

IoT Based Contactless Doorbell System

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Abstract— Traditional doorbells used till now requires human participation for operating them which can lead to different problems such as spreading of harmful germs and bacteria. This problem was very dangerous from 2020 – 2021 as the pandemic Covid-19 got spread worldwide affecting more than half of the population of the world because people were getting affected when they were in contact of others. IoT based contactless doorbell system offers a more convenient, harmless and hygienic solution. This system is implemented with sensors like passive infrared sensor (PIR) or ultrasonic sensor to detect the visitor's presence and alert the homeowner about the visitor without involving any physical contact. This practice would lead to less physical contact as compared to the previous traditional doorbells. IoT based contactless doorbell system is a new technology but it is getting popular among the people and started gaining popularity among them. In the upcoming few years, they are expected to become even more widespread.

Keywords—IoT doorbell, contactless doorbell system, sensors, human detection, facial recognition, sound control, smart lock, smart home security, home monitoring.

I. INTRODUCTION

Doorbell is one of the most essential things we need in a house. A doorbell is a device that is placed or fixed near the entry point to signal when a visitor arrives. In today's world where the technology became so advanced so the traditional doorbell system were replaced by sensor and with the help of this sensor visitor's movement will be detected after that it will trigger an alert. This contactless doorbell system will give us a huge knowledge about the working of ultrasonic and IR sensor. Ultrasonic sensor helps us to determine the distance of the object with the help of ultrasonic sound wave.

Since the 1970s, developers have been implementing and improving the technologies for smart homes. As innovation evolved, electronic gadgets and online use became more prevalent and acceptable, therefore the concept of house mechanization and person's desire for a smart home altered dramatically. Nowadays, a smart home is an advanced combination of various Smart Devices and remote Sensor/Actor Networks. All of these are new client needs, complicated gadgets, and unique client behavior brought new security challenges to the home automation upfront. With the passage of time, the module of home security has evolved.

The Internet of Things (IoT) refers to the interaction or communication of various devices and gadgets, structures, cars, and other things connected with hardware, software, sensors, and system availability are all important considerations.

According to IoT, burglary appropriation provides a framework. The Web of Things is expected to provide a high level of human-to-machine communication as well as machine-to-machine communication.

Despite the fact that smart home security is fundamental, there are some of the flaws in the current implementations. Throughout the years, experts have revealed several security risks associated to the gadgets and innovation used in today's smart homes. The remote sensor systems used in today's smart homes for device-to-device communication are defenseless against various Routing and Wormhole assaults. Mainstream communication advancements, for example, ZigBee and 802.15.4, which are used in smart homes, are vulnerable to frequent attacks. Each one of these factors contributed to the rapid rise in home robberies over the preceding

time, demonstrates the importance of home safety and security in the modern world. The previous work in home security signifies the substituting role of modern home security implementations and characterizes the role of an advanced safety and security system as well as the home mechanization framework as one fit for recognizing, alerting and interruption endeavors in a home security.

This project provides a security system based on IoT that predicts or foresee robberies in the home, offices, and etc. The primary goal of this project is to increase efficiency and reduce human labor.

Computerization has always been a important component of security architecture. We stated that the aim is to design and implement a security doorbell, a framework that allows control on a smart phone via IoT approaches.

II. BACKGROUND: DOORBELLSYSTEM:

It operates in both daylight and moonlight. Even in low light, the video and picture quality are excellent. When someone roams in public. The owner will be notified. As soon as someone arrives, you will be notified. If somebody enters the range of IR sensor the bell will ring. Makes a video call to the owner automatically. He can even respond during the video conversation, and the guest can as well. Speaker allows you to communicate with him. If an intruder wanders then it will send a notification to the appropriate mobile device. If somebody tries to take it, it will notify the owner alarming. We can use the doorbell by saying okay. This is a QUBO video doorbell project. It has features such as:

1. Video Call for visitor to owner
2. Intrusion Detection System
3. HD Camera for better picture quality
4. Two-Way Communication
5. Alarm for theft
6. 3 AAA batteries operated

III. PROPOSED SYSTEM

We'd like to improve the functionality of this current device. Although the device has loads of features, still it has reduced extant drawbacks. To avoid those drawbacks we have to alter the mode of power supply to the intercom. Otherwise we have to include some commands in the software to get notify about it. Like,

instead of using batteries, charging feature benefits more to this device. Because, if no one in residence then how a person can change batteries. Then undoubtedly, if battery ends then the device becomes useless then our motive of security will be spoiled.

To get clear of this, the battery percentage should be notified to mobile daily and also should notify when the battery is intended to dead. So that they can change batteries before itself. Otherwise, the automatic charging system should be added to this so that it automatically charges itself when the battery capacity reduces, when itreaches the level which we specify.

IV. DESIGN & DEVELOPMENT

While collecting information and other useful data, we took a lot of references from published journals and other study paper. Most of the data was taken from articles and journals regarding security threats and issues and smart doorbell system.

The hardware used in this design are:

1. ESP32 cam: It contains ESP32-S chip as well as a microSD card slot which can be used to insert SD card to store the data such as the photographs of the visitor for future references. ESP32 cam is a perfect device for smart home security.

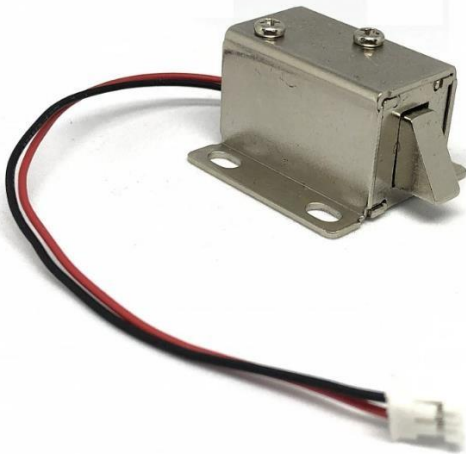


ESP32 CAM



ESP32 cam circuit diagram

1. 12V SOLENOID LOCK: It is a 12V DC power supply electromagnetic lock that uses the concept of solenoid to lock and unlock the door or any other object.



12V SOLENOID LOCK

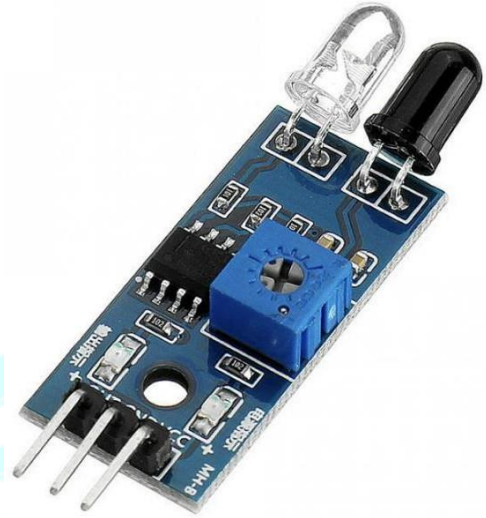
2. RELAY MODULE: It is an electronic device that consist of a relay to turn or switch a circuit on or off. As the electric current is passed through the coil, magnetic field is generated and the armature is attracted. The armature is further connected to switch which closes when attracted by armature.

When the current is stopped, the magnetic field disappears and armature is back to its original state.



RELAY MODULE

3. NFRARED SENSOR: It is a sensor in which an electronic device is used to detect IR radiations which are invisible to naked human eye but are detectable by electronic devices.



INFRARED SENSOR

4. BREADBOARD: Breadboard is a plastic board with small holes in it and these holes allows you to insert electronic device to design an electronic circuit.

The small holes in breadboard are interconnected in certain groups by metal strips underside which creates electrical connections in devices or components.



BREADBOARD

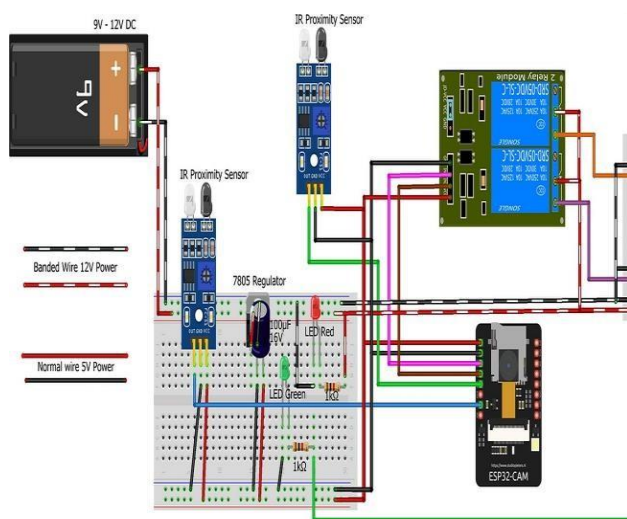
V. IMPLEMENTATION TECHNIQUES

On a breadboard, consider a ESP32 cam and UART TTL module, connect them as shown in the below circuit diagram with the correct pins for power supply, ground pin and other digital pins. The main source of power supply for the system would be 3 AAA batteries.

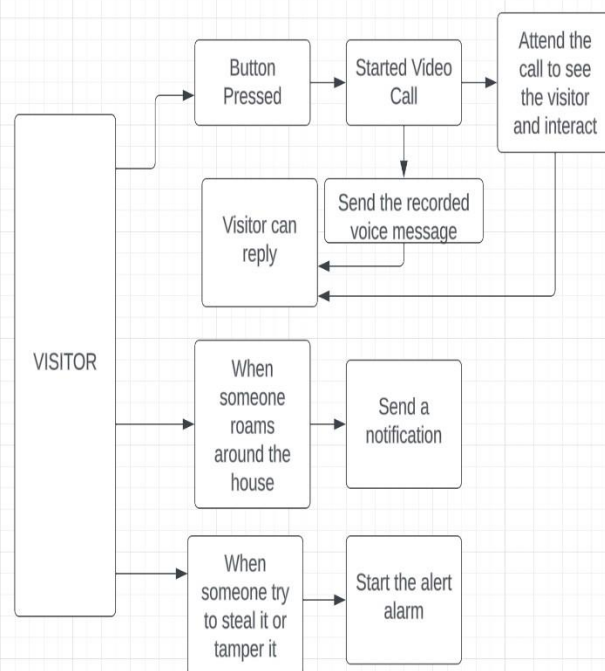
There would be two units of system, one would be the outdoor unit for the visitor who wants to use the doorbell and interact with the owner. The other unit would be for the person inside the house if they want to go out. They can easily go out as the IR sensor would easily sense the motion and open the lock by itself.

The application we will be using for this system would be Blynk. We need to setup the application with the correct configuration pins of our system, provide all the labels to ease the work of user so that user can access the application without any type of guidance. The user can interact with the visitor through video system, take photographs of visitor for future reference, and can open or close the lock while sitting inside the house itself.

The application will be connected to the hardware system with the help of code and once the code is compiled and uploaded successfully the system is ready to use.



Circuit diagram of doorbell system



FLOWCHART OF DOORBELL SYSTEM

VI. RESULT AND ANALYSIS

Firstly the camera was checked by standing at different angles to check the picture. The picture quality was great and the visitor was clearly visible to the owner. After that the camera quality was checked at night which also worked perfectly well.

When the visitor entered the range of IR sensor, the sensor sensed the radiations and automatically initiated the video call without needing any physical contact with the doorbell system, which was the main objective of implementing this system. As soon as the video call was initiated, the owner received a notification on the application. When checked, the visitor was clearly visible in the camera. The owner was able to click the photos for future references.

The owner can talk to the visitor to know their identity and interact with them. In our test, the voice of each other was clearly audible to both the parties, i.e., to owner as well as visitor. If the owner recognizes the visitor, they can open the lock while sitting inside the house itself, they can also ask the visitor to leave if they don't want to meet them.

Another case was tested when the owner was away from their home and an unknown visitor arrived at their house, the owner received a notification on their device alerting that someone arrived. The owner checked the picture of visitor on mobile application and since the owner didn't knew the visitor, they denied the entry and asked them to leave.

VIII. REFERENCES

The buzzer implemented in the doorbell was also working well. The sound of buzzer was clearly audible to owner sitting inside the house.

Scenario	Test	Result
Day and Night	Camera test	Visible perfectly
When visitor enters the IR range	Video call	Video call started
When away from house	Video Call	Video call started
When someone try to steal	Alarm	Alarm started

VII. CONCLUSION

To conclude, the smart IoT doorbells employing domain IoT project was successfully created and executed.

The primary objective of this doorbell system was of security which was achieved to a greater extent by implementing the concept of video call between owner and visitor without needing any physical contact. This would also reduce the risk of spreading of contagious diseases which had more chances when physical contact was required. IoT enabled security in doorbells is implemented such as if someone rings the bell, without opening the door, we can see them and then allow or deny the entry, reducing kidnappings, murders, and thefts. Also we can also communicate to the visitor through this doorbell system, which was really useful throughout this covid since we could avoid the spreading of Covid-19 virus by social distancing.

If someone is questionable, we will receive a notification so that we can be vigilant and take any necessary security precautions and action. We also don't have to worry about the device getting stolen if we leave it out, because if someone tries to steal it, it will inform us with an alert system by ringing the alarm. As a result, the doorbell system is secure. The owner can look after their house even when they are away from their home travelling. Remotely monitoring the home is really handy and very important nowadays because the robbery and other criminal cases are increasing day by day. So, this doorbell system will really take care of the house and reduce the chances of mishappening.

[1] S. Dadhich, P. Dabre, R. Dabreo and P. Raut, "Contactless IoT Doorbell for Covid-safe Household," 2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC), Bangalore, India, 2021, pp. 01-04, doi: 10.1109/R10-HTC53172.2021.9641565.

[2] U. Lokesh, M. Logeshwaran, J. J. Jeya Sheela and S. SK, "Security based Contactless Covid-19 Doorbell using Internet of Things," 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2022, pp. 885-892, doi: 10.1109/ICICCS53718.2022.9788357.

[3] S. N. Saud Al-Humairi, K. A-L Selvamani and L. Raya, "Design and Development of an IoT Contactless Door Buzzer, Automation and Home Security Device," 2022 IEEE 10th Conference on Systems, Process & Control (ICSPPC), Malacca, Malaysia, 2022, pp. 12-17, doi:10.1109/ICSPPC55597.2022.10001769.

[4] G. Rodrigo and D. De Silva, "IoT-enabled Contactless Doorbell with Facial Recognition," 2023 4th International Conference on Innovative Trends in Information Technology (ICITIIT), Kottayam, India, 2023, pp. 1-6, doi: 10.1109/ICITIIT57246.2023.10068625.

[5] V. Valarmathi, T. Sathya, J. Nirmala, S. Sivarajeswari, R. M. Prasanth and V. Srihari, "Design and Implementation of Secured Contactless Doorbell using IOT," 2022 International Conference on Computer, Power and Communications (ICCCPC), Chennai, India, 2022, pp. 187-191, doi: 10.1109/ICCCPC55978.2022.10072073.

[6] B. Baron Sam¹, K. Purna Chander², K. Vinay² and A. Piosajin¹, Published under licence by IOP Publishing Ltd
IOP Conference Series: Materials Science and Engineering, Volume 590, International Conference on Frontiers in Materials and Smart System Technologies 10 April 2019, Tamil Nadu, India
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DOI 10.1088/1757-899X/590/1/012018

[7] Dadi Tirumala Tarun, A Project Report on Wireless Doorbell with Arduino,
https://www.academia.edu/42640890/A_Project_Report_on_Wireless_Doorbell_with_Arduino

[8] C.K.Gomathy.(2010),"Cloud Computing: Business Management for Effective Service Oriented Architecture" International Journal of Power Control Signal and Computation (IJPCSC), Volume 1, Issue IV, Oct - Dec 2010, P.No:22-27, ISSN: 0976-268X

- [9] Aman A. & Soni A., (2018) Distance Measurement of an Object by using Ultrasonic Sensors with Arduino and GSM Module. Retrieved from https://www.academia.edu/37657821/Distance_Measurement_of_an_Object_by_using_Ultrasonic_Sensors_with_Arduino_and_GSM_Module?from=cover_page
- [10] Karvinen, K. & Karvinen, T., (2011). Make: Arduino Bots and Gadgets: Six Embedded Projects with Open Source Hardware and Software (Learning by Discovery) (1st ed.). Make Community, LLC.
- [11] Wikipedia. (2021, June 20). Doorbell. <https://en.wikipedia.org/wiki/Doorbell>
- [12] Ursan, R. (2020). Contactless doorbell. Hackster.Io. Retrieved October 22, 2021, from <https://www.hackster.io/robert-ursan/contactless-doorbell-143390>
- [13] G. K. S, R. Priyadarshi, A. Kumar and W. Tasnin, "Cost-Effective Touch-less Doorbell to Combat COVID-19," 2021 Innovations in Power and Advanced Computing Technologies (i-PACT), Kuala Lumpur, Malaysia, 2021, pp. 1-7, doi: 10.1109/i-PACT52855.2021.9696966.
- [14] A. Sharma, D Kumar, VC Sati, "An IoT Enabled Smart Doorway Security System", <https://www.bremcet.edu.in/downloads/files/n61bdb5ca83452.pdf>
- [15] Abhishek Gudipalli, Vaibhav Kejriwal, Vaishnavi Patel, Riddhi Gupta and Utkarsh Dixit, "Covid Bell – A smart doorbell solution for prevention of Covid-19", <https://doi.org/10.1515/pjbr-2022-0115>
- [16] MA Sharma, V Kumar, MV Verma, "Design & Development of an IoT System to Enable User to Remotely Monitor and Control Doorway Access", https://d1wqtxtslxzle7.cloudfront.net/73378349/IRJET_V8I10105-libre.pdf?1634901281=&response-content-disposition=inline%3B+filename%3DIRJET_Design_and_Development_of_an_IoT_S.pdf&Expires=1696691764&Signature=PD5A7G97sHmPhh2hYj0SsEn6YEsuNf-qVK4zr9eFtXjpvxqz0oidy22HCC8n2HRNKT0BSaR3ECCbVkJpQzj0Err3-9ZjA-GKQAO~lZfWjKeLHd9OYKlp6ijsNKAftMJSSLE6h7BXrTeY78Dif4hjiWJAM5yoRHCIwWv~-yEj~ipQJv- uSZCFODfjO2x~-ULjeD0xOm0Kd9zNrzqpMmBgvvgw &Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA
- [17] A. Mosenia and N. K. Jha, "A Comprehensive Study of Security of Internet-of-Things," in IEEE Transactions on Emerging Topics in Computing, vol. 5, no. 4, pp. 586-602, 1 Oct.-Dec. 2017, doi: 10.1109/TETC.2016.2606384.

