

Internet Calling Bell with Two-Way Communication Using Motion Detection Sensor and Facial Recognition

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Abstract. Important part of everyone's personal and impersonal life focuses on security in which this system focuses on wireless home security doorbell. It combines the function of the apparatus with home network to design a peer to peer communication system. Existing system has Camera, which is integrated to video calling as such however there is very few interface application to model the device. In this system, a motion detection sensor is used to sense the human movement which will automatically activate the doorbell within a short period of time. Literally motion sensor is used for alarm based products which will notify an emergency alert in the base of the alarm, when a fire explosion is caused in company or factory. When a person touches the calling bell it allows to talk to the person who is standing near the doorbell and communicate with them by using microphone with the concept of Live Cloud integrated solution for 24/7 security system. Sensor is activated through the Arduino IDE which is programmed with a time limit to send the signal of the sensed movement of the human to the calling bell. It also matches the existing dataset images with the visitor to notify the home owner and inserts the new visitor image into the dataset using facial recognition technique. This system is also meant to serve elder people and to identify unauthorised intruders through camera. In the age of automation, it is necessary to update our security systems with new technology and to make living easier.

Keywords. Doorbell, Motion Sensor, Arduino, Facerecognition

1. Introduction

Matching of human level intelligence to an automated system is an artificial intelligence which will work like a human. Using any algorithm with a programming concept it imitates as a human thought by analyzing and solving the problems through learning the algorithms. Self-teaching is also done for certain tasks to make the machine adapt with the environmental surroundings. Machine intelligence makes the computer to be smart enough to solve the complicated issues within a certain period of time. Artificial intelligence is sub divided into several characteristics: Machine learning,

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motion and manipulation, Natural language processing, knowledge representation, planning and reasoning.

This technique is applied in the form of facial recognition integrated with a doorbell to match the existing person stored in the dataset with the person who visits the home[1]. These techniques include several algorithms to make the machine more active with respect to time complexity, increased speed of outcomes when compared to normal human capability. [2-4] Along with a collection of algorithms used for the machine to process in an automated form without the human control, dataset algorithm is used to match the existing data with the currently processing data.

Normally, a doorbell is a signaling device which is placed near a door to a building entrance or home. If a visitor presses the button on the calling bell then the bell rings inside the building which will alert the occupant about the presence of a visitor. The proposed system allows the house owner to see the visitor to his/her home when no one is present inside the home[5].

A calling bell is interconnected with a wireless network through a mobile application which allows the house owner to see the visitor via camera. It activates only when the visitor presses the button of the doorbell, or alternatively, when the doorbell senses a visitor using a Motion sensor. It also allows the house owner to use a Smartphone application to watch and talk with the visitor through a camera and microphone which is integrated with the calling bell.

Smart doorbell is controlled by audiovisual communication between the inside and outside of the building or home. The main feature of this system include the ability which enables the person indoors to identify the visitor and, if they wish, engage in conversation and/or open the door to allow access to the person calling. Motion sensor detects the human movement which automatically activates the doorbell activity through Arduino IDE (Integrated Development Environment) within a period of time. This activity is done only when the user does not press the calling bell but stands near the door for a certain period of time. The proposed application is also helpful for the house owner to record the attended call and store it to in the storage of the Smartphone. This recorded video call is kept as evidence in case of any emergency situations. Face recognition allows the regular user to notify the house owner easily using dataset technique and also a new visitor image can be included to the database.

2. Existing System

Thailand has increased elderly aging population, so there will not be enough home security therefore initially the smart doorbell with audio and video facility was implemented. It allows the aging people to identify the unknown person from the known person who visits the house. This system helps to communicate with the visitor who is standing near the door. It includes a doorbell with a camera, microphone for the elder people to speak, hear which avoids face to face communication. It works through a network connected doorbell which is connected with a mobile application. It also allows the elder people to send a message to a connected mobile device or neighbor as like message featured applications. Though this system includes many advantages to elder people, it faces some problems like detection of unusual events cannot be judged regularly in front of home.

Raspberry Pi based doorbell system was implemented to increase the security system of the previously implemented system which include Advanced Encryption

scheme[6]. It also includes a camera placed near the doorbell to see the visitor from the connected house owner mobile. Initially a picture of the visitor is sent via Gmail to the house owner that keeps in track of the sound of doorbell and allows the authorized user to send the message. It works perfectly with the MTQQ feature for MAC based encryption scheme which is cost effective. However, it fails to stop the delay in between the transmission of packet from the visitor to house owner [7-9][12].

Another system is implemented with a camera and microphone interconnected with a doorbell for real time communication. Initially the doorbell has to connect with the respective house owner mobile through a mobile application. When a visitor rings the doorbell then through the server it will send a message with the picture of visitor afterwards camera will be opened in house owner mobile for real time communication between visitor and owner. This is done only when the owner is not present inside the house since he/she belongs to the home can reject the call in their presence at the home. It does not include any type of sensor and recognition system to identify the present of visitor. Sometime the visitor may leave the home by not pressing the doorbell due to locked door of the home so house owner doesnot know the present of the visitor. In this proposed system, a doorbell is implemented to identify the visitor through the sensor by activating the calling bell through relay automatically after a certain period of time, when a visitor does not press the doorbell in the absence of house owner. Also it identifies the regular visitor by comparing the visitor face with the already stored picture of them in database using Dataset algorithm. It allows the house owner to view the recorded call logs which is stored in connected mobile and can view the camera placed near the door at any time with 24/7 surveillance camera.

3. System Architecture

The system architecture includes three layers of the proposed system: Application and software layer, Network layer, Hardware layer. It shows the working process of calling bell which is initially connected through a wireless network via mobile application. When a visitor arrives near door to press the doorbell then the mobile application is activated to open the mobile camera through which a house owner can see and talk to the visitor. Also visitor can respond to the house owner through microphone which is integrated near the doorbell [12-14]. Then a network layer is built for storing the attended call logs for security purpose. Motion sensor is activated when a visitor does not press the doorbell since the absence of house owner that is a locked door of the home. This sensor senses the human movement and automatically activates the doorbell by which the house owner mobile camera is opened and a two way communication occurs through microphone.

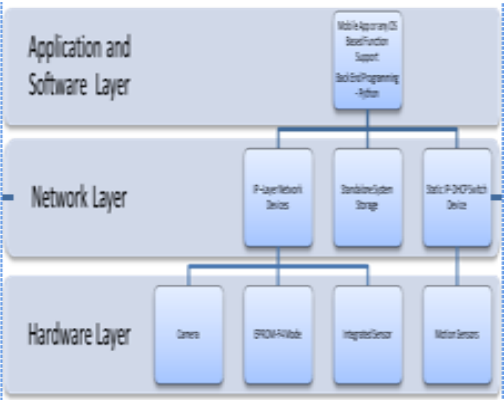


Figure 1. System Architecture

4. System Implementation

System is implemented in following ways of modules:

- Calling bell is integrated with Printable Circuit Board
- Sensor activation through Relay
- Storing of attended call logs to Database

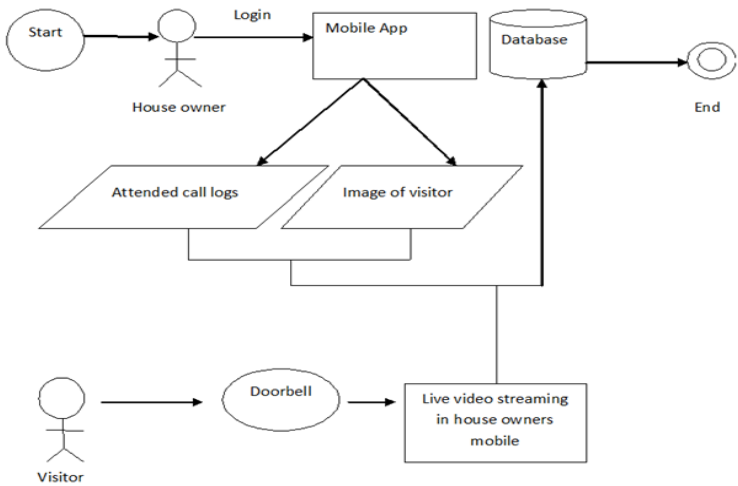


Figure 2. Data Flow Diagram

4.1 Calling bell is integrated with printable circuit board

A calling bell is integrated with printed circuit board to get connected with the Smart phone through a mobile application. If a visitor presses the doorbell then automatically, camera is opened to the connected device with calling bell. House owner can attend the

call if no one is present in the home or otherwise simply disconnect the call when the owner is present inside the home. Real time communication can be done with this PCB since it is also integrated with camera, microphone and speaker near doorbell. If a call is attended by the owner then he/she can see the visitor through camera and speak to the person who is standing near the doorbell. Response is received via speaker to visitor and parallelly the visitor can talk to the owner through microphone

4.2 Sensor activation through relay

When a visitor does not press the doorbell, the internet calling bell is activated automatically as he/she came to know that there was no one inside the house. PIR motion sensors sense the human movement and send the output to relay by a program coded to Arduino board which activates the sensor. Activation of sensor is done within a certain period of time.

4.3 Storing of attended call logs to database

This module allows the house owner to capture the picture of the visitor that is used to store into database for recognising the face of person, who visits to the house regularly. Also video of attended call is stored to database. This type of information can be used in emergency situations like an unknown person can visit to home, therefore at that time home owner can file a complaint against that person with a proof.

5. Testing and Results

The doorbell is tested in different cases and the effect of result is recorded in the following inventory:Every module is implemented with a set of cables connecting to calling bell. Initially a doorbell is integrated with a camera and microphone in a printable circuit board.This is interconnected with a wireless network through an existing mobile application in house owner’s Smart phone.In case of visitor doesnot press the doorbell, PIR motion sensor is used to activate the doorbell automatically through a Relay driver.

Table 1 Context and result

CONTEXT	TYPE OF TEST	RESULT
Waiting time	Connecting to owners mobile from the bell pressed Test	Acknowledgement by the owner is sent to visitor within 3 seconds
Slog in Weather condition	Sensor Test	Works flawlessly in all type of weather condition
Visitor does not rang the bell	Arrival of visitor Test	Calling bell is automatically activated within 15 seconds

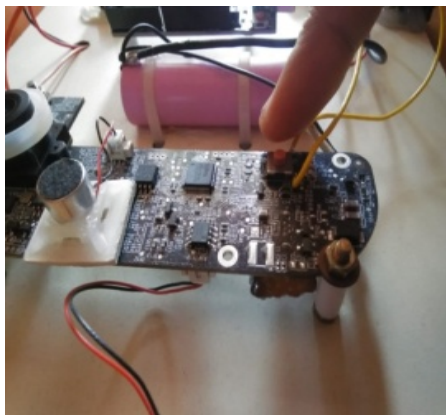


Figure 3. Calling bell

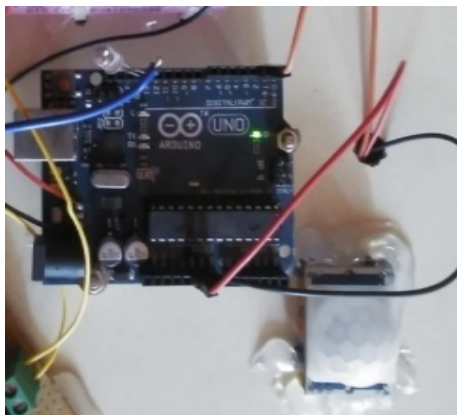


Figure 4. Sensor activation

6. Conclusion

Internet calling bell is designed for communicating with the visitor when a house owner or any member belongs to the home is not present at the active of visitor. It can be made on activating the network to doorbell through a mobile application of the house owner. It offers the house owner to record every call and store to the database of the mobile which is connected to doorbell and a picture of the visitor is also stored to owners mobile. Sensor allows the doorbell to activate automatically through relay, when the visitor doesnot press the calling bell for more than a time limit. To improve the security, face recognition is introduced to identify the regular visitor by storing their image to database. Dataset algorithm compares the visitor with the images stored to database for recognizing the regular visitor to home. The future enhancements include a high capacity of web camera to recognize the face of the regular visitor to allow them to unlock the door automatically by implementing with mobile application.

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