PROJECT ABSTRACT

Knock-Detecting Door Alert with Strobe and Vibration Signals for the Hearing Impaired

An ESP32-based door-knock alert for hearing-impaired users — piezo vibration sensing with adjustable sensitivity, LED strobe bar and vibration motor alerts, knock-strength LCD readout — built-to-order with prototype, firmware, tuning procedure, report, PPT and viva kit.

01. Title

Knock-Detecting Door Alert with Strobe and Vibration Signals for the Hearing Impaired

02. Introduction / Background

A knock on the door is an audio event — useless to someone who cannot hear it. Hearing-impaired people miss visitors and deliveries because the entire signalling channel assumes working ears, and commercial flashing doorbells are expensive imports. This project reroutes the signal through light and touch: a piezo disc bonded to the door panel converts knock vibration into an electrical signal, an ESP32 validates it against an adjustable sensitivity threshold, and a bright LED strobe bar plus a vibration motor deliver the alert. A 20x4 LCD shows each knock with its measured strength. The detection is deliberately simple threshold logic — reliable enough to reason about, honest enough to discuss its limits — because the assistive purpose demands explainability.

03. Problem Statement

Assistive signalling is either expensive imported hardware or absent. Students can close this gap with a low-cost build, but only if the design is honest: threshold detection catches knocks and occasionally catches thumps, and the report must say so. The project delivers a working, tunable, well-documented alert with its limitations stated, which is exactly what assistive technology done responsibly looks like.

04. Objectives

- Sense door knocks with a bonded piezo disc on an ESP32, without any microphone.
- Validate knocks with amplitude-plus-timing threshold logic and an adjustable sensitivity.
- Alert through a flashing LED strobe bar and a vibration motor simultaneously.
- Show each knock event with its measured strength on a 20x4 LCD.
- Provide a button-adjustable, persistent sensitivity setting with a tuning procedure.
- Deliver the complete student kit: prototype, mount, firmware, docs, report, PPT and viva Q&A.;

05. Proposed Methodology

The build proceeds in three stages. (1) Sensing: the piezo disc is bonded to the door panel per the assembly procedure and its signal characterised — knock peaks vs background. (2) Detection: firmware implements amplitude thresholding with a timing window to reject isolated spikes; the sensitivity button steps the threshold. (3) Alerting: validated knocks fire the strobe and vibration motor for the configured duration while the LCD logs the event with its strength value for tuning.

06. System Architecture / Working

Piezo disc → ESP32 (sampling, threshold + timing validation) → LED strobe bar + vibration motor + 20x4 LCD; sensitivity button → threshold setting. The working flow is: bond the piezo per the procedure → characterise knock vs background on the LCD readout → set the sensitivity → verify knocks alert and bumps do not → document the tuning for the report.

07. Hardware / Software Requirements

- ESP32 DevKit board
- Piezo disc sensor
- LED strobe bar
- Vibration motor module
- 20x4 character LCD
- Sensitivity push-button
- Wooden door-panel demo mount with adhesive
- 5 V DC supply
- Arduino IDE (C/C++ firmware)

08. Expected Outcomes

- A working alert that flashes and buzzes on door knocks with the strength shown on the LCD.
- A tuned sensitivity setting documented with knock-vs-background measurements.
- A repeatable assembly and tuning procedure for the door mount.
- A complete report, PPT and viva Q&A; on vibration sensing, threshold processing and assistive design.

09. Applications

- Assistive alerting for hearing-impaired users.
- Workshop and noisy-room knock notification.
- Teaching threshold-based signal detection.

10. Future Scope

- Knock-pattern recognition (e.g. two-knock vs three-knock codes).
- Wireless alert to a wearable vibration band.
- Multi-room strobe networking.
- User trials with hearing-impaired volunteers (with ethics clearance).