is present just outside the home the IR sensor which is attached to the door will senses the moment of the person. IR sensor sends this information to camera module (webcam) and now the camera will turn ON. Camera then takes a picture of the person with its valuable resolution and the picture is sent to the owner mail account using matlab code.

After getting the picture of person through mail, owner has to decide the allowance of person to get into the home. If the person is known owner has to unlock the door by sending the command from android app through Bluetooth. And if the person is unknown owner can let the door to be in locked state.

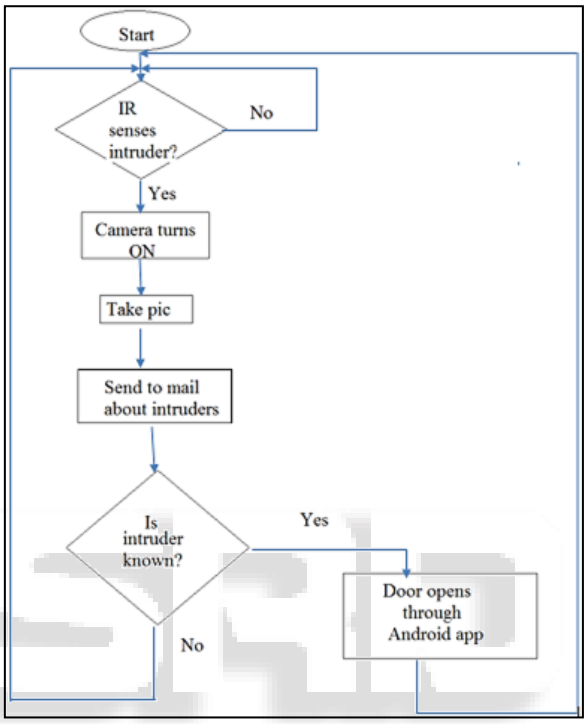

Fig.3. Flowchart For of Monitoring & Controlling of Door Lock System

III. RESULTS & ANALYSIS

The intruders are detected by the IR sensor. The camera turns on and captures the picture and it will be sent to the user's mail. By using the captured image user can identify the person and lock/unlock the door by using mobile app. The following figures indicate the system results in step by step.

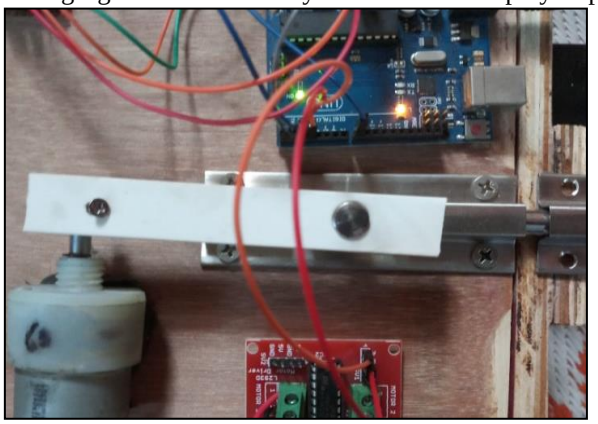

Fig. 4: Initially Door is closed

Figure.4. shows the initial state of the door i.e., the door is in closed at the beginning.

Fig.5. IR sensor is in idle state

Figure.5. shows the idle state of IR sensor. These IR sensors will always be in active state to detect any intruder. If the intruder is not detected by IR sensor, IR sensors stay in idle state.

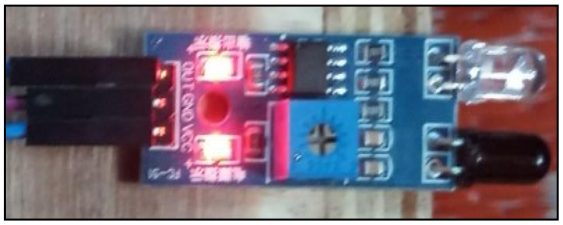

Fig.6. IR sensor detects the intruder

Figure.6. shows the detection of intruder by IR sensor. When the intruder is detected by IR sensor, the controller immediately turns on the camera.

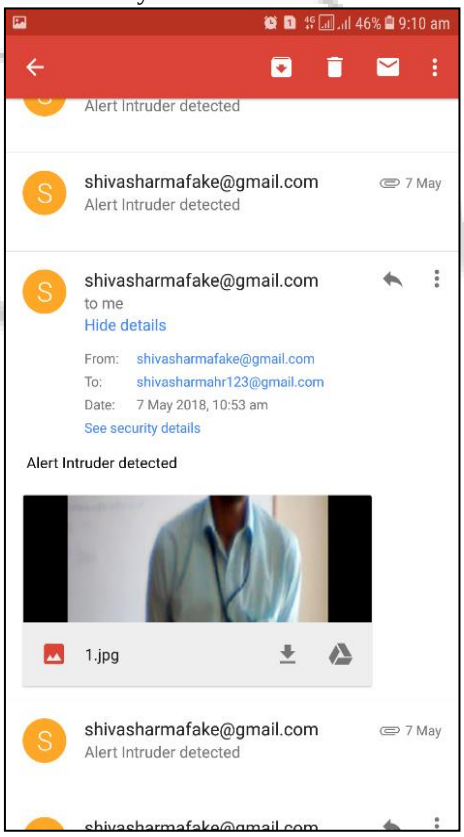

Fig. 6: Intruder's Picture is sent to Mail

Figure.6. shows the captured picture which is sent to the user's mail box. The captured picture by the camera is sent along with the message stating "Alert Intruder detected".

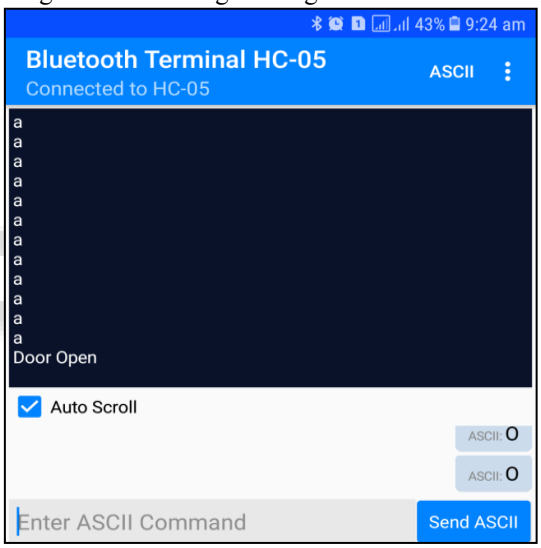

Fig. 7: Unlocking of Door through Android App

Figure.7. shows android app's view. By using the image sent to mail, user will decide whether to unlock the door or not. We are assuming the intruder is known, user unlocks the door by sending a command 'O' (open) through android app which is connected through the Bluetooth.

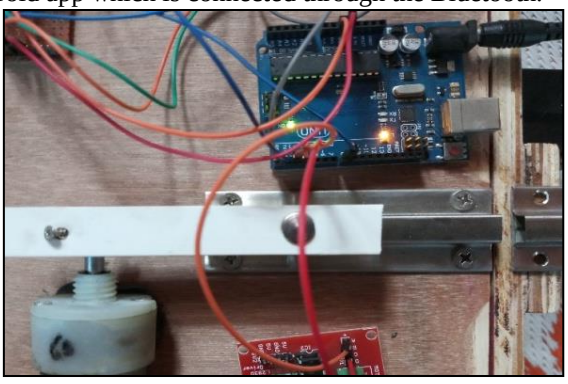

Fig.8: The Door is Unlocked

Figure.8. shows the door is been unlocked by the android app's command. When the command 'O' is received by the Bluetooth it will make the motor to rotate in a clockwise-direction so that the door is unlocked.

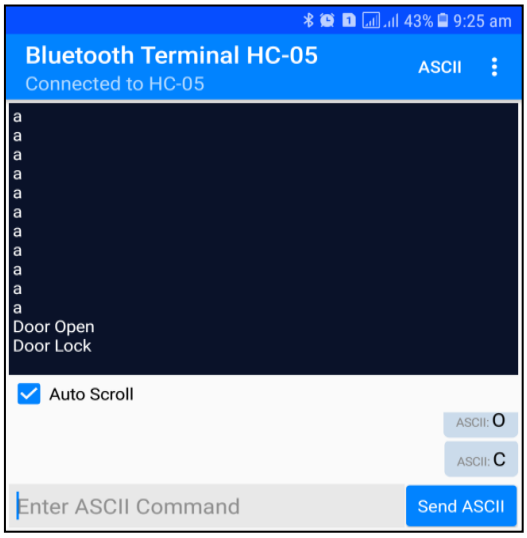

Fig. 9: Locking of Door through Android App

Figure.9. shows the locking command of the door in the android app. The user has a privilege to lock the door by sending command 'C' (close).

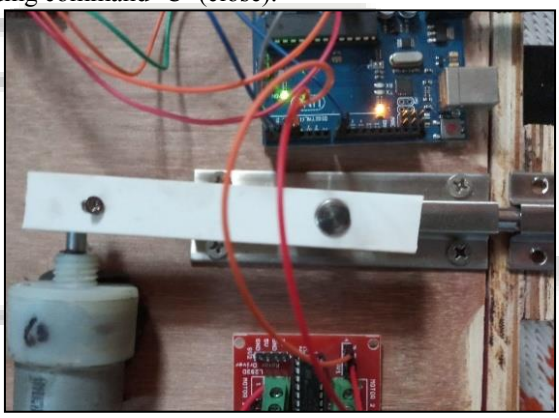

Fig. 10: The Door is Locked

Figure.10. shows the door is been locked by the android app's command. When the command 'C' is received by the Bluetooth it will make the motor to rotate in a direction so that the door is locked.

IV. Conclusion & Future Works

Security is becoming necessary nowadays at several places such as industries, home etc. As there may be possibilities of intrusion into the property, therefore, by using this system user can clearly see who is outside the door/gate by using the camera's captured image that has been sent to user's mail. If the intruder is known to the user and then user opens the door wirelessly through the Bluetooth.

In the future, this work may be extended to a full deployment by using the existing system's feature and upgrading it to IOT. As every activity will be controlled and monitored over the internet it will be more convenient and useful for the user.

Acknowledgment

The authors would like to thank Dr. M Manoj Kumar, HoD, ECE Department and all the staff members of ECE Department, PESITM, Shivamogga, for the support of this study.

References

[1] Islam, M.R., "Right of the People with Disabilities and Social Exclusion in Malaysia", International Journal of Social Science and Humanity, Vo. 5, No. 2, pp. 171-177, 2015.

[2] R.A. Ramlee, D. H. Z. Tang, M.M.Ismail, "Smart Home System for Disabled People Via Wireless Bluetooth", in Proc. of IEEE International Conference on System Engineering and Technology, pp. 1-4, 2012.

[3] Julius Bin Pelipos (2010), "Smart Key Door with Wireless Security System using RF Signal," Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia: Final Year Project Report.

[4] Harnani Hassan, Raudah Abu Bakar, Ahmad Thaqib and Fawwaz Mokhtar (2012), "Face Recognition Based on Auto- Switching Magnetic Door Lock System using Microcontroller" in International Conference on System Engineering and Technology, Indonesia.

[5] Stapathy, A. and Das, D.P., "A system for remote operation of devices: Helpful for elderly and disabled people" in Proc. of IEEE International Conf. on Advanced Electronic Systems, pp. 350- 353, 2013.

[6] Kuang-Yow Lian, Sung-Jung Hsiao and Wen-Tsai Sung, "Home Safety Handwriting Pattern Recognition System" in Proc. Of IEEE 11th International Conf. on Cognitive Informatics and Cognitive Computing, pp. 477-483, 2012.

