**Ring Me Up: IoT Doorbell Receives an Alert and Webcam**

A Capstone Project Documentation

Presented to

The Institute of Information, Communication Technology

**PATEROS TECHNOLOGICAL COLLEGE**

In Partial Fulfillment

of the Requirements for the Degree

**BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

BSIT-3A

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March 2024

Chapter 1

**Background**

This chapter provides an overview of the project “Ring Me Up” IoT Doorbell system, outlining the introduction, project context and its background, project purpose, and description, the objective of the study, the significance of the study, scope and delimitation, conceptual framework, and definition of terms.

## Introduction

In the present day, the Internet of Things (IoT) has entered into a golden era of rapid technological progress and a rising focus on convenience, communication, and home security. The Internet of Things is an idea that proposes to spread the advantages of consistent internet constant connectivity, remote control ability, data sharing, and others. The IoT doorbell system is one example of this innovation; it combines modern technology with conventional doorbells to provide real-time notifications and security features. This idea can be used to achieve the safety concerns in a rate-effective technique. The doorbell system is a method of communication, It is usually at the house. However, The doorbell system has several problems which as the user cannot hear or alert the sound of the doorbell from the source point and poor camera quality. Then, the user does not know the identity of the pressed doorbell button. In the our today’s world we wanted to highlighting the current landscape of technological advancement and the growing emphasis on convenience, communication, and home security in the era of the Internet of Things (IoT). We as IT students, expressed that the IoT represents a paradigm aimed at leveraging the benefits of seamless internet connectivity, remote control capabilities, data sharing, and more. Specifically, the focus of our project is on the development and utilization of “Ring Me Up” an innovative IoT doorbell system designed to address the limitations of traditional doorbells by providing real-time notification and security features. Through our project, we aim to explore and the possibilities of the technology to effectively address safety concerns in a cost-efficient manner, while also addressing common issues such as the inability to hear the doorbell from certain areas of the house and the lack of clarity in visitor identification.

This project examine and benefit of the creation and use of "Ring Me Up" an Internet of Things (IoT) doorbell device intended to completely transform convenience, communication and home security.

## Project Context and It’s Background

In today's world, homeowners are constantly looking for ways to make their homes safer and more convenient. Traditional doorbell systems are functional but don't always meet modern security needs. With more people working remotely and being on the go, there's a growing need to monitor visitors from anywhere.

The idea for the "Ring Me Up" IoT doorbell system comes from recognizing these challenges. It's designed to bridge the gap between old-fashioned doorbells and the demands of today's security needs. By using alert notifications and a webcam, the project aims to give homeowners instant alerts and visual identification features, making homes significantly monitored and secured.

The Internet of Things (IoT) Theory; the theory focuses on the integration of physical devices, sensors, and software within a network to enable data exchange and automation. The project will draw on IoT integration theory to establish seamless connectivity and communication between the IoT doorbell system, Raspberry Pi. Related to security and privacy in IoT systems will guide the implementation of measures to protect user data, secure communication channels, and detect unauthorized entry attempts. The project will prioritize the integration of security features to enhance home security and safeguard user privacy.

To create a system that enhances convenience, security, and communication within residential environments. Home automation principles will inform the design of features such as real-time alerts, visitor image capture, and potential voice/video communication.

User-centered design and HCI principles will be applied to ensure that the "Ring Me Up" IoT doorbell system is intuitive, user-friendly, and accessible to individuals with varying needs, including homeowners and individuals with hearing impairments. The project will prioritize usability, accessibility, and a seamless user experience.

This project is not just about technology—it's about adapting to the way we live today. By complementing new hardware finds, "Ring Me Up" offers a modern solution to home security, meeting the changing needs of homeowners. It draws on theories of IoT integration, and home automation to create a system that's easy to use in our fast-paced world.

## Project Purpose and Description

Our project introduces the "Ring me up" IoT smart doorbell system powered by Raspberry Pi and with a Webcam. When a visitor presses the doorbell, an alert is immediately sent through the service via Email or SMS, ensuring that the homeowner is notified regardless of their location. This innovative solution not only benefits forgetful homeowners but also provides a crucial alert mechanism for individuals with hearing impairments. The "Ring me up" IoT smart doorbell system offers a comprehensive and practical solution for modern home security and convenience, leveraging IoT technology to create a seamless and efficient visitor notification system.

Objectives for this project are to design and develop the doorbell image capturing with notification through SMS or Email by applying Raspberry Pi, for achieving the functional requirements that are usability, performance, and efficiency. This project examines the creation and use of "Ring Me Up," an Internet of Things (IoT) doorbell device intended to completely transform convenience, communication, and home security needs.

## Objectives of the Study

**General Objectives**

The proponents will develop an IoT doorbell system using Raspberry Pi integrated and to provide real-time alerts and webcam functionality for enhanced home security, communication, and convenience.

**Specific Objectives**

The study aims to achieve the following:

* To implement a doorbell system that publishes alerts via email or SMS when activated.
* To integrate a webcam to capture and upload visitor images, providing visual identification through email.
* To ensure that all functions activate when the doorbell is pressed.
* To explore the potential for voice/video call capability on Raspberry Pi for communication with visitors.
* To investigate the addition of sensors to detect unauthorized entry attempts and enhance home security measures.

**Significance of the Study**

The person who will benefit from the “Ring Me Up” IoT Door Bell System is the following:

**Homeowners**

Homeowners stand to benefit significantly from the implementation of the IoT doorbell system.

**Individuals with Hearing Impairments**

To individuals with hearing impairments, ensuring that they are promptly notified when visitors arrive at their doorstep.

**Remote Monitoring Enthusiasts**

The users can receive alerts and access webcam feeds from anywhere, enabling them to stay connected to their homes even when they are away.

**Researchers**

The proposed project is beneficial to the researchers for this will broaden their knowledge assess their individual skills in the field of Information Technology.

**Future Researchers**

This study would serve as a handy reference for the other researchers would embark on a similar study in the future especially on certain aspects not derived into by the present study.

## Scope and Delimitation

The scope of this study encompasses the design and development of the "Ring Me Up" IoT doorbell system using Raspberry Pi (webcam) integrated with the alert notification. The study will focus on implementing a doorbell system that publishes alerts using the service via Email or SMS when activated, integrating a webcam to capture and upload visitor images for visual identification through notifications, and exploring the potential for voice/video call capability for communication with visitors. The study will investigate the addition of sensors to detect unauthorized entry attempts and enhance home security measures.

* A doorbell system that publishes alerts using the service.
* Integrate a webcam to capture and upload visitor images, providing visual identification.
* The alert function will activate once the doorbell is pressed.
* Explore the potential for voice/video call capability for communication with visitors.
* The addition of sensors to detect unauthorized entry attempts and enhance home security measures.

As part of the limitations of the system. The IoT smart doorbell system using Raspberry Pi is integrated with the alert notification. The project will only focus on the testing and implementation of the "Ring Me Up" IoT doorbell system, which will be limited to a specific geographical location or a controlled environment for practicality and resource constraints. The study will focus on the specified objectives, including the implementation of doorbell alerts using the service via Email or SMS, integration of a webcam for visitor image capture, and exploring the potential for voice/video call capability on Raspberry Pi. Other functionalities beyond these objectives may not be extensively covered.

However, the system will focus mainly on the development and integration of the "Ring Me Up" IoT doorbell system using Raspberry Pi and Webcam, emphasizing real-time alert notifications, visitor image capture, and communication capabilities through Email or SMS.

## Conceptual Framework

A diagram of a software system

Description automatically generated

Figure 1.1. Input-Process-Output

The figure shows the requirements/variables in the development of the **Ring Me Up - IoT Smart Door Bell Receive an Alert Notification and Webcam.** Input shows the base knowledge. Hardware and Software requirements needed in the actualization of the system.

## Definition of Terms

**Technical Terms**

**Real-time notifications.** Immediate alerts or messages are delivered as soon as an event occurs, providing timely information to users.

**Raspberry Pi.** A small, affordable computer used to learn programming through fun, practical projects. It is capable of performing tasks similar to a desktop computer.

**Alert notification.** A message or signal that provides information about a specific event or occurrence.

**Voice/video call capability.** The ability to make and receive voice or video calls using a specific device or system.

**IoT integration.** The process of incorporating various IoT devices, sensors, and software into a unified network for data exchange and automation.

**User-centered design.** An approach to design that involves the users throughout the design process to ensure that the resulting product meets their needs and is easy to use.

**Human-Computer Interaction (HCI).** The study, planning, and design of the interaction between people (users) and computers.

**Data exchange.** The process of transferring data between different systems or devices.

**Automation.** The use of technology to perform tasks with minimal human intervention.

**Security and privacy in IoT systems.** Measures and protocols designed to protect user data, secure communication channels, and maintain privacy in IoT environments.

**Sensor integration.** The incorporation of sensors into a system to detect and respond to changes in the environment.

**Remote monitoring.** The ability to monitor and control systems or devices from a distance, typically over the internet.

**Hardware components.** The physical parts or devices used in a system, such as Raspberry Pi, sensors, and webcams.

**Software integration.** The process of combining different software components or systems to function as a single unit.

**Operational Terms**

**Design and development.** The process of creating and building a system or product, including planning, design, and implementation.

**Alert mechanism.** A feature or system that provides notifications or warnings about specific events or conditions.

**Visitor image capture.** The action of recording or capturing images of individuals visiting a specific location.

**Unauthorized entry attempts.** Efforts to gain access to a location or system without proper authorization or permission.

**System testing and implementation.** The process of evaluating and deploying a system to ensure its functionality and effectiveness.

**User acceptance testing.** Testing conducted to determine whether a system meets the requirements and expectations of its users.

**Requirement gathering and analysis.** The process of collecting and analyzing the needs and expectations of stakeholders to define the system's requirements.

**Integration of hardware and software.** The process of combining physical components and software to create a functional system.

**Remote monitoring and control.** The ability to oversee and manage systems or devices from a remote location.

**Implementation of doorbell alerts.** The activation and delivery of alerts in response to doorbell activations.

**Seamless user experience.** A user experience that is smooth, consistent, and easy to navigate without interruptions or difficulties.

**System maintenance.** The ongoing process of keeping a system operational, up to date, and in good working condition.

**User notification.** The act of informing users about specific events or changes within the system.

**Visual identification.** The use of visual information to identify individuals or objects.

**Data sharing.** The process of exchanging data between different systems or users.

**Communication with visitors.** The ability to interact with individuals visiting a specific location, typically through voice or video communication.

**Practical testing and evaluation.** Testing and evaluation conducted in real-world scenarios to assess the system's performance and functionality.

**Deployment in real-world scenarios.** The process of introducing and using the system in actual operational environments.

**User feedback analysis.** The examination and interpretation of feedback provided by users to identify areas for improvement.

**Iterative processes.** The repetition of a sequence of steps or activities to refine and enhance the system's design and functionality.

# Chapter 2

**Review of Related Literature, Studies, and Systems**

This chapter serves the writings and research of other authors that have relevance to the present study. It involves quotations of the author with reference materials that may serve as the basis for the elucidation and solution of problems that might be encountered in the development of the presented study/project.

## Related Literature

## Local Literature

**SMS BASED HOME APPLIANCE CONTROL SYSTEM** According to Ledonio, A.L., Tacuban, T.N., & Porras, A.P. (2021) An Internet of Things capstone project that focuses on home automation and remote appliance monitoring may find value in this article. The paper describes a system that makes use of a Short Messaging Service (SMS) to enable users to monitor and manage electrical equipment remotely. By allowing for remote device access and control, the project's integration of an SMS module, Arduino microcontroller, voltage sensor, and current transformer (CT) sensor for appliance monitoring and control adheres to the principles of the Internet of Things. An IoT capstone project that aims to develop smart home automation solutions can benefit greatly from the study's findings on accuracy in electricity consumption monitoring and functionality testing for on/off appliance switching. [1]

**INSIGHTS INTO LEVERAGING IOT TECHNOLOGIES** According to Yasay, J.J.R. (2021) The Internet of Things (IoT) is a global knowledge society system that uses new and present interoperable information and communication technologies to connect (virtual and physical) objects in order to enable improved services. Things have changed as a result of the confluence of several technologies, including machine learning, real-time analytics, commodity sensors, and embedded systems. Conventional domains such control systems, wireless sensor networks, embedded systems, automation (including residential and building automation), among other areas, all aid in the deployment of the Internet of Things. In the market for consumers, The things that are most closely linked to the idea of the "smart home," like gadgets and appliances (such thermostats, light fixtures, and home security systems). The goal of the Internet of Things (IoT) is to link "dumb" objects to the internet and to one another in order to make them "smart" online. It makes it possible to sense and manipulate physical items remotely, facilitating more direct integration of the real world and systems that rely on computers [2]

**CLOUD COMPUTING** According to Alimboyong, C. R., & Bucjan, M. E. (2021). Higher education institutions (HEIs) are thought to have adopted cloud computing (CC) widely by now. Both enormous advantages and possible problems accompany its rise. This study looks into a few problems and obstacles that state universities and colleges (SUCs) in the Philippines face when implementing cloud computing. Due to the study's utilization of several case studies, a qualitative design was adopted. The research identifies two significant problems, including a poor internet connection and a lack of knowledge or awareness of cloud computing, based on the findings. The results showed that, despite the worldwide epidemic, cloud computing at SUCs is useful to the educational system. While students may readily access the materials online, professors can submit lessons and teaching materials with ease. The country's internet availability presents a barrier, though. Even if they don't interact in person, administrators can readily work with the entire academic community and even its stakeholders. It is the ideal way to be effective and productive since it makes all procedures accessible to everyone involved in the academic community, including staff, instructors, students, and other stakeholders. [3]

**SECURITY SECTOR** Research by Arugay, A. A. (2021) In the Manchester University Press eBooks, One of the world's densest and healthiest civil societies is said to exist in the Philippines. It emerged from the fight against dictatorship and gained a reputation as a tenacious champion of democracy and human rights. Even though the country was being protected, this was also done to protect the current regimes from oppositional elites and civil society allies. The Philippines' example shows that, even while governments can defend expanded authority and regimes of exception for homeland security, these measures are frequently used primarily for the purpose of preserving domestic political power and regaining legitimacy. In order to address the nation's complex security concerns, it ends by providing an overview of the ways in which the Duterte administration uses and improves the anti-terrorism and security policy frameworks already in place. [4]

**SIGNIFICANCE OF THE INTERNET OF THINGS** Stated by researchers’ Garcia, M. R. T., & Culaba, A. B. (2021) In the specific year (2021) where we experiencing and ongoing (pandemic) its more than is a critical time to talk about the gaps in IoT. Professionals and tech experts are required to identify these problems using a suitable methodology in order to further improve the system. They also have to make decisions on setbacks, market pricing, and convenience assurance. The congress also needs to draft legislation protecting the privacy and data rights of Internet of Things users. It is just one of the numerous signs that every natural thing interrelates with each other. Novel coronavirus outbreak began in China in December 2019. It continues to alter the society causing economic plight across the globe, including highly developed nations and medical researchers remaining wide awake to seek an effective vaccine. Regardless of race or even status, nobody is spared from the threat of this virus. The Internet of Things, or IoT, is one of the technologies that could be used to support physical distance limitation among individuals. Terminating this virus in light of the somber count of deaths and transfer cases requires the demand to utilize sufficient vital equipment, systematic, and prepared facilities. [5]

**EMERGING TECHNOLOGIES IN THE PHILIPPINES IOT** In the age of emerging technology, many automated systems and remote-control system applications have been put into place to improve human comfort in the era of developing technology. An array of internet-connected sensors and smart devices can be controlled and navigated with the help of the Internet of Things (IoT), a cloud-based platform. Numerous nations are currently utilizing diverse IoT-related applications in the field of smart technology. Smart technology will assist emerging nations like the Philippines in adjusting to the changing requirements of their citizens. Integration with smart devices, such as smart homes, smart cities, and other smart applications, will eliminate common problems people face on a regular basis. The Philippines' development is aided by digitally enabled technologies, which enable its business, agricultural, and other sectors to apply cutting-edge technology for improved production to their products that may compete internationally. In the years to come, the Philippines will witness the advancement of modernization as IoT gains popularity and acceptance in society. [6]

**SMART CITIES, IOT SEEN TO LEAD TECHNOLOGY** According to Philstar.com (2019) In order to develop connected cities and communities, the global technology services company NTT Ltd. anticipates a greater uptake of disruptive technologies in 2019. These technologies combine data, automation, and the internet of things (IoT). At the unveiling of its "Future Disrupted" predictions, which examine technology trends for the upcoming year and beyond, NTT predicted that 2020 will finally see the convergence of all the buzzwords from the previous ten years to create fully connected environments that can operate independently to create more intelligent workplaces, cities, and businesses in a secure manner.

“Smart cities and IoT will become the norm as they improve productivity, growth and innovation across entire regions,” he said.

“The industry has been talking about different technologies, including the cloud, data, AI and security in different siloes. But 2020 is the year that will change. Next year, we’ll see complete end-to-end computing come to the fore, bringing to life fully intelligent environments that are completely connected and will have a big impact on the world we live in.” [7]

**DICT SUPPORTS FASTER CONNECTIVITY** According to dict.gov.ph (2023) After President Ferdinand R. Marcos Jr. announced the agreement between the two parties on the said subsea cable system project on February 21, 2023, at Malacañang Palace in Manila, ICT Chief Ivan John Uy expressed his full support for Converge ICT Solutions Inc. and Keppel Telecommunications and Transport (T&T) Ltd. Through its Broadband ng Masa program, which aims to provide connectivity throughout the nation, particularly in geographically isolated and disadvantaged areas (GIDAs), the Department of Information and Communications Technology (DICT) supports the efforts of its private sector partners in improving their digital infrastructures. In accordance with R.A. 10929, the Free Public Internet connection Program, aims to offer free Internet connection in public spaces around the nation. By 2025, the program hopes to have more than 100,000 locations functioning. The nation's internet connection speed and dependability have improved as a result of these activities, as seen by the most recent Ookla Speed test Global Index statistics from January 2023. With a median fixed broadband speed of 88.13 Mbps, the Philippines ranks 82nd out of 142 nations; this is a quicker speed than the previous statistics, which was 87.13 Mbps in December 2022. [8]

**INTEGRATION OF 5G TECHNOLOGY IN IOT** According to the study of T. M. A. M. Bedonia et al., (2024) The study examined the mutually beneficial relationship between 5G and the Internet of Things (IoT) with the goal of investigating how the combination of these two cutting-edge technologies could transform a number of different businesses. The main goal was to evaluate how 5G would affect IoT application functionality and efficiency, with an emphasis on increased connection, scalability, and energy efficiency. A multimodal approach was used in the process to guarantee a thorough study. The groundwork was established by a comprehensive analysis of the literature, which offered insights into current IoT installations and the possible benefits of 5G integration. To comprehend real-world applications, case studies were reviewed, and simulations were used in empirical analysis to evaluate the performance of 5G-enabled IoT devices in various scenarios. [9]

**PHILIPPINES CLIMBS IN TECHNOLOGICAL READINESS** According to Philstar.com (2018) In the coming years, the Philippines will be better equipped to handle technological transformation. The Philippines rose to the 55th position among the 82 economies included in the Economist Intelligence Unit's most recent Technological Readiness Ranking, which was released on Tuesday. With a score of 5.5, the Philippines was tied for 55th position with Kazakhstan, Colombia, Jordan, Serbia, and Sri Lanka. The Philippines has the fourth-most tech-ready economy in Southeast Asia. The EIU's most recent ranking evaluated three major categories internet access, infrastructure for the digital economy, and innovation openness to determine how ready consumers, companies, and governments are for digital disruption from this year until 2022.

"As infrastructure development takes hold in the Philippines, it will ramp up the archipelago's technical readiness," the EIU analyst Anwita Basu said in an interview.

"The situation as it currently stands is not as favorable as compared to other countries in the region. However, we believe that the country will make steady progress in improving cyber security, creating e-government portals and raising internet connectivity speed, over the forthcoming years. These factors have led to a slight improvement in the country's forward looking rank," Basu added. [10]

## Foreign Literature

**AN (IOT) DOORBELL SYSTEM FOR SMART NOTIFICATION ALERT** In the words of the authors Melissa Q., et al. (2019) Stated that, challenges setting up a connection between Raspberry Pi and users’ phones. It was a little challenging for the researchers to connect the two gadgets as they were outlining their idea. Initially, they considered pairing them directly over Bluetooth, but they soon recognized that this would have a drawback they would need to be close together for the connection to be maintained. After doing some research, they discovered that connecting over the cloud would be a better option because Wi-Fi is now a household standard and would effectively reach people as there are no restrictions. Setting up the connection between Firebase and the mobile app Setting up Firebase itself wasn't too difficult, but getting an interactive connection between Firebase and the mobile app proved to be difficult. They conducted a lot of research to find a way to connect Android Studio and Firebase to fix this issue, and in the process, they discovered how to use tokens. Solution As shown, the IoT Doorbell System consists of the following main aspects: Raspberry Pi, speaker and phone app installed on users’ phone. In order to boost the whole system and connect the dots, every component should be able to interact with each other once the system is triggered (when someone rings the bell) (Qian, 2019, pp. 44-45).

The doorbell has become an incredibly important device in today's environment. Almost everyone has this little device, which emits a sound when activated, near their front door since they rely on it to alert them when guests arrive. The doorbell is convenient, but it can also be inconvenient. The loud alarm can easily disrupt people's routines and cause them to feel more exhausted when it rings at the wrong time or is initiated by an unauthorized individual. Although the doorbell's overall impact seems negligible, people should never overlook the potential butterfly effect. In modern society, living under pressure from work, family, and personal social life, people will inevitably be in some extent of anxiety that keeps building up if they lack proper rest. As a solution, the approach presented in this paper includes revolutionizing a traditional doorbell with features such as internet connection and face recognition. By attaching a camera to its device, Smart Doorbell will record the visitor’s face when they press the button and use its algorithms to determine the familiar level of the visitation to the house owner. Based on the result, Smart Doorbell will then choose one or both of the notifying methods: rings directly or sends out notifications to the user’s phone through the corresponding app, along with the visitor’s photo, prediction of his or her identity, and the visiting time. [11]

**SMART SURVEILLANCE WITH SMART DOORBELL** As stated by Lalitha., et al. (2019) The Internet of Things (IoT) has developed as a concept to facilitate communication between heterogeneous devices (things or items like sensors, actuators, RFID tags, etc.) with the evolution of the Internet and Wireless Sensor Network Technologies. These Internet of Things (IoT) devices function in environments with limited resources, typically devoted to a particular activity, without a screen or user interface. Because these devices are instantly connected to everything, everywhere, and at any time, there are numerous limitations associated with IoT, including memory capacity, battery life, and security. The Internet of Things (IoT) gathers and analyzes human activity intelligently, in contrast to traditional internet. These intelligent objects' strong connectedness creates significant security risks. The Internet of Things (IoT) is a network of sensor objects that can interact with their surroundings and communicate through the Internet. The network can include any communicating device that has been given a special identifier. IoT-based technology will impact daily activities in the future. Many IoT applications can be found in many industrial, scientific, agricultural equipment, transportation systems etc. According to Gartner report the number of smart phones and tablets will reach up to 7.3 billion units by 2020. As a tremendous growth is observed in IoT, the communication network has challenges in terms of huge amount of data, processing power with energy consumption, security threats, and efficiency of cryptographic algorithms. Lalitha, (2019 , p. 1841) International Journal of Innovative Technology and Exploring Engineering (IJITEE). The idea of home security has grown in importance in the contemporary day. The CCTV surveillance provided by the home security system allows for ongoing monitoring. The world is becoming smarter in every way as we observe a massive shift in technology. While providing the necessary solitude, these smart devices are intruding into our lives. These Internet of Things (IoT) gadgets remotely keep an eye on anything that are linked to the Internet. Today's digital environment demands that all activities be captured on Closed Circuit Television (CCTV) security cameras. It is impossible to keep an eye on the CCTV feed all the time or to check the door once every minute. We must keep an eye on our property; if a stranger is spotted in front of the door, we must get alerted right once. When a guest is at the door, our smart doorbell may instantly sound an alarm to notify the resident. In this work, we have created an Internet of Things (IoT) based smart doorbell that can automatically sound an alarm to notify the resident when someone is at the door. With its internet connection, the smart doorbell may record visitors at the door and automatically upload their information to the cloud or other storage devices. We have the video footage as proof of crime in case there is a break-in at the house. These systems are solely meant to be used for monitoring. This camera footage can be useful in providing eyewitnesses for post-event investigation in the event of any unanticipated incident. When a guest is waiting at the door, the system can notify the homeowner. Since this monitoring is conducted around-the-clock, the system needs a lot of memory to retain the video data. The fact that these gadgets are connected to wireless networks and that the constant recording of video increases the device's memory requirements are the obvious causes. The development of intelligent communications is made easier for motion detection applications based on Raspberry Pi’s. Since family members are no longer home most of the time and feel uneasy about their residence, the Smart Doorbell is useful for remotely monitoring a home's grounds from an office. This Internet of Things (IoT) system offers a dependable and safe solution. Before then, a number of systems were developed, such as the GSM module and the pi camera, which had a number of incompatibilities, such as slow user alerting times and heavy, non-portable equipment systems. [12]

**SMART DOORBELL SECURITY SYSTEM USING IOT** According to Udit C., Sushmita G., et al. (2020) To keep our homes safe from invaders, a remote home security system is becoming increasingly necessary. The device consists of a camera interfaced with a Raspberry Pi. When the doorbell is pressed, the camera detects the person and records their face, which it then compares to a database of previously recorded faces. Security in this system combines the home network system and smartphone functionality. With the help of the Internet of Things-based doorbell camera, customers may remotely watch guests in real-time. These photos are also processed to identify things that could cause harm. By automatically collecting the image, analyzing it for facial recognition, and using mail communication to the server to verify whether the intruder is known or unknown, this method further enhances autonomy in security. The Raspberry Pi, camera, PIR sensor, buzzer, and microcontroller are all used in the Smart Bell Notification System. The steps toward a smart home and way of living are indicated in this paper. In today's world, deliveries that encounter issues with customs and delivery personnel when the recipient is not home are inconvenient. It provides the impression of the same doorbell, which is useful for unexpected visits from friends and family. The smart doorbell, which uses a Raspberry Pi microprocessor, addresses the issue of visitors leaving unattended when the person in question is unavailable. This smart doorbell notifies you when it is rung and enables you to see and communicate with visitors from anywhere at any time using a smartphone. The course will be delivered on the Internet. Additionally, the doorbell system has an integrated "Face Recognition" module that can tell the difference between recognized and unknown individuals. Additionally, the user has the option to enable or disable notifications. One limitation of the method is that although the Internet is the primary medium for instruction, users' smartphones may not receive notifications if their Internet connection is unstable. For that reason, we will incorporate an SMS system to provide the notification. Even if the user's connection is unstable or they are not online, they will still receive notifications when their doorbell rings. [13]

**VIDEO DOORBELLS: A MODERN APPROACH TO HOME SECURITY** As noted in the literature Staysafe.org (2024) Video doorbells have emerged as a modern and innovative solution to enhance home security. By combining advanced technology, convenience, and connectivity, video doorbells provide homeowners with a comprehensive approach to monitoring and protecting their homes. With features like live video streaming, motion detection, two-way communication, and integration with smart home systems, video doorbells offer a new level of awareness, convenience, and peace of mind. In this article, we will explore the functionality, benefits, key features, and considerations of video doorbells, highlighting their role as a modern approach to home security. (Staysafe.org 2024)

There are many advantages to video doorbells for home security. They serve as a deterrent by making themselves visible and giving prospective robbers the impression that everything they do is being videotaped. By enabling homeowners to see and speak with guests in real-time, even when they are not at home, video doorbells improve awareness. This gives householders the power to decide for themselves whether to answer the door and keeps them on the lookout for unusual activities. One of the main benefits of video doorbells is remote monitoring. Homeowners can monitor their front door from anywhere in the world by using live video feeds and alerts that can be accessed on their cell phones or other devices. This function, which enables customers to interact with delivery staff and give detailed directions for package drop-offs, is particularly helpful for tracking deliveries. It guarantees the protection of valuable deliveries and aids in the prevention of package theft. Video doorbells also give users a sense of security and control, which reduces anxiety. Homeowners can keep an eye on their property, vet guests, and watch over their kids or pets while they play outside. Video doorbells can also be integrated with other smart home appliances to provide an all-encompassing security environment. Through the integration of video doorbells with other home security systems, like voice assistants, security cameras, and door locks, homeowners can feel more at ease and secure in their house.

Video doorbells have completely changed the home security game by offering a cutting-edge, practical method of keeping an eye on and safeguarding your property. They are an invaluable addition to any home security system because of their practicality, ease of use, and cutting-edge capabilities like two-way communication, motion detection, and night vision. By being able to access and control video doorbells remotely from computers or smartphones, homeowners may increase their peace of mind and guarantee the security of their belongings and loved ones. Even though video doorbells could have drawbacks and difficulties, they can be solved with careful configuration, personalization, and troubleshooting frequent problems. Homeowners can enjoy enhanced awareness, danger deterrence, and a general sense of security by adopting video doorbells as a cutting-edge method of home protection. [14]

**AN IOT-BASED SMART DOORBELL SYSTEM FOR MITIGATING STEALTH ATTACKS** According to Nguyen., et al. (2021) The Internet of Things (IoT) has revolutionized daily life by enabling monitoring and control of various processes. One of the most important application areas of the Internet of Things is the evolution of traditional doorbell systems into intelligent doorbell systems. These improvements address the limitations of traditional doorbells, such as: B. their lack of functionality and security gaps (Priyanka et al., 2022). Smart doorbell systems offer a range of features including real-time notifications, motion detection, facial recognition, and package detection, providing homeowners with greater convenience and security (Thakkar and Ukani, 2022).

According to Aguilar-Gonzalez (2019), these systems typically consist of components such as the doorbell button, camera, and smartphone connectivity. However, challenges such as unreliable operation, high power consumption, and difficulty accessing notifications remotely remain (Shaout and Theisen, 2021). To address these challenges, Zielonka et al. (2020) present a low-power doorbell system that autonomously detects human presence and sends notifications regardless of the owner's location. This system integrates a microcontroller, an ultrasonic sensor, and a GSM module, enabling proactive and automatic notification to owners.

According to Priyanka et al. (2022), empirical testing demonstrated the system's large detection range and improved ability to detect human presence over a larger area, contributing to its effectiveness in mitigating security threats. To address today's security challenges and improve user experience, Thakkar, and Ukani (2022) note that an IoT-based smart doorbell system represents a significant advancement in home security technology. [15]

**DESIGN OF A SMART DOORBELL FOR A LEADER’S OFFICE WITH AVAILABILITY STATUS NOTIFICATION AND VISITOR RECOGNITION FEATURE** Following the findings of Panasonic (2022) Many smart doorbells on the market have built-in cameras and audio devices that enable visual monitoring and communication with guests from inside the property. As noted by Panasonic (2022), some of these doorbells also offer video recording capabilities. Yaro (2020) introduces the concept of 3D motion detection, another feature built into some smart doorbell models. Delaney (2021) highlights the availability of support for the smartphone app to control and manage smart doorbell systems. In addition, BKAV SMARTHOME (2021) highlights the existence of advanced smart home systems with additional security features. Omnicore (2022) points out that while there are smart doorbells for office use, their primary function is typically limited to enabling video communication to alert you to your entry into the office. In addition, Omnicore (2022) and Patel et al. (2021) discuss the integration of AI-based facial recognition technology and cloud computing technologies with some smart doorbell systems. [16]

**DEVELOPMENT OF COVID-19 DETECTION SMART DOORBELL BASED ON IOT** According to the findings of Kumar, Kaur, and Singh (2021) The development of an IoT-based smart doorbell that detects Covid-19 aims to dispel fear of Covid-19 and lead to a reduction in outdoor activities. The authors highlight the efforts of scientists and technical experts to develop devices to identify and track infected people to prevent the spread of the virus. They highlight the potential of smart doorbells to detect COVID-19 infections by alerting visitors and verifying their identities. Equipped with temperature detection, these doorbells can identify people with a high temperature and alert residents to their presence, thereby preventing infections.

In addition, the distributed system structure, including Raspberry Pi 3, infrared sensor, camera, C programming and laptop, enables rapid error detection and diagnosis. The authors note that the designed system was successfully installed, which helped reduce manual work and the risk of infection, save time and generate timely reports. In addition, it reduces human errors, properly manages Covid-19 patients, and can generate various reports in the future. The current work serves as a pre-development overview during the assembly phase of the project and covers the system's core operating systems, linear actuators, transmission and distribution, thermal management, and electronic designs. The authors propose the use of more computational and advanced programming tools in the further development of this type of gadget. [17]

**SMART WI-FI DOORBELL USING ESP32CAM WITH IOT** As noted in the work of Kayiram and Kavitha (2019) Modern society places great emphasis on home security, leading to the development of smart doorbells with intelligent monitoring features. These doorbells can alert residents to the presence of guests by sounding an alarm and automatically sending data to the cloud when guest presence is detected. In the area of object recognition, Orovi et al. (2018) demonstrated the use of the YOLO algorithm for real-time detection of road users, which is important for the development of intelligent monitoring and security systems.

Regarding smart home surveillance systems, Babiuch and Postulka (2020) discuss implementing a surveillance system using ESP32 microcontrollers and highlight their role in home security through features such as intrusion detection and data collection.

As for the existing method, the paper has limitations such as the limitation of GPIO pins for device control and the high cost of some components such as Raspberry Pi for face lock. Issues related to GSM modules such as signal loss and coverage, as well as challenges related to GPS signal interference and location inaccuracy were also addressed. A comprehensive overview of state-of-the-art technologies and methods in the development of advanced smart doorbell systems and integrates the concepts of intelligent surveillance, object detection, surveillance systems and existing methods. [18]

**THE SMART DOORBELL: A PROOF OF CONCEPT IMPLEMENTATION OF A BLUETOOTH MESH NETWORK** For authors Martinez., Eras., Dominguez., (2018) Indicates that the Internet of Things (IoT) is a key innovation in Industry 4.0, and more than one billion smart devices are expected to be connected worldwide by 2025. This rapid growth of IoT devices challenges existing communication protocols that were not previously used for IoT. applications. Although Wi-Fi and IPv4 are widely used in home and office automation, they are limited in capacity and cannot accommodate the increased address space required for IoT applications.

Various low-power wireless communication protocols exist to solve these problems, such as ZigBee, Wire, WirelessHart, and ZWave. These protocols are capable of creating large and efficient networks but face difficulties in wide deployment due to the closed ecosystem. Originally designed for computer hardware, Bluetooth has been enhanced to address the power of IoT with Bluetooth Low Energy (BLE). Although BLE remains point-to-point, it has enabled wearable applications such as smartwatches and smart shoes. To compete with other IoT technologies such as ZigBee and ZWave, the Bluetooth SIG developed Bluetooth Mesh, a multi-to-many protocol based on Bluetooth LE. Approved in July 2017, Bluetooth Mesh allows Bluetooth 4 and 5 to work with devices and features a secure mesh network.

The potential of Bluetooth Mesh in IoT communications is significant due to the current ecosystem of billions of devices. But the technology is still evolving and hardware vendors are starting to offer Bluetooth Mesh solutions. To evaluate Bluetooth Mesh for automatic construction, a proof-of-concept mesh generation application was developed and tested. Using the Nordic NRF52832 System-on-Chip, the network is designed to act as a simple alarm system. As stated by the researchers, key features of the initial Bluetooth Mesh architecture, including a discussion of Bluetooth Mesh implementation, implementation details, hardware specifications, and test results on power consumption and network reliability. [19]

**FUTURE OF TELECOM** According to Chauhan, A., Joshi, M., Kumar, A., Abidi, S., Singh, S. (2020) The volatile, unpredictable, complex, and ambiguous (VUCA) world in which we live has changed as a result of black swan events. The course of world history was altered by the previous "black swan" incidents. A gunfight in Sarajevo in 1914 sparked the start of World War I. Other crises included the September 11, 2001 attack on the World Trade Center, the 2008 bankruptcy of Lehman Brothers, the 2010 Gulf of Mexico oil spill, and the 2011 Japanese Tsunami. It's unclear how quickly increasing automation and the new norm will interact in fractals, but one thing is certain: prepare ready for a virtual society that is largely controlled and entwined with technology. This research hope to raise awareness of the fact that the telecom industry is the fastest growing, with the potential to provide significant job opportunities and wealth. The paper also looks at the telecom industry's transition from wireline to wireless, from 1G to 5G the "future of telecom", and so forth. Future industries will be impacted by and aligned with the telecom sector, and vice versa. Our need for fast internet and communications is likely to grow dramatically as we move toward digitization. 5G and other advanced technologies will be necessary to meet this need and accelerate growth. Customers in both urban and rural locations can readily use the telecom services provided by the Telecom Service Providers (TSP) at reasonable pricing.

In industrialized nations, the telecommunications industry serves as the foundation for improving the standard of living. In the last ten years, this business has seen radical transformation, with customer demands and competitive environments shifting in ways that few could have predicted. After 1995 The use of mobile phones has increased throughout nations. Although it was a latecomer to the telecom industry, India is now the fourth most promising market in Asia, behind China, Japan, and South Korea. In actuality, India's economy has grown to become the second fastest growing in the world and the seventh largest overall.

As a result, new technologies will need to bring about more breakthroughs for the telecom industry in the future. Cloud computing, the Internet of Things (IoT), artificial intelligence (AI), 3-D printing, and other digital applications where devices will communicate with one another are some examples of the next generation of technologies. [20]

## Related Studies

## Local Studies

**CONTACTLESS DOORBELL** According to the study by Barañao, E.L., Alayon, D.F., Pelaez, S.G.V., & Larrauri, R.D. (2022) A doorbell is a tool for signaling. It is frequently placed close to a building's front door. An internal bell chimes when a visitor presses the button. Letting the residents know that there is a visitor. It does more than merely knock; it works louder and clearer. A door chimes formerly had a real bell that you had to pull with a rope to make it chime, however modern doorbells currently is mechanical and announces your arrival with a single button press. The researchers primary objective of the study is to develop a contactless doorbell using an ultrasonic detector. And according to Ursan (2020), the doorbell is a surface that is regularly touched. When using a contactless doorbell, We are able to lessen the risk of infection. Hand placement in close proximity to the sensor activates a contactless doorbell. The buzzer will go off to let you know that someone has called. Additionally, he said that each time someone comes to our Instead of ringing the bell at home, the individual can raise their hand around 10 cm away such that the When a human is detected by an ultrasonic sensor, the bell will immediately ring. [21]

**WEBCAM** According to Guillermo, M., et al. (2020) The risk to one's life when in public has been a worry for Filipinos forever. Even though there are backups Among laws and customs that are imparted, these are just merely temporary fixes for the issue. With the earliest identification and categorization of typical risks to public safety Using the CCTV feeds' videos will be of great assistance. to keep Filipinos safe. The application of pre-trained R-CNN in this study model conception v2 in addition to tools for other stages like We'll talk about training, testing, and annotation. The procedure This allowed the study to achieve the system's objective will be emphasized. Security cameras are all over the city and yet crimes are still everywhere. Worst is that some incidents are blatant but can’t be actioned right away, others are unreported, and some cases remained unresolved. [22]

**TECHNOLOGICAL BREAKTHROUGHS** As Dadios, Elmer P. et al. (2018) Stated, technological developments and the interaction of several fields, such as sophisticated robotics, data analytics, nanotechnology, neurotechnology, artificial intelligence (AI), Biotechnology, Internet of Things (IOT), blockchain, cloud computing, and 3D printing have all the Fourth Industrial Revolution (FIRe) into being. The several FIRe technologies that are Philippine businesses have already embraced it, albeit to differing degrees of dispersion. The degree to which these technologies will provide all of their prospective benefits relies on the nation's ability to get beyond its inability to appropriately adjust to the disruptions occurring globally anticipated to accompany the FIRe. [23]

**THE ECONOMICS OF SLOW INTERNET CONNECTIVITY IN THE PHILIPPINES** As the study conducted by Azcarraga, A.M.J., & Pena, P.J.M. (2019) In the Philippines, internet access is still an issue. Nevertheless, The nation is working more than ever to improve connectivity, current The rates of Internet and smartphone adoption are significantly lower than the desired figures, which is said to be brought on by institutional inflexibilities. The research seeks to examine Automation and technological advancement as a means of boosting production and to demonstrate how the presence of the Internet points to overall growth. The technical memo implies that increasing technology improves productivity, as seen in how the slopes behave. Additional research indicates that a rise in the degree of Internet would additionally boost each firm's productivity by demonstrating development, and hence advancements in Internet connectivity and a rise in the quantity of businesses implementing Both internet access and productivity are increased in businesses. The research suggests a few tactics like increasing demand for broadband, lowering taxes on telecommunications, rivalry in the telecom sector, as well as more infrastructure to discuss these issues. [24]

**INTERNET OF THINGS ADOPTION PHILIPPINES** According to Ramos, P.N., Enteria, M.L.B., & Norona, M.I. (2021) Internet of Things (IoT) was one of the industry 4.0 applications that significantly altered the through the independent integration of several systems and processes, both industrial and corporate. Consequently, using IoT aid strengthened the industrial sector and gave our nation a competitive edge over its neighbors. Finding the variables that are propelling and impeding the Philippine manufacturing sector as well as its readiness were the main goals of this study. SMEs' use of IoT adoption. The researchers polled Philippine manufacturing SMEs regarding their perception of the forces propelling and impeding the adoption of IoT, as well as their readiness to embrace it. The research made use of structural Kurt Lewin's Force Field Analysis, equation modeling, and preparedness model. The outcome demonstrated that Philippine IoT adoption by manufacturing SMEs is anticipated, but we're not sure if we should fully utilize IoT technologies like such as big data analytics, cloud systems, and sensors for optimal operating conditions. Finally, simplicity of management and early investment demonstrated the importance of implementing IoT. [25]

**RASPBERRY PI** According to Arriola, C. C., et al (2020) An internet-based computer network that can be controlled with a computer and a modem is known as a controllable automated switch. The goal of this project is to create a system that meets people's requirements and helps the elderly and disabled maintain a higher level of independence for as long as feasible. This system is used to monitor electrical switches, control lights both inside and outside, and other things. The study made use of an Android application on any smartphone serving as a user interface, a web server, a router, and a raspberry pi as the central device. With a Raspberry Pi serving as the server system and the internet, Android devices would operate the appliances. The appliances in the house will be managed by this relay circuit board. The researchers come to the conclusion that people's satisfaction, which benefits both society and the workforce, is what makes the systems work. With regard to lights that people might inadvertently leave on during the day, the benefit of this method is to make money while saving money. [26]

**SMART DOORBELL** According to Patilano, H.S.L., Algaba, V.R.E., Deslate, K.F., Dominguez, N.A., Francisco, K.M., Gamboa, J.L., Ison, G.J.C., & Leon, J.C. (2022). These days, one of the things we have to offer Our house has robust security, particularly if there are more danger to safety in the vicinity. In this work, we created a  smart doorbell that can alert your smartphone automatically when a person reaches the door. The issue here is that they cost too much, therefore Some locals cannot afford the merchandise. Results showed that Of those surveyed, 19% do not own a smart doorbell. The marketplace The price is higher; it starts at 9,194 PHP and goes up from there. The anticipated cost of what we created is just 2,500 PHP. The Esp32 camera is an affordable, high-performance camera for making doorbells with intelligence. Thus, we distribute the advantages of clever doorbells to homeowners and contribute to a safer society and improved through technological means. [27]

**LOW RESOLUTION IMAGE ENHANCEMENT ASSESSMENT** According to De Goma, J.C., Aquino, J.M., Arcelo, C., & Sauli, Z. (2018) In order to balance out the brightness, the authors want to apply additional lighting algorithms in addition to learning-based super-resolution and picture noise reduction techniques. Image noise is the random variation in color or pixel information found in images. That is typically a component of electrical noise. Together, these three distinct approaches will be utilized to develop an optimization strategy. They plan to employ a fuzzy filter to reduce noise, an illumination correction technique based on tone mapping to enhance image brightness, and a super-resolution algorithm to recover lost high-frequency data that is lost during the image generation process. Since this work will employ several methods, including the Super Resolution Algorithm, Tone Mapping based Illumination Correction, and Fuzzy Filter, part of the study will enhance currently available algorithms. These algorithms were coupled to see whether they could enhance the quality of the photographs. [28]

**UNLOCKING INTERNET OF THINGS FOR ENCHANCED KNOWLEDGE** According to Sangalang, R. M., et al. (2024). Increased information decentralization was the outcome of Web 3.0, particularly with the rise of the Internet of Things (IoT). Since IoT transformed data transfer, knowledge management in businesses has changed as well. This study focuses on how real-time data exchange is made possible by the Internet of Things and how this improves business operations and knowledge management in a variety of local enterprises. This study uses a qualitative embedded cross-case analysis to look at how five Philippine businesses use the Internet of Things. Information about how the Internet of Things affects knowledge management procedures was gathered through a variety of techniques, including focus groups, surveys, and interviews. The study used a case study methodology, and the results demonstrate how the Internet of Things (IoT) enhances knowledge generation, storage, sharing, and utilization. This helps businesses improve business processes by helping them increase operational efficiency and the quality of their products and services. Additionally, the study provides information about the potential of IoT. [29]

**INTERNET OF THINGS IN THE PHILIPPINES** According to Illahi, A. A. C., Culaba, A., & Dadios, E. P. (2019). The disruptive technology of the Internet of Things (IoT) technological innovations that would benefit both individuals and the industry of business. When a worker is assigned a task to measure and IoT provides safety in hazardous situations by providing oversight. due to the fact that individuals won't be placed in peril. IoT-based automation is essential for tracking and Manage the system without shifting from your chair. IoT and other new technologies have a significant positive impact on society and the people, but there are some reasons why they might not be sustainable for the country's development. The most pressing issue in 4IR is jobs for the people, as we don't know how the labor market will be set up. The World Economic Forum estimates that there will be a net loss of over 5 million jobs by 2020, and that two-thirds of all jobs will be automated in the next decades. IoT application provides ease to the people. IoT in the Philippines could transform society into a healthy environment. People don't have to go around to monitor things. Devices are connected on the internet. The user has an installed software application sees the real-time status of the system your handling. IoT will save time and effort and increase efficiency also [30]

## Foreign Studies

**SMART DOORBELL SYSTEM USING INTERNET OF THINGS** According to Madhu S., Swarnamugi. (2021) The study describes an Internet of Things (IoT) doorbell with security features and minimal human interaction. The smartphone will receive real-time notifications from the smart doorbell. It detects human presence using a camera sensor presence and gets the picture. The paper's goal is to use the internet of things to instantly notify a mobile device when someone presses the doorbell. Automation process uses face recognition technology. It consist of three phases - Data gathering, Face detection and Face recognition. Tools such as Python Open CV is used. Dataset images are created from the live camera. Dataset images are trained. Haarcascade classifier is used to detect the face and LBPH for recognition purpose. In this automation process, image is not sent to human. Instead image is sent to web cloud platform. When doorbell is pressed, camera module gets triggered and will capture the image. The captured image will be mapped with stored image. If it matches, it unlocks the door automatically.

Manual process (mobile IOT cloud platform) When a person presses the doorbell switch, a camera is triggered to capture a picture of the person. Notification is delivered to the owner's mobile device. After opening the Blynk IOT mobile app and clicking the "Unlock" button, the homeowner can unlock the door. Automation process: Machine learning techniques and dataset pictures are used to automate the same procedure. There is no human sentient in this photograph. Instead, the cloud platform receives the image. Pressing the doorbell activates the camera module, which then takes a picture. The photographed shall be mapped using the saved picture. It automatically unlocks the door if they match. Data collection, face detection, and face recognition are its three stages. Images from the live camera are used to produce datasets. Images from datasets are trained. The LBPH and face are detected using the Haarcascade classifier in order to facilitate recognition. [31]

**IOT SMART DOORBELL SURVEILLANCE** According to Caroline El. F., Srushti B., et al. (2018) The Internet of Things, or IoT, is a popular topic in the engineering, and technology group and has become headlines in media. This technology is present in a broad range of networked systems, devices, and sensors. It makes use of developments in processing power, electronics downsizing, and network linkages to provide previously unattainable new capabilities. A profusion of conferences, papers, and news items explore and argue the potential implications of the "IoT revolution" from new business models and market prospects to worries over privacy, security, and technology compatibility.

According to the study the goal is to leverage IOT to improve home security systems. Current doorbell systems operate in the conventional manner, ringing within the house when a visitor touches the switch bell. When a visitor arrives at a residence, they answer the door if someone is inside, otherwise they wait a set amount of time before disappearing. The last few years have seen a technological takeover of civilization. These days, technology is essential and simplifies everything. One such development in the doorbell industry is "The Automatic doorbell system" (ADBS) is employed. Door bells have transitioned from antique switches to contemporary touch pads, and because to the use of sensors and IOT, it is now more advanced.

The basic concepts and working of IOT has been displayed in the running of the project. Their study uses mainly an Arduino Board and OOPS programming concept. Since, today, in a technologically enhancing environment, security issues is of utmost concern, this project shows how technology can be used to enhance the security features of people's homes. A doorbell is constructed which has the feature to send a notification to the owner when somebody is at the door, with an attached picture of the person. It uses materials such as an Arduino Board, an Ethernet Shield (to send notifications across services), a doorbell, resistors and a web camera. This project enables users to stay connected to their homes and ensure safety, even when they're travelling. [32]

**IOT & AI BASED SMART DOORBELL SYSTEM** According to Prof. S. B. Sahu., Arati F. P., 3Kavita K. T. (2018) Recognizing the unique shape of the human face involves intricate computations. People can be identified by their faces, which are used to identify them. Face recognition systems are highly useful embedded systems that can be utilized in various uses, including access verification, security systems, and terrorist identification. In actuality, it's used in several both open and even designated spaces. Thanks to advanced computer science tools, we can get remarkably good and gratifying outcomes of facial recognition and revelation. The collected facial detail will be examined and contrasted with the previously comparable face-operated details already in the Thing Speak database. face recognition is initiated by pressing the doorbell button. Indeed, an integrated web camera will captured several pictures of the visitor. The face recently scanned will be verified in the present database. In case of unknown face, a message with captured image is generated and pop at the owner screen. Otherwise, in case of known face, actual face id is matched with face id’s which is already stored in database and door will automatically open’s for few seconds. Furthermore, the owner will be notified through his device connected with system. Comparing to old face recognition systems that are already commercialized, this project is more efficient in real time response with better recognition rate. This system can be utilized in numerous locations where the highest level of security is required and protection cannot be provided. [33]

**IOT BASED CONTACTLESS DOORBELL SYSTEM** According to Rohan C., Harsh A., Diksha B. (2023) Doorbells has become essential in every house nowadays. A doorbell is an object that is fixed or installed close to the entrance to indicate the arrival of a visitor. In the modern world, when technology has grown to such an extent, the classic doorbell system has been replaced by a sensor that detects the movement of visitors and then sounds an alert. This doorbell with contactless technology will provide us with a wealth of information regarding how IR and ultrasonic sensors. Using ultrasonic sound waves, an ultrasonic sensor allows us to measure an object's distance. Although smart home security is fundamental, there are still some flaws in the current implementations.

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 the 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. The 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 Video Call for visitor to owner, Intrusion Detection System , HD Camera for better picture quality, Two-Way Communication, Alarm for theft and 3 AAA batteries operated. 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. [34]

**AN IOT-BASED SMART DOORBELL SYSTEM FOR MITIGATING STEALTH ATTACKS** According to Martins O., Godswill I., Ayodeji O., et al. (2023) The Internet of Things (IoT) really malives by empowering us to monitor and control crucial processes (Nguyen et al., 2021). This is achieved using gadgets fit for detecting, handling and remotely transmitting information to remote storage like a cloud which stores, breaks down and displays this information in a valuable structure (Zielonka et al., 2020). Based on requirements and suitability, this data can be accessed via the cloud via a variety of front-end user interfaces, including web and mobile applications. A smart doorbell system is among these application areas. Smart doorbell systems address these problems by providing a more convenient, functional, and secure solution for homeowners. Specifically, they offer the ability to notify users in real-time and often include security features such as motion detection, facial recognition, and package detection. These features can provide homeowners with greater peace of mind and enhance the overall security of their homes (Thakkar & Ukani, 2022).

The researchers presents the design and development of a smart doorbell system that detects human presence and notifies the homeowner. The system utilizes an ultrasonic sensor, a microcontroller, a GSM module, and software to detect and notify the homeowner of any human presence at the door. The system was tested for accuracy, distance, and energy consumption, and the results showed that it can detect human presence within the range of 1-80cm and consumes only a small percentage of energy from a 5v 16800mAh energy bank. The smart doorbell system presented in this paper addresses the problem of burglars using stealth and visitors spending time searching for doorbells around the house. With the increasing need for security and convenience, this system provides a reliable solution for homeowners and businesses. Osifeko, Iroegbu. al. (2023) [35]

**SMART SECURITY SURVEILLANCE USING IOT** According to Akter, S., Sima, R. A., Ullah, M. S., & Hossain, S. A. (2018) The Internet of Things (IoT) is a growing trend in modern technology that allows physical devices to be controlled over the Internet using a computer or software, allowing remote access anytime, anywhere. As the Internet of Things continues to evolve, it integrates a variety of technologies, from the Internet to wireless communications to embedded systems. Experts predict that there will be more than 30 billion IoT devices by 2020 and the global market value will be $7.1 billion.

The Internet of Things facilitates seamless communication between objects on the Internet, increasing efficiency and accuracy and reducing human intervention. A key component of IoT is the pyroelectric passive infrared sensor (PIR), which detects air pollutants from objects based on temperature gradients. Split into two parts to detect radiation and changes in its field, this sensor emits a signal when the object moves in its field.

The use of IoT, PIR sensors, and camera models in smart security monitoring increases overall security by providing a better way to detect and respond to moving objects. In this research, we propose a technique that uses Raspberry Pi, PIR sensor and camera module for smart security monitoring.

In the words of the researchers, a security control system was developed using a combination of Raspberry Pi and PIR sensor and camera module. And study was conducted to investigate the performance of a PIR sensor combined with a camera module, focusing on the direction of motion and then activating the camera module to detect intrusions in real time. The control system has been tested to detect intruders. It is suggested that the proposed system, which uses the PIR sensor and camera module, can be further developed using change threshold based face detection and recognition algorithm and computer vision technology. [36]

**WAVE OF TECHNOLOGY** In the study conducted by Febiandini, V., Sony, M. S. (2023) In the 1960s with minicomputers, personal computers (PCs), and networks. The following era, characterized by the internet of things (IoT), the internet of commerce, the internet of people (social media), and the internet of documents, began with the emergence of the internet in the 1990s. There are three essential all of these breakthroughs are driven by three key technological advancements: cost-effective computation, storage, and communication. The Internet of Things (IoT) wave will connect every physical device to the internet that can be equipped with sensors and uses electricity and connectivity. Thermostats, garage doors, doorbells, and chairs are all networked. Two examples of IoT are internet-connected refrigerators that can be watched by consumers and networked toothbrushes that can track dental hygiene habits. It feels like these objects are speaking to us. [37]

**PRIVACY AND SECURITY OF IOT** According to Ivancevic, D., (2020) In a world where technology is always advancing, it is critical to comprehend user perspectives and experiences. Utilizing technology comes with a number of risks. Among these are concerns about security and privacy. Understanding how people see security and privacy in smart home IoT devices is the focus of this thesis. The development notions of trust, potential intrusion methods, and protection are covered in the literature review, along with further details regarding Internet of Things technologies and smart homes. Notes on prior user perception findings are also included in the review. The studies review also establishes a connection between potential breaches and the IoT infrastructure. architecture, GDPR, compliance, and privacy by design are all explained. In order to comprehend security and privacy issues in the context of smart homes, a basic It was a qualitative investigation. Sixteen members of the general public participated in the study. Conducted an interview. A broad inductive approach was used to assess the data that had been gathered, and Thematic analysis led to the categorization of the responses. Conversations were conducted online, and the final Appendix has a transcript summary.

The results of the interviews indicate that the most important things to the consumers. Participants showed that they would be willing to buy a device if they thought it was something that will improve their standard of living and were prepared to divulge information like location, but they refused to give up their anonymity. What kind of information and why was highlighted as being of utmost importance. Regarding security breaches, participants showed less more concerned about what might happen to them than about how it might occur. [38]

**IMPLEMENTATION OF AN INTELLIGENT DOOR BELL SYSTEM** According to Prof Kamala, R., Asist Prof Kumar, P., Anish., A. (2019) In order to partially eliminate these intruder-related actions, a number of tactics and systems were created and released onto the market. The majority of suggested smart home systems aim to address security issues, albeit at the expense of using a lot of sensors gadgets. Threats to these security measures also include growing as technology advances. The Internet of Things (IOT) are linked together via a shared network path to converse, share information, or exert mutual control. The "things" that are connected to a network path could be any sensor, hardware, or embedded software. They concluded that a brief overview of remote monitoring the residence and defend it against trespassers' threats. It will function. when the doorbell rings, which will serve as a trigger to the camera, which will then take a picture of the individual in front of the door. The representation of the registered user who is not present will see the visitor. using email and SMS alerts to check mail from home is transmitted to a phone. After then, the person is identified. and he can respond to the person standing by email and ahead of the door. [39]

**A STUDY ON IOT SMART DOORBELLS** According to the study of Gomathy, C.K., Satya, D. (2021) In their study, It functions both during the day and at night. Even at night, the Both the picture and video quality are excellent. When an individual groan in the environment. The relevant proprietor shall be informed that someone is present. Should someone press the bell, it instantly places a video call to the relevant owner. He can even respond to the visitor via a video call. can communicate with him via Speaker. Thus, the initiative known as "smart IOT doorbells using IOT domain design and implementation were completed successfully. This project's primary goal is security. The IOT enabled doorbells to provide security, such as If someone without opening the door, ring the bell so we can see them and then we can open to lessen child naps and murders as well as pilfering. Also they stated that we can discuss the individuals by means of this doorbell, so that in this COVID it was quite helpful because it allows us to regulate the corona by social distancing in this way. If someone is dubious about it provided us with a notice so that we may be vigilant and also we can implement any appropriate security measures. And also we do not have any worry about the device loss even we keep it out. Because, if anyone try to steal it, it alerts us by loud alert alarm. So device is safe. Even they are travelling they can spy on home. It is very useful to monitor the home/office remotely. [40]

## Synthesis

What we have identified in this chapter 02 is the **SMS BASED HOME APPLIANCE CONTROL SYSTEM** by Ledonio, A.L., Tacuban, T.N., & Porras, A.P. (2021) and the study of This system **utilizes Short Messaging Service (SMS)** to enable **users to monitor** and **manage electrical equipment remotely**. It integrates an SMS module, Arduino microcontroller, voltage sensor, and Fcurrent transformer for appliance monitoring and control, adhering to IoT principles. "Internet of Things that focuses on **home automation** and **remote appliance monitoring** may find value in this article. The paper describes a system that makes use of a **Short Messaging Service (SMS)** to enable users to monitor and manage electrical equipment remotely. By allowing for remote device access and control, the project's integration of an **SMS module**, Arduino microcontroller, voltage sensor, and current transformer (CT) sensor for appliance monitoring and control adheres to the principles of the Internet of Things. An IoT capstone project that aims to develop smart home automation solutions **can benefit greatly from the study's findings** on accuracy in electricity consumption monitoring and functionality testing for on/off appliance switching. We are thankful for these past researchers and their studies it's like they give us information that we as future researchers need at this point of our academic years for us to fully develop our project. Next is **INSIGHTS INTO LEVERAGING IOT TECHNOLOGIES** of Yasay, J.J.R. (2021) The Internet of Things (IoT) is a global knowledge society system that uses new and present interoperable information and communication technologies to connect (virtual and physical) objects to enable improved services. Things have changed as a result of the confluence of several technologies, including **machine learning**, **real-time analytics**, **commodity sensors**, and **embedded systems**. Conventional domains such as control systems, wireless sensor networks, embedded systems, and **automation** (including residential and building automation), among other areas, all aid in the **deployment of the Internet of Things**. In the market for consumers, The things that are most closely linked to the idea of the "**smart home**," like gadgets and appliances (such thermostats, light fixtures, and home security systems). The goal of the Internet of Things (IoT) is to link "**dumb**" objects to the internet and one another to make them "**smart**" online. It makes it possible to sense and manipulate physical items remotely, facilitating more direct integration of the real world and systems that rely on computers. Next is **CLOUD COMPUTING** by Alimboyong, C. R., & Bucjan, M. E. (2021). Higher education institutions (HEIs) are thought to have adopted cloud computing (CC) widely by now. Both enormous advantages and possible problems accompany its rise. This study looks into a few problems and obstacles that state universities and colleges (SUCs) in the Philippines face when implementing cloud computing. Due to the study's utilization of several case studies, a qualitative design was adopted. The research identifies two significant problems, including a **poor internet connection** and a **lack of knowledge** or **awareness of cloud computing**, based on the findings. The results showed that, despite the worldwide epidemic, cloud computing at SUCs is useful to the educational system. While students may readily access the materials online, professors can submit lessons and teaching materials with ease. The country's internet availability presents a barrier, though. Even if they don't interact in person, administrators can readily work with the entire academic community and even its stakeholders. It is the ideal way to be effective and productive since it makes all procedures accessible to everyone involved in the academic community, including staff, instructors, students, and other stakeholders. our insights Higher education institutions in the **Philippines face challenges like poor internet connectivity and lack of awareness when implementing cloud computing**. Despite these obstacles, cloud computing proves beneficial in the educational system. Next is **SECURITY SECTOR** by Arugay, A. A. (2021) In the Manchester University Press eBooks, One of the world's densest and healthiest civil societies is said to exist in the Philippines. It emerged from the fight against dictatorship and gained a reputation as a tenacious champion of democracy and human rights. Even though the country was being protected, this was also done to protect the current regimes from oppositional elites and civil society allies. The Philippines' example shows that, even while governments can defend expanded authority and regimes of exception for **homeland security**, these measures are frequently used primarily to preserve domestic political power and regain legitimacy. To address the nation's **complex security concerns**, it ends by providing an overview of how the Duterte administration uses and improves the anti-terrorism and **security policy frameworks** already in place. our understanding, the Philippines' civil society emerged as a champion of democracy and human rights, utilizing security measures to maintain political power and legitimacy. Next is the **SIGNIFICANCE OF THE INTERNET OF THINGS** by Garcia, M. R. T., & Culaba, A. B. (2021) In the specific year (2021) where we experiencing an ongoing (pandemic) it's more than is a critical time to talk about the gaps in **IoT**. Professionals and tech experts are required to identify these problems using a **suitable methodology to further improve the system**. They also have to make decisions on setbacks, market pricing, and convenience assurance. Congress also needs to draft legislation protecting the **privacy and data rights of Internet of Things users**. It is just one of the numerous signs that every natural thing interrelates with each other. A novel coronavirus outbreak began in China in December 2019. It continues to alter society causing economic plight across the globe, including highly developed nations and medical researchers remaining wide awake to seek an effective vaccine. Regardless of race or even status, nobody is spared from the threat of this virus. The **Internet of Things**, or IoT, is **one of the technologies** that could be used to support **physical distance limitation** among individuals. Terminating this virus in light of the somber count of deaths and transfer cases requires the demand to utilize sufficient vital equipment and **systematic**, and prepared facilities. Professionals and tech experts are required to **identify these problems** using a **suitable methodology** to further improve the system. They also have to make decisions on setbacks, market pricing, and convenience assurance. Congress also needs to draft legislation protecting the privacy and **data rights of Internet of Things users**. It is just one of the numerous signs that every natural thing interrelates with each other. Next is **FUTURE OF TELECOM** by the researchers Chauhan, A., Joshi, M., Kumar, A., Abidi, S., Singh, S. (2020) The volatile, unpredictable, complex, and ambiguous (VUCA) world in which we live has changed because of black swan events. The course of world history was altered by the previous "**black swan**" incidents. A gunfight in Sarajevo in 1914 sparked the start of World War I. Other crises included the September 11, 2001 attack on the World Trade Center, the 2008 bankruptcy of Lehman Brothers, the 2010 Gulf of Mexico oil spill, and the 2011 Japanese Tsunami. It's unclear how quickly increasing **automation** and the **new norm** will interact in fractals, but one thing is certain: prepare ready for a virtual society that is largely controlled and entwined with technology. This research hope to raise awareness of the fact that the **telecom industry** is the fastest growing, with the potential to provide significant job opportunities and wealth. The paper also looks at the telecom industry's transition from **wireline to wireless**, from **1G to 5G** the "**future of telecom**", and so forth. Future industries will be impacted by and aligned with the **telecom sector**, and vice versa. Our need for fast internet and communications is likely to grow dramatically as we move toward digitization. **5G** and other advanced technologies will be necessary to meet this need and accelerate growth. Customers in both urban and rural locations can readily use the telecom services **provided by the Telecom Service Providers (TSP**) at reasonable pricing. In industrialized nations, the telecommunications industry serves as the foundation for improving the standard of living. In the last ten years, this business has seen radical transformation, with customer demands and competitive environments shifting in ways that few could have predicted. After 1995 The use of **mobile phones** has increased throughout nations. Although it was a latecomer to the telecom industry, India is now the fourth most promising market in Asia, behind China, Japan, and South Korea. In actuality, India's economy has grown to become the second fastest-growing in the world and the seventh largest overall. As a result, new technologies will need to bring about more **breakthroughs for the telecom industry in the future**. **Cloud computing**, **the Internet of Things (IoT)**, **artificial intelligence (AI)**, **3-D printing**, and other digital applications where devices will communicate with one another are some examples of the **next generation** of technologies.

# Chapter 3

**Design and Methodology**

This chapter presents the research methodology for the " Ring Me Up: IoT Doorbell Receives an Alert and Webcam System" project, outlining the strategies, approaches, and techniques used to answer research questions and achieve project objectives.

## Methodology

This study uses a mixed-method research design, integrating qualitative and quantitative approaches. A case study of current smart doorbell solutions to identify their limitations and user pain points.

This is achieved through a comprehensive literature review and semi-structured interviews with homeowners. A survey to gather user requirements and preferences for the proposed "Ring Me Up" IoT Doorbell System. The researchers will employ a cluster sampling technique, targeting homeowners within the Pasig Metro Manila area. The “Ring Me Up” Doorbell is capable of capturing the video in real-time and viewing it live at the same time and is also viewable via the monitor or mobile application. User-centered design and HCI principles will be applied to ensure that the "Ring Me Up" IoT doorbell system is intuitive, user-friendly, and accessible to individuals with varying needs, including homeowners and individuals with hearing impairments. The project will prioritize usability, accessibility, and seamless user experience.

## Requirement Analysis

Our requirement analysis for the "Ring Me Up" IoT Smart Doorbell System highlights the need for a comprehensive and user-friendly solution to enhance home security, convenience, and communication. The primary goal is to develop a system that seamlessly integrates modern technology with traditional doorbell functionality, providing real-time notifications and visitor identification features.

To achieve this, we propose simplifying the current doorbell system by optimizing design, reducing complexity, and ensuring intuitive user interaction. The system should efficiently capture images or video clips of visitors upon doorbell press, allowing homeowners to access and view notifications from any location remotely.

Real-time updates and timely communication between homeowners and visitors are essential aspects that the system must support. The analysis aims to address common issues such as poor camera quality and lack of clarity in visitor identification, ensuring that the "Ring Me Up" IoT Smart Doorbell System offers a reliable and effective solution for modern home security needs.

### Sampling Technique

The respondents chosen in the study are homeowners with internet connections around Pasig Metro Manila. Specifically, Barangay San Miguel. The researchers intend to gather information from 50 homeowners.

Barangay San Miguel is located in the Second District of Pasig. Based on the 2020 Census of Population conducted by the National Statistics Office of the Philippines, and the National Statistical Coordination Board, San Miguel has a total of 40,199 population. The researchers used Cluster Sampling; As stated by McCombes (2022), Systematic sampling is similar to simple random sampling, but it is usually slightly easier to conduct. Every member of the population is listed with a number, but instead of randomly generating numbers, individuals are chosen at regular intervals.

The respondents that were currently answering the questionnaire referred other Homeowners from their neighborhood to the researchers.

**Statistical Treatment**

The following statistical tools are used in the treatment and analysis of data.

1. **Frequency**: It was then the actual response to a specific item or question in the questionnaire where the respondent ticks off the choice.

2. **Percentage**: This will be used to establish the profile of the respondents of the study. It will be used to answer sub-problem no. 1

**Percentage Formula**:

Where:

P = **percentage of the collected data**

f = **the number of frequency of the respondent's answer**

n = **the number of respondents**

### Current Technical Situation

Analysis of current (technical situation) doorbell solutions and their limitations indicates the need for a more comprehensive and user-friendly home security and communication approach. Existing doorbell systems often fail to provide reliable clear visitor identification, poor quality voice communication, and convenient remote monitoring capabilities, which are crucial for today’s homeowners because nowadays people are on their cellphones and even kids are using them. As such researchers found several technical challenges they encountered while developing a smart video doorbell, According to **Netatmo.com** (A brand of Legrand) the **first smart video doorbell was compatible with both low-voltage (8-24 V) and high-voltage (230 V) installations**. We are thinking of these possibilities, outcomes, and the challenges we might face when we develop and design our system. It gives us (the proponents) a clear understanding and makes us aware of our project. The **person detection feature would work regardless of the user’s installation and the electrical power available**. With this, we can prepare and have the means to make solutions of the detection algorithms that we will develop by our teams work locally on the ”Ring Me Up” IoT Doorbell, which means we will also respect our user privacy and limitation for only in as said in the scope and delimitation of the project. The **product is fully protected in all weather conditions**. As we develop this, we want the product to work in all conditions too (hopefully).

## 

## Requirement Documentation

## Project In – Scope

**A. Project Objective** The project will develop an IoT doorbell system using Raspberry Pi integrated and to provide real-time alerts and webcam functionality for enhanced home security, communication, and convenience.

**B. Project Deliverables** The deliverables are to be the functional IoT-Doorbell System along with a detailed user manual and a final report explaining how the project was completed and the end results.

**C. System Features** The project will require certain features such as monitoring and Gmail notification that will be responsible for alerting the homeowner or the user of our application.

**D. User Requirements** The system will have a user-friendly interface, secured, and give the best experience to users for communication, efficiency, and adaptability.

**E. Hardware/Software Requirements** Hardware requirements include Raspberry Pi for Microcontroller, webcam for image/video capturing, and mobile devices for remote monitoring, while software includes the use of Gmail for data management and application development.

**F. Testing** Test shall be conducted to ensure the functionality, security, and user acceptance of the system; and test include functionality testing, security testing, and user acceptance testing.

**G. Constraints and Assumptions** Constraints include budget and time constraints; assumptions may include the physical installation and integration of the user in IoT technologies.

**H. Project Timeline** Milestones and timeline within the project timeline is also include the design phase, development phase, testing phase, and implementation.

## Project Out – Scope

**A. Risks** Potential compatibility issues between the Raspberry Pi, Doorbell Sensor, and Webcam.Challenges in ensuring reliability and security.User adoption and acceptance of the IoT-based doorbell system.

**B.** **Assumptions** Homeowners have a stable internet connection to support the IoT system.The proponents have the necessary skills and expertise to develop the IoT Smart Doorbell System.

## Design of Software, Systems, Product, and/or Processes



Following the design and development of our “Ring Me Up” IoT Doorbell System will be favorable to **Agile methodology** specifically, the proponents selected the **Scrum** framework. As we gather ideas while visiting the PTC library we find it significant for our project using the **Scrum methodology**, with this approach allows our team to respond to changing requirements, collaborate closely with the stakeholders, and deliver incremental value throughout the project lifecycle. The next topic will explain the key phases of the agile methodology. **Requirement gathering and analysis** are to identify and document our system's functional and non-functional requirements. Engage with homeowners and stakeholders to understand their needs and preferences. And will prioritize the requirements based on importance and feasibility. Next is **Sprint Planning** which divides the project into smaller, manageable sprints for us to enable iterative development and assign tasks and responsibilities to the project team members. **Design and Development** With implementation of the system features and functionality in an incremental manner. Collaborate with the project team to design the system architecture, software components, and user interface. **Sprint review and Retrospective** reflect on the success and challenges of the previous sprint identify the areas for improvement and incorporate them into the next sprint. And completed sprint deliverables to stakeholders and gather feedback. Lastly, **Deployment and Maintenance** which the team continuously iterates and enhances the system based on user needs. Monitor the system’s performance and address any issues or feedback. And provide user documentation and training to ensure smooth adoption. The final system and deployed to the target environment.

A diagram of a software system

Description automatically generated



Figure 3.1 System Architecture Diagram

In Figure 3.1 System Architecture Diagram our “Ring Me Up” IoT-Doorbell System uses buzzer to monitor conditions the buzzer is the trigger to set all the functions take an action and checking the camera for the homeowner to view the visitor like in real-time and the development camera we give some time to decide with the development. When it clicks or triggers it will alert the homeowner using Gmail in mobile application that connects in our project used by Wi-Fi.

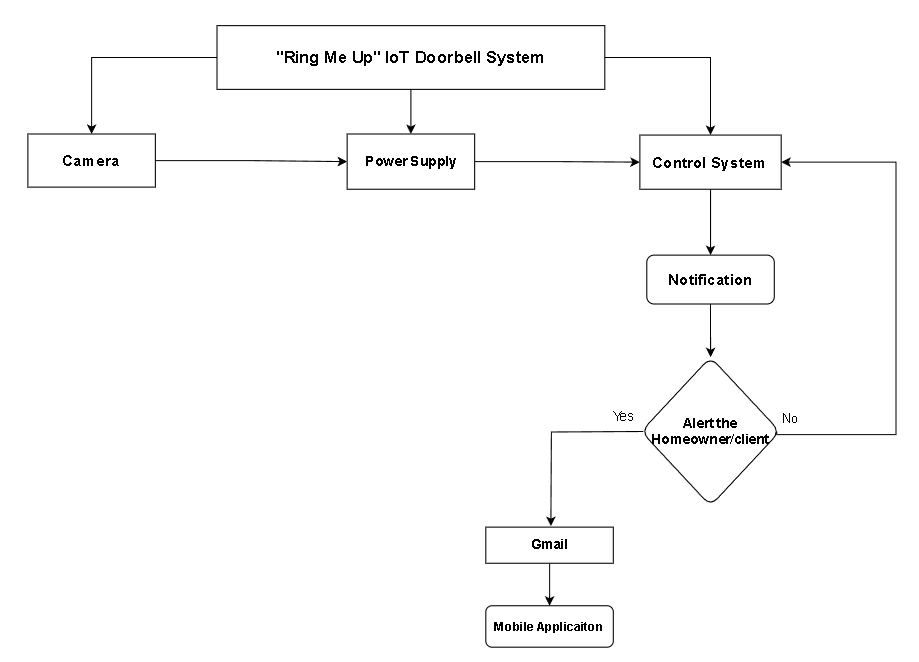


Figure 3.2 Block Diagram

**System Overview**

The project introduces the "Ring Me Up" IoT doorbell system powered by Raspberry Pi. When a visitor presses the doorbell, an alert is immediately sent through service via Email or SMS, ensuring that the homeowner is notified regardless of their location. This innovative solution not only benefits forgetful homeowners but also provides a crucial alert mechanism for individuals with hearing impairments. The "Ring Me Up" IoT doorbell system offers a comprehensive and practical solution for modern home security and convenience, leveraging IoT technology to create a seamless and efficient visitor notification system.

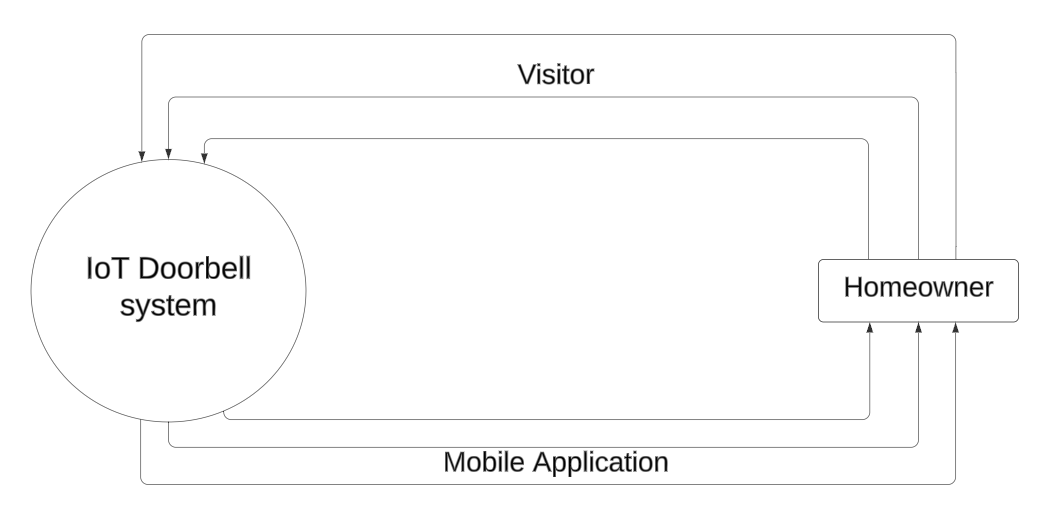
****

Figure 3.3 Context Diagram

Figure 3.3 Context Diagram illustrates how homeowner, visitor, the IoT Doorbell System, and the Mobile Application together to facilitate remote monitoring and control of the IoT-Doorbell System. The mobile application serves as the user interface, while the homeowner, visitor, and the IoT-Doorbell System handle, manage, and communication.

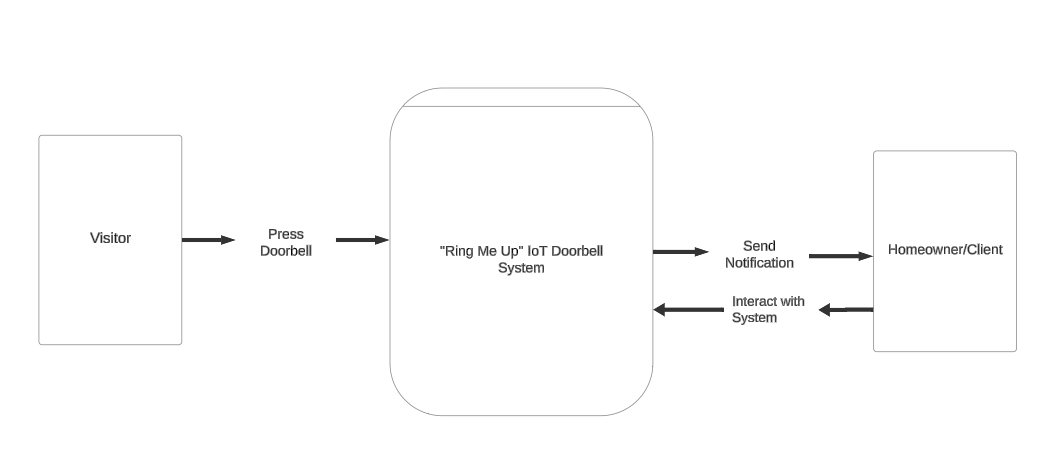


Figure 3.4 Data Flow Diagram (DFD) Level 0

Figure 3.4 DFD level 0 illustrates a high-level view of the Homeowner and Visitor interaction with the “Ring Me Up” IoT-Doorbell System.

A diagram of a software process

Description automatically generated

Figure 3.5 Data Flow Diagram (DFD) Level 1

**A diagram of a webcam system

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Figure 3.6 Use Case Diagram

A diagram of a system

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Figure 3.7 System Flowchart

**A diagram of a system

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Figure 3.8 Client-side Data Flow Diagram (DFD)

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Figure 3.9 Normalization Table

**System design**

The “Ring Me Up” IoT Doorbell system design will provide a comprehensive and user-friendly home security and communications solution. The system design will consider the following key aspects:

**Requirement analysis**

Gathering and analyzing the functional and non-functional requirements of homeowners and stakeholders. Identify the critical features and capabilities required for the IoT Doorbell System.

**Architecture design**

Developing a modular and scalable architecture that integrates the Raspberry Pi, Doorbell Sensor, and Webcam. Ensure the system's flexibility to accommodate future enhancements.

**Integration design**

Defining the interfaces and communication protocols between the hardware components (Raspberry Pi, Doorbell Sensor, Webcam). Ensure seamless data exchange and synchronization across the system.

**Security design**

Implementing robust security measures to protect user data and prevent unauthorized access. Incorporate features like user authentication, data encryption, and secure communication channels.

**Scalability design**

Designing the system to handle increasing user base and data volumes without compromising performance.Ensure the system can scale horizontally and vertically to accommodate future growth.

**Project design**

Develop a comprehensive project plan with defined milestones, timelines, and resource allocation. Implement effective project management practices to ensure timely delivery and stakeholder alignment.

**Process design**

Establishing well-defined system development, testing, deployment, and maintenance processes. Incorporate continuous improvement practices to optimize the development and delivery of workflows.

## Development and Testing

In the development of our project the “Ring Me Up” IoT Doorbell, we follow a structured approach to satisfy a reliable, user-friendly, and security for our system. We focus on analyzing user requirements and the surroundings and interface. The testing methodology focuses on compliance with ISO 25010, covering functional, performance, security, and usability aspects. It will be developed using an agile software development methodology, specifically the Scrum framework. The team will execute sprints (testing) making sure new updates can’t be a hindrance to current functionalities.

The researchers gathered data through surveys which served as their basis for the requirements of the IoT they developed. The researchers also observed which parts of the IoT can be improved.

After the required data has been gathered the researchers analyzed the information to create the IoT project. The data have been analyzed; the researchers then proceeded to the development of a prototype.

Once the prototypes have been developed, the researchers will evaluate the respondents if there are any changes or recommendations, they had for the improvement of the IoT project.

### Data Analysis Plan

<https://docs.google.com/forms/d/e/1FAIpQLSfJ7EKb0q4_H-NjdikpgCvEQlDZcIaaT5QBF9ErmQHBxiI8qQ/viewform?usp=sf_link>

A screen shot of a phone

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Figure 3.10 Questionnaire

***A screenshot of a computer

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Figure 3.11 Questionnaire

A screenshot of a phone

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Figure 3.12 Questionnaire

A screenshot of a survey

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Figure 3.13 Questionnaire

A screenshot of a phone

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Figure 3.14 Questionnaire

A screenshot of a survey

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Figure 3.15 Questionnaire

## Implementation Plan

**Table 3-1. Implementation Plan**

|  |  |  |  |
| --- | --- | --- | --- |
| STRATEGY | ACTIVITIES | PERSON INVOLVED | DURATION |
| Title Proposal | Letters for the Administrator | Proponents | 1 day |
| System’s installations | Installation of the system and required hardware and software | Proponents | 2 day |
| Gathering of Data | Sampling Technique and Population | Proponents | 9 Days |
|  | Requirements Analysis | Proponents | 27 Days |
|  | Current Technical Assessment | Proponents | 27 Days |
|  | Documentation | Proponents | 27 Days |
| Application | Finding Right Hardware for the Project | Proponents | 3 Days |
|  | Installing Raspberry Pi Os | Proponents | 3 Days |
|  | Design of Software, Systems, Product, and/or Processes | Proponents | 18 Days |
|  | Development and Testing | Proponents | 9 Days |
|  | Data Analysis | Proponents | 13 Days |
|  | Implementation Plan | Proponents | 30 Days |

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