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Smart Door Bell

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ABSTRACT:

The Smart Doorbell Project is all about making doorbell systems better by using advanced technology to improve security and convenience. This project is all about creating a smart doorbell that has features like high-quality video streaming, two-way audio communication, and the ability to connect to your smartphone. This smart doorbell lets you keep an eye on your front door from and the best part is, this smart doorbell works seamlessly with other smart home devices, so you can have a complete home security system. The Smart Doorbell Project is all about using the latest hardware and software to create a doorbell system that's smart, efficient, and easy to use for all your security needs. The Smart Doorbell Project places great emphasis on utilizing the latest hardware and software technologies by leveraging these advancements, the project aims to create a doorbell system that is not only intelligent but also efficient and user-friendly, catering to all security needs. This capability not only provides personalized alerts but also enhances the overall sense of security for users. The Smart Doorbell Project also aims to revolutionize the way we interact with our front doors. With features like remote access, this smart doorbell is designed to make your life easier and more secure. Imagine being able to see who's at your door, even when you're not home, or being able to let in a delivery person with just a tap on your smartphone. The possibilities are endless with the Smart Doorbell Project, and we're excited to bring this innovative technology to homes everywhere.

Keywords: Video streaming, Security, Software technologies.

Introduction:

Security has always been an important issue in house. The owner of the house can see the person who is standing near the door using website. Also communicate through microphone and speaker. Also, open or close the door through website or externally connected touch sensors. The Smart Doorbell Project is a major step forward in home security and convenience. Traditional doorbells have been limited in their functions, mainly just alerting people to visitors at the front door. However, with technology advancing quickly, there is a chance to turn this simple device into a complex tool that fits seamlessly into modern life. The main goal of the Smart Doorbell Project is to create a doorbell system that not only tells you when someone is at the door but also streams live video, allows for two-way audio communication, and connects to your smartphone. This project wants to let users check their doorstep, talk to visitors, and control security settings from anywhere through a website. By using top-notch hardware and software, this project aims to change the way we think about doorbell systems, offering an intelligent, effective, and easy-to-use solution for today's security challenges. In short, the Smart Doorbell Project is a big innovation in home security, blending advanced technology with practical features to give users more peace of mind and convenience. Through this project, we hope to make a meaningful contribution to the evolution of smart home solutions and make meaningful advancements in the way we safeguard our homes and loved ones.

Literature Survey:

1. Title: "Smart Doorbell System Based on IoT and Image Processing" Authors: A. Kumar, P. Sharma, and S. Singh Published in: IEEE International Conference on Communication and Signal Processing, 2019 Summary: This paper presents a smart doorbell system that utilizes IoT (Internet of Things) and image processing techniques for enhanced security and convenience. The system integrates a camera with the doorbell to capture images of visitors, which are then processed and analyzed using computer vision algorithms. The authors demonstrate the feasibility and effectiveness of their approach through experimental results.
2. Title: "Smart Doorbell System for Home Security using Raspberry Pi and OpenCV" Authors: S. Gupta and R. Kaur Published in: International Journal of Computer Applications, 2018 Summary: This paper proposes a smart doorbell system based on Raspberry Pi and OpenCV (Open-Source Computer Vision Library). The system is designed to provide real-time monitoring of the doorstep area, allowing homeowners to remotely view and interact with visitors through a mobile application. The authors describe the system architecture, implementation details, and evaluation results, highlighting its practicality and effectiveness for home security.
3. Title: "Design and Implementation of Smart Doorbell System Based on IoT and Deep Learning" Authors: Y. Chen, et al. Published in: IEEE Access, 2020 Summary: This paper presents a smart doorbell system that combines IoT technology with deep learning techniques for intelligent visitor

recognition. The system utilizes a network of sensors and cameras to capture and analyze data from the doorstep area. Deep learning algorithms are employed to recognize and classify visitors based on facial features or other characteristics. Experimental results demonstrate the accuracy and reliability of the proposed system in identifying known and unknown visitors.

4. Title: "Smart Doorbell with Facial Recognition and Voice Interaction" Authors: H. Lee, et al. Published in: ACM Transactions on Embedded Computing Systems, 2021 Summary: This paper introduces a smart doorbell system equipped with facial recognition and voice interaction capabilities. The system employs advanced machine learning algorithms for facial recognition and natural language processing for voice interaction. Users can customize settings and preferences through voice commands, and the system can notify homeowners about recognized visitors. The authors evaluate the system's performance and user satisfaction through user studies, demonstrating its potential for enhancing home security and convenience.

Methodology:

1. **Requirement Analysis:**
   - Identify the core functionalities: video streaming, two-way audio, motion detection, mobile notifications.
   - Determine hardware and software requirements.
2. **Hardware Setup:**
   - Select components: microcontroller (e.g., Raspberry Pi or ESP32), camera module, PIR motion sensor, microphone, speaker, Wi-Fi module.
   - Assemble and connect the hardware components for power and data transmission.
3. **Software Development:**
   - Embedded Programming: Write code for controlling sensors, capturing video/audio, and detecting motion. 9
   - Backend Setup: Use Python/Node.js to handle device communication, video processing, and cloud integration.
   - Mobile Application: Develop a user-friendly app (e.g., using Flutter or React Native) for remote monitoring and control.
4. **Motion Detection and Alert System:**
   - Use a PIR sensor or computer vision (OpenCV) to detect movement.
   - Send real-time push notifications to the mobile device upon detection.
5. **Real-Time Video & Audio Communication:**
   - Integrate camera and mic/speaker to enable live video feed and two-way communication.
   - Use streaming protocols (e.g., WebRTC or RTSP) for efficient data transfer.
6. **Cloud Integration:**
   - Store video clips or snapshots securely using cloud services (e.g., Firebase, AWS).
   - Provide access control and history of recorded events.
7. **Testing & Optimization:**
   - Test the complete system for latency, accuracy, and reliability.
   - Optimize power consumption, network usage, and response time.
8. **Deployment & User Feedback:**
   - Install the system in a real-world environment.
   - Collect user feedback and make improvements.

1. **Block Diagram:**

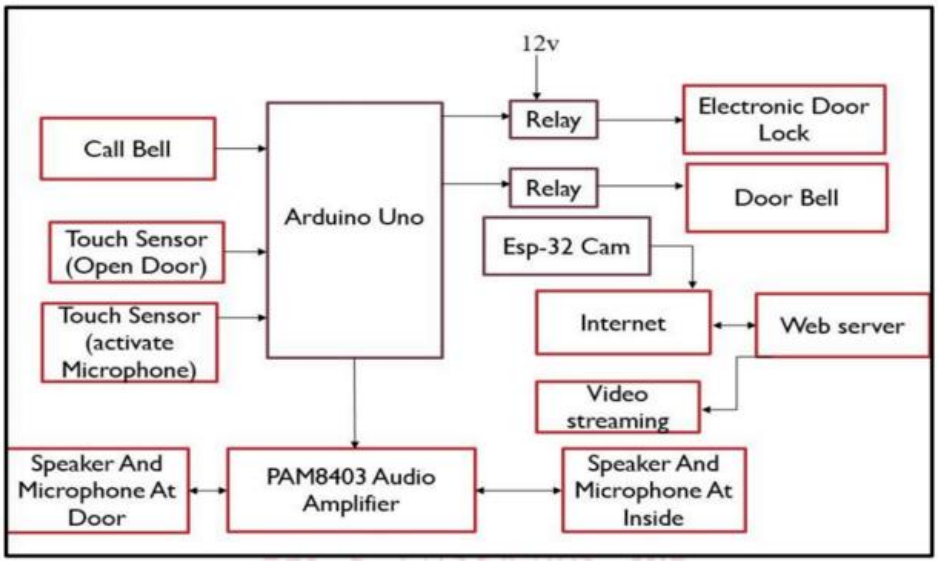

Fig.1 Block diagram of Smart Door Bell

2. Circuit Diagram:

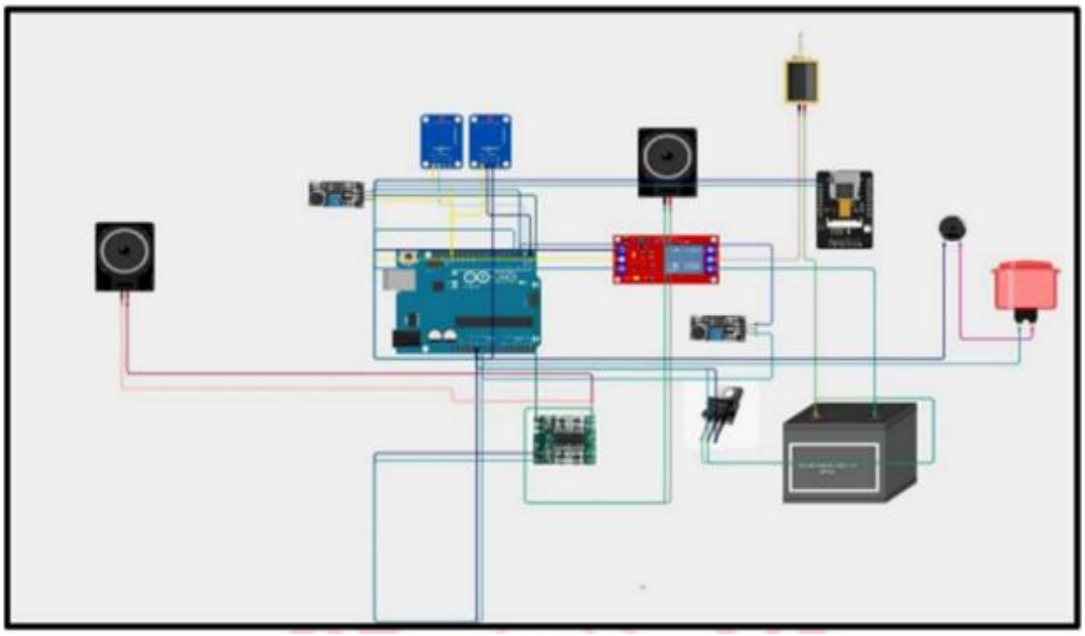

Fig.2 Circuit diagram of Smart Door Bell

3. Hardware Used:

Arduino Uno

The Arduino Uno is equipped with an ATmega328P microcontroller and offers 14 digital input/output pins, among which 6 support pulse-width modulation (PWM) for analog-like output. Additionally, it features 6 analog input pins for reading analog voltages. The operating voltage of the Arduino Uno is 5 volts. The board operates at 5 volts and is commonly powered via USB or an external power supply. It is popular for its versatility and ease of use in prototyping and DIY electronics projects. The Arduino UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

ESP-32

This is a small-size ESP32 board variation. Especially, it includes a camera module. Therefore, we can get photos and videos through this board. Also, this board is mainly based on the ESP32- S microcontroller. It consists of two cores and includes WIFI and Bluetooth. So, we can easily communicate with this board. ESP32 is highly-integrated with in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 adds priceless functionality and versatility to your applications with minimal Printed Circuit Board (PCB) requirements.

Touch Sensor

Touch sensors work similar to a switch. When they are subjected to touch, pressure or force they get activated and acts as a closed switch. When the pressure or contact is removed, they act as an open switch. It enables a device or object to detect touch or near proximity, typically by a human user or operator. A touch switch is a type of switch that only has to be touched by an object to operate. It is used in many lamps and wall switches that have a metal exterior as well as on public computer terminals. A touchscreen includes an array of touch switches on a display. A touch switch is the simplest kind of tactile sensor.

Microphone

When sound waves, such as speech or music, reach the microphone, they cause the microphone diaphragm or membrane to vibrate. The diaphragm movement due to sound waves causes changes in air pressure around it. These pressure variations cause the diaphragm to move back and forth. A microphone is a device that converts sound waves into an electrical signal. It allows you to capture audio and transmit it to various devices, such as computers, amplifiers, or recording equipment.

Speaker

An electrical audio signal, typically from a music player, amplifier, or other audio source, is fed into the speaker. Inside the speaker, there is a coil of wire, often called the voice coil, which is attached to the speaker cone. A loudspeaker (commonly referred to as a speaker or speaker 6 driver) is an electroacoustic transducer that converts an electrical audio signal into a corresponding sound.

Relay Module

Relay module connections: Input side with 3 or 4 jumper pins, output side with 3 screw terminals. Control signal activates electromagnet, closing switch contacts on output side, allowing electricity flow. A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

Electronic Door Bell

The switch is pressed and current flows through the circuit. The electromagnet is powered and generates a magnetic field that attracts the iron strip towards it. The electric doorbell is a simple circuit that triggers a sound on the completion of the circuit by pressing the button. It is this simplicity that makes the doorbell such a marvel. The simple devices in the doorbell but the scientific principle of electromagnetism into action in a useful way.

Electromagnetic Door Lock

The lock contains a coil of wire, known as the solenoid, which is wound around a magnetic core. When an electric current passes through this coil, it generates a magnetic field. The magnetic field produced by the solenoid attracts a metal armature or bolt mechanism within the lock. This action pulls the bolt or armature into a locked position, securely holding the door closed. An electromagnetic lock creates a magnetic field when energized or powered up, causing an electromagnet and armature plate to become attracted to each other strongly enough to keep a door from opening. PAM8403 Audio **Amplifier**

The PAM8403 is a 3W, class-D audio amplifier. It offers low THD+N, allowing it to achieve high-quality sound reproduction. It offers low THD+N, allowing it to achieve high-quality sound reproduction. The new filter-less architecture allows the device to drive the speaker directly, requiring no low-pass output filters, thus saving system cost and PCB area. PAM8403 is used to amplify the audio by connecting it to a minimum 3W rating speaker.

Software Used:

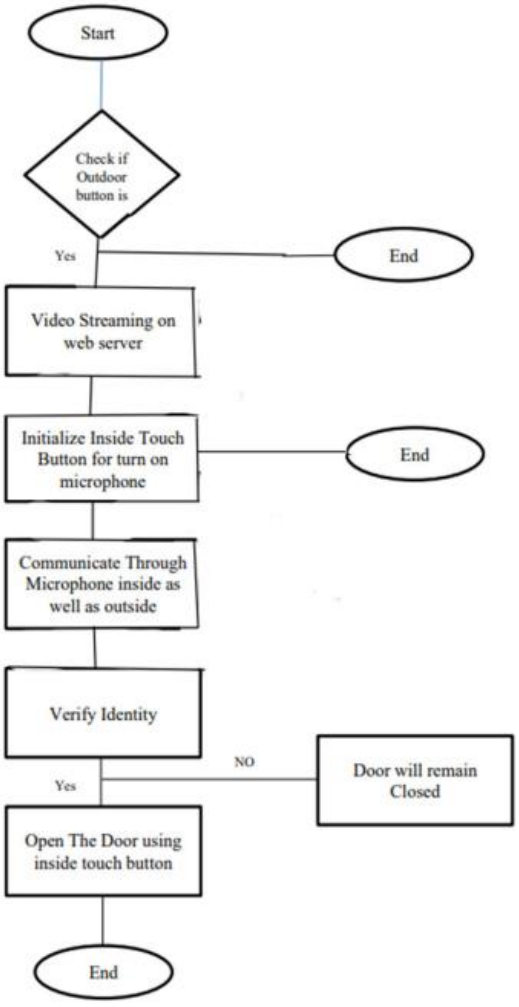

Fig.3-Flow chart of Smart Door Bell

Algorithm:

1. Start
2. Initialize the system:
2.1 Initialize the camera module.
2.2 Initialize the communication module.
2.3 Initialize the user interface module for displaying images/videos and receiving responses.
3. Check for button press.
3.1. If the doorbell button is pressed:
3.2. Capture an image or video using the camera module.
3.3. Display the captured image or video on web server.
3.4. Communicate through Microphone.

3. 5. Wait for a response from the user.
3.5.1. If the user responds affirmatively:
3.5.1.1. Unlock the door.
3.5.2. If the user responds negatively or does not respond:
3.5.2.1. Do not unlock the door.
4. End.

Results:

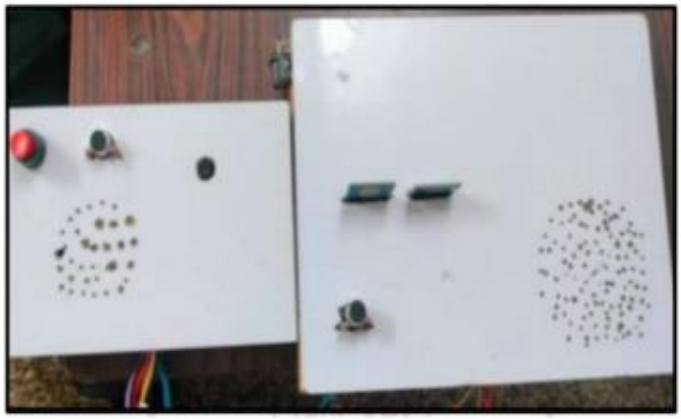

Fig.5-Hardware of Smart Door Bell

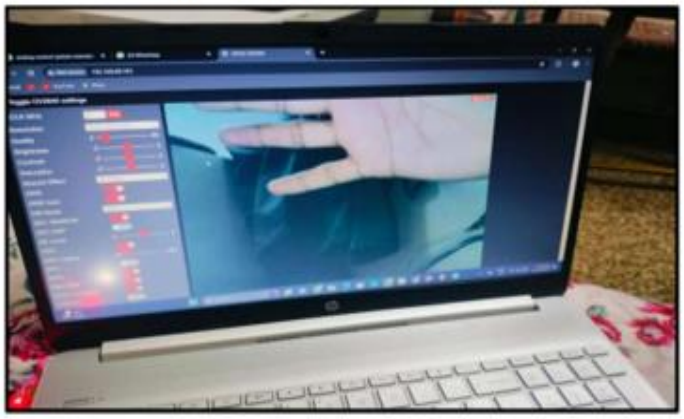

Fig.6-Software of Smart Door Bell

Conclusion and Future Scope:

In conclusion, the development and implementation of the smart doorbell project have successfully addressed the objectives of enhancing home security, providing convenience, and integrating with emerging technologies. Through extensive research, design iterations, and testing phases, several key outcomes have been achieved. Firstly, the cameras, and two-way audio communication has significantly bolstered home security by providing real-time monitoring. This has empowered homeowners with greater control and awareness of their property, mitigating potential security risks and enhancing peace of mind. Looking ahead, there are several exciting avenues for future development and enhancement. These include the integration of advanced artificial intelligence for improved facial recognition and gesture control, the incorporation of environmental sensors for broader home monitoring capabilities, and further integration with emerging technologies such as drones and augmented reality. Overall, the smart doorbell project represents a significant step forward in the evolution of home security and automation. The project has successfully demonstrated the potential for smart doorbells to transform the way we interact with and protect our homes.

Future Scope

1. **Advanced Security and AI**
    - Facial Recognition: Identify family, friends, or strangers automatically.
    - Intruder Detection: AI alerts for unusual behaviour (e.g., loitering, package theft).

- License Plate Recognition: For identifying vehicles near your door.

2. **Smarter Integrations**
   - Smart Lock Syncing: Unlock doors for trusted visitors or delivery personnel.
   - Voice Assistant Support: Alexa, Google Assistant, Siri integration.
   - Home Automation: Trigger lights, alarms, or recorders based on door activity.
3. **Remote Access & Control**
   - Mobile App Access: View, talk, or unlock remotely via smartphone.
   - Cloud & Edge Storage: Secure video storage and faster access.
4. **Improved Connectivity**
   - 5G and Wi-Fi 6: Faster, more reliable connections. 12
   - Low Latency Video Streaming: Instant door view and communication.
5. **Sustainable and Smart Design**
   - Solar Charging: Eco-friendly, no need for frequent charging.
   - Weatherproofing: Durable in extreme conditions.
6. **E-commerce & Delivery Integration**
   - Secure Package Drop Zones: With camera confirmation.
   - One-Time Access Codes: For delivery personnel.
7. **Community and Public Use**
   - Shared Entry Management: Useful in apartments or gated communities.

Acknowledgement:

To put an effort like this requires the determination and help of many people around us and we would not be doing justice to their efforts by not mentioning each helping hand in person. We are highly thankful to Mrs. Supriya Dhoke for their guidance and constant supervision as well as for providing necessary information regarding the project. We express our sincere gratitude to Prof Supriya Dhoke, Dr. V.M.Joshi Project Based Learning Coordinator (E&TC Dept), Prof. D.D.Kulkarni (Head of E&TC Engineering Department), Dr. Rupesh J. Patil Principal of Institute and other Teaching and Non-teaching staff members of the Electronics & Telecommunication Engineering Department for their kind co-operation. We would like to give sincere thanks to the Library Department for their kind co-operation throughout our work. And people who have willingly helped us out with their abilities. We would like to express gratitude towards our parents for their kind co-operation and encouragement which help us in working on this project.

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