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Smart Auto-Ringing Doorbell System

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Abstract: - ***n recent years, the wireless control of appliances has become increasingly common due to its numerous benefits, such as enhanced convenience, the elimination of wiring, and simplified operation. This project focuses on an electric wireless doorbell with a control range of up to 100 meters. Being based on wireless technology, the system is divided into two primary sections: the Receiver (which contains the RF receiver module and the HT12D decoder) and the Transmitter (which includes the RF transmitter module and the HT12E encoder). When the pushbutton on the transmitter side is pressed, the receiver section produces a melodious and consistent-pitch sound through its buzzer, maintaining effective communication within a 100-meter distance.***

Keywords—*Electronic Design, transmitter, receiver, doorbell.*

INTRODUCTION

A doorbell is a signaling device typically installed near a building's entrance. When a visitor presses the button, the bell or buzzer emits a melodious sound inside the building, notifying the occupants of their presence. Doorbells enable homeowners to receive alerts when someone is at their door. Traditionally, wired doorbells were common, but today they are becoming outdated and are increasingly being replaced by wireless doorbells, which offer easier installation with minimal setup requirements. In most wired systems, a button placed next to the door lock connects to a transformer through wiring [1].

As countries continue to develop and urbanization increases, particularly in high-end residential areas, Nigeria too is experiencing rapid growth in its real estate sector — including residential homes, office buildings, and hotels. Consequently, the demand for wireless electric doorbells has risen significantly. This project seeks to design and implement a wireless electric doorbell that is durable, simple to construct, and well-suited to the Nigerian market. Recognizing challenges such as frequent power outages, the project incorporates a 9V battery and an AC-DC adapter to ensure functionality even in the absence of a stable power supply. Additionally, the system provides a wireless range of 100 meters, allowing the transmitter to be installed at a compound gate or entrance while the receiver remains indoors [2].

SYSTEM OVERVIEW

The wireless electric doorbell consists of two main parts: the transmitter and the receiver.

- **Transmitter Section**: Built around a 5V voltage regulator (7805), an HT12E encoder, a 435 MHz RF transmitter, and an antenna, along with other minor components, the transmitter sends signals to the receiver.
- **Receiver Section**: Powered by a 9V battery with an optional AC-DC adapter, the receiver features a 5V voltage regulator (7805), an HT12D decoder, and a 435 MHz RF receiver with an antenna. It captures the transmitted signals and triggers the buzzer.

The receiver is designed to be portable, enabling users to reposition it easily as needed.

PROJECT AIM AND OBJECTIVES

The primary aim of this project is to design and implement a wireless electric doorbell tailored to the Nigerian market conditions.
The objectives include:

- Designing a functional wireless electric doorbell circuit.
- Creating a robust and cost-effective wireless electric doorbell.
- Ensuring a 100-meter wireless operating range with dual power options (9V battery and AC-DC adapter).

Wireless electric doorbells have become essential as guests need a reliable way to announce their arrival, especially given the global rise in real estate development and increased focus on security. A dependable long-range wireless doorbell meets this need effectively.

This project focuses on delivering a robust, user-friendly solution that addresses the challenges and limitations observed in existing products within the Nigerian market.

LITERATURE REVIEW

A detailed literature review was conducted on wireless doorbell designs:

- **Suprita D. et al. [3]** proposed an IoT-based smart doorbell system using Raspberry Pi, incorporating advanced encryption (MAC scheme) for enhanced security at low cost.
- **Mukul P. et al. [4]** developed a "Touchless Doorbell" using an IR sensor, which detects nearby objects and activates a buzzer and LED. This system finds applications in fire engines, railways, schools, and industries.
- **Arshey D. et al. [5]** worked on a "Smart Doorbell" using IoT for image processing, recognizing visitors from a pre-existing database — a solution ideal for smart cities.
- **Tanpure P. et al. [6]** designed a wireless doorbell with distinct transmitter and receiver sections, incorporating an RF amplifier and bell trigger mechanism.
- **Manaswi S. et al. [7]** explored "Door Surveillance with Smart Bell," combining image capture and text notifications to enhance door security.
- **Udit C. [8]** discussed a Bluetooth-based doorbell system where visitor identification occurs via smart device communication.
- **Caroline F. et al. [9]** introduced an IoT-based real-time doorbell surveillance system, sending visitor photos and SMS alerts to homeowners.
- **Devendra L. et al. [10]** developed the "Dash Bell," a low-cost smart doorbell using Amazon's Dash Button to trigger notifications through smartphones.
- **Gerald Kelechi I. et al. [11]** designed an automatic triggered bell ringer using an LED and LDR setup to detect movement and sound an alarm.

Gaps in Existing Literature

Many reviewed works focus on futuristic, high-end technologies like IoT integration and smart city compatibility, which may not yet be viable or affordable for developing countries like Nigeria. As such, this project instead concentrates on developing a simple, reliable, and robust wireless electric doorbell that aligns with Nigeria's current technological and economic landscape.

LITERATURE GAPS

The reviewed studies offer no elementary theoretical background upon which this system is built. Although some works have presented circuit designs, most are complex and difficult to replicate. Additionally, the issue of reliable electrical energy supply, particularly important in developing nations like Nigeria, was not adequately considered in the design and implementation phases of these projects.

Improvements Made in This Study

This project addresses the challenge of inconsistent power supply in Nigeria by designing a wireless electric doorbell powered by both a 9V battery and an AC–DC adapter. A detailed list of design components is provided to ensure ease of replication globally. This work was carried out to meet the growing demand for robust and reliable wireless doorbell circuits among students, scholars, and industries, especially in the emerging smart housing systems.

Design and Implementation

The wireless electric doorbell project was first simulated using Proteus version 8.8 before being physically designed and implemented.

Design Components

The key electronic components used include:

- HT12E Remote Wireless Encoder
- HT12D Remote Wireless Decoder
- RF Module 433 MHz Transmitter
- RF Module 433 MHz Receiver
- Resistors (10k, 33k, 1k ohms, etc.)
- Buzzer
- Push Button Switch
- ON/OFF Switches
- 9V Batteries
- AC–DC Power Adapter
- 7805 Voltage Regulators
- BC-457 Transistor
- Connecting Wires

System Description

Transmitter Section

The transmitter circuit is built around a 9V battery, a 5V voltage regulator (7805), an HT12E encoder, a 9-way DIP switch, a push button, and a 433 MHz RF module transmitter.

- The 9V battery is regulated to 5V by the 7805 voltage regulator.
- This 5V powers both the HT12E Encoder and the 433 MHz RF module transmitter.
- The HT12E encoder converts 12-bit (8-bit address and 4-bit data) parallel data to serial data, which is transmitted through the RF module.
- A push button is connected between the TE (Transmission Enable) pin of the HT12E and the ground. When pressed, it triggers the wireless transmission.

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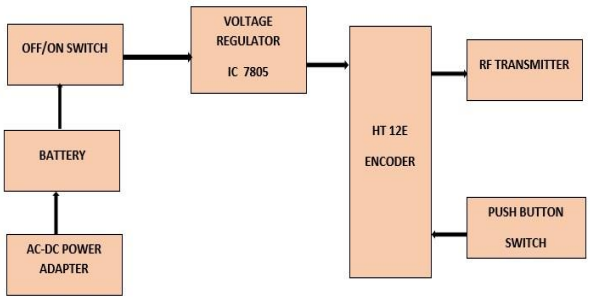
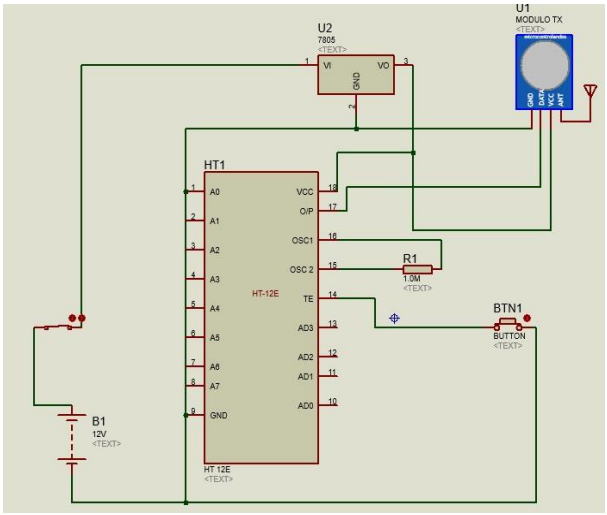


(Figure 1: Block Diagram of the Transmitter Section)

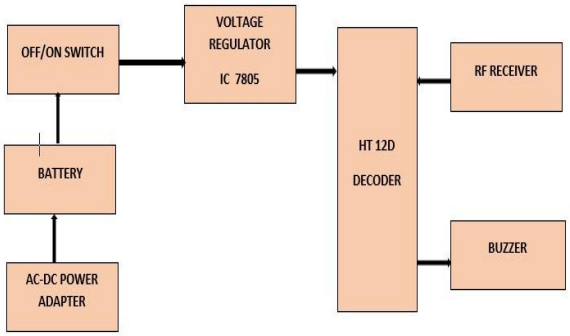


(Figure 2: Circuit Diagram of the Transmitter Section – simulated in Proteus 8.8)

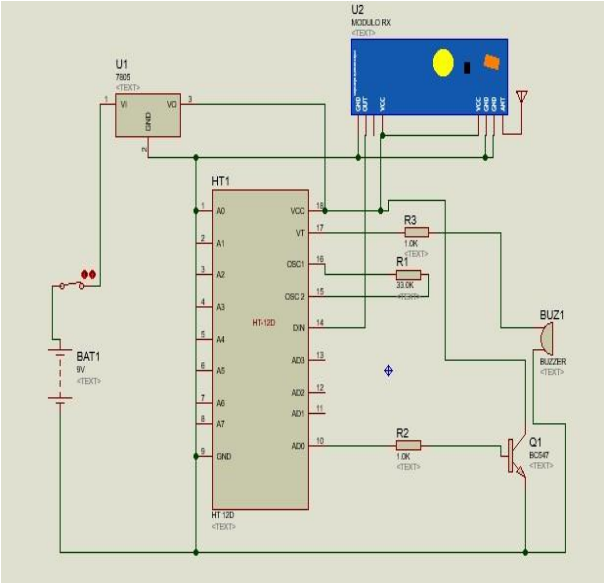
Receiver Section

The receiver circuit also uses a 9V battery regulated down to 5V via a 7805 voltage regulator, an HT12D decoder, a 9-way DIP switch, a buzzer, and a 433 MHz RF module receiver.

- The serial data received through the RF receiver is fed into the HT12D decoder.
- The buzzer is connected to the output pin of the HT12D, so when a matching signal is detected, the buzzer is activated.
- The buzzer produces a melodious sound when the corresponding transmitter push button is pressed.



(Figure 3: Block Diagram of the Receiver Section)

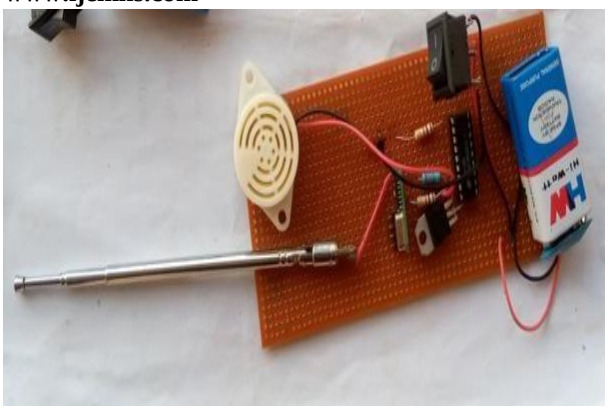


(Figure 4: Circuit Diagram of the Receiver Section – simulated in Proteus 8.8)

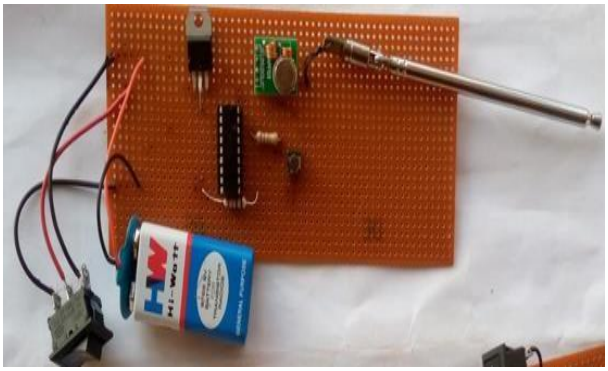
RESULTS AND DISCUSSION

Upon completing the design and implementation:

- The transmitter and receiver sections were connected wirelessly using the 433 MHz RF modules.
- When the push button on the transmitter is pressed, the buzzer on the receiver sounds melodiously.
- The wireless range achieved was approximately 100 meters, even under challenging conditions.
- This design provides a simple, cost-effective, and highly efficient solution suitable for homes, offices, and apartments.



(Figure 5: Actual Receiver Section After Implementation)



(Figure 6: Actual Transmitter Section After Implementation)

The robustness of the circuit was evident during testing, where even in low signal conditions, the system performed reliably with a consistent and clear sound output.

CONCLUSION

The designed wireless electric doorbell consists of two main parts: a transmitter and a receiver. Physically implemented, the system operated with a wireless range of up to 100 meters. If additional funding is made available, this project could be further enhanced to include additional smart features such as video capture (camera integration) and smartphone communication capabilities, making it even more competitive in the modern smart home industry.

REFERENCES

1] Q. Bradley, K. Ronit, L. Devendra, and D. Muhammad, "Dashbell: A Low-cost Smart Doorbell System for Home Use," Department of EECS, University of California, CA 92617, USA, 2015.

[2] R. V. S. Lalitha, K. Kayiram, R. N. V. Krishna, G. R. Mounika, and V. Sandhya, "Smart Surveillance with Smart Doorbell," *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, vol. 8, no. 8, June 2019.

[3] D. Suprita, S. R. N. Reddy, and K. Ila, "Raspberry Pi Based Smart Doorbell System with Advanced Encryption Scheme," *International Journal of Advanced Computational Engineering and Networking*, vol. 5, no. 9, pp. 138, 2017.

[4] P. Mukul, P. Sanjay, and D. Biki, "Touchless Doorbell," Department of Electronics and Telecommunication Engineering, Kokrajhar - 783370, BTAD, Assam, India, 2015.

[5] D. Arshey, V. Rambabu, S. Shubham, and G. Shreyan, "Smart Doorbell: The Product of IoT Era," *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, vol. 6, issue IV, April 2018.

[6] P. Tanpure, P. Sandbhor, P. Sarjine, and R. Hande, "Wireless Doorbell," *International Journal of Advance Engineering and Research Development (IJAERD)*, vol. 5, special issue 04, 2018.

[7] S. Manaswi, K. Kamran, L. Daawar, and S. Deepali, "Door Surveillance with Smart Bell," *International Journal of Research in Engineering, Science and Management (IJRESM)*, vol. 2, issue 2, pp. 143, 2019.

[8] C. Udit, G. Sushmita, B. Gayatri, C. Nishigandha, and W. Prashant, "Smart Doorbell Security System Using IoT," AISSMS's Institute of Information Technology, Pune, India, *EasyChair Preprint*, no. 4228, 2021.

[9] F. Caroline, B. Srushti, S. Madhumita, G. Maithili, and A. Aravind, "IoT Smart Doorbell Surveillance," *International Journal of Advanced Research and Innovative Ideas in Education (IJARIIE)*, vol. 4, issue 2, 2018.

[10] S. Devendra, L. Devi, G. Hemraj, and K. Santosh, "Wireless Controlled Door-Bell," *International Journal of Advanced Engineering, Management and Science (IJAEMS)*, vol. 2, issue 3, pp. 58, 2016.

[11] K. G. Ijemaru, Z. M. Adamu, S. Yaduma, K. B. Adedayo, and K. Olusuyi, "Design and Construction of an Automatic Triggered Bell Ringer Circuit," *Innovative Systems Design and Engineering (IISTE)*, vol. 5, no. 12, 2014.