PROJECT ABSTRACT

Long-Range LoRa Text Messenger for Off-Grid Communication

Two handheld peer-to-peer LoRa messenger units (ATmega328P, Ra-02 433 MHz, OLED, battery packs) exchanging addressed text messages with live RSSI and acknowledgements. Delivered built-to-order with both units, firmware, report, PPT and viva kit.

01. Title

Long-Range LoRa Text Messenger for Off-Grid Communication

02. Introduction / Background

When the network goes down — in a disaster zone, on a trek, across a large farm — ordinary messaging dies with it. LoRa exists precisely for that gap: chirp spread-spectrum modulation that trades data rate for kilometres of range at milliwatts of power. This project turns that principle into something you can hold: two identical handheld messenger units, each built around an ATmega328P with a Ra-02 433 MHz LoRa module, an OLED display, three message buttons and an AA battery pack. Compose a short text on Unit A and it appears on Unit B's screen with the received signal strength beside it — no mobile network, no Wi-Fi, no infrastructure.

03. Problem Statement

Long-range wireless is usually demonstrated as a range number on a slide, leaving students with no feel for link budgets, addressing or what 'the other end heard' means. This project addresses that by putting a complete peer-to-peer LoRa text link in the student's hands: addressed messages, delivery acknowledgements, live RSSI on every reception, and a buyer-run range procedure — the full communication loop, measurable and demonstrable.

04. Objectives

- Build two identical handheld messenger units (ATmega328P, Ra-02 433 MHz, OLED, buttons, AA pack).
- Implement peer-to-peer addressed text messaging with delivery acknowledgements.
- Display every message with its measured RSSI as a visible link-quality metric.
- Provide a button-driven composer with presets and character entry.
- Implement low-power sleep between activity for battery-powered field use.
- Provide a buyer-run range and RSSI fall-off measurement procedure.
- Deliver the complete student kit: both units, firmware, report, PPT and viva Q&A.;

05. Proposed Methodology

Each unit is built around a custom PCB carrying the ATmega328P, Ra-02 LoRa module, OLED and button interface, powered by an AA pack. The firmware implements a simple addressed protocol: compose, frame with destination address and sequence, transmit via chirp spread-spectrum, receive, validate, display with RSSI, and acknowledge. Units sleep between activity and wake on button press or radio preamble. The student then runs the range procedure at several sites, recording RSSI against distance for the report's link analysis.

06. System Architecture / Working

The user composes a message with the buttons and presses send; the microcontroller frames it with destination address and sequence number and the Ra-02 transmits it as LoRa chirps at 433 MHz. The receiving unit decodes the chirps, checks the address, displays the text with its RSSI, and returns an acknowledgement. The sender marks the message delivered or reports the failure honestly. Between activity both units sleep to conserve the AA batteries, waking on button press or incoming preamble.

07. Hardware / Software Requirements

- 2x custom messenger PCBs with ATmega328P
- 2x Ra-02 LoRa modules (SX1278, 433 MHz)
- 2x OLED displays
- Push-button sets (3 per unit)
- 2x AA battery packs
- Antennas for 433 MHz
- Arduino IDE (C/C++ firmware)

08. Expected Outcomes

- Two working handheld units exchanging addressed texts with acknowledgements.
- Live RSSI displayed with every received message.
- Student-measured range and RSSI-vs-distance data from buyer-run procedures.
- A complete report, PPT and viva Q&A; on LoRa, spread spectrum and link budgets.

09. Applications

- Demonstrating long-range low-power wireless for disaster, farm and trekking scenarios.
- Teaching chirp spread spectrum, addressing and link-quality measurement.
- Field-messaging concept prototyping for off-grid use cases.

10. Future Scope

- Multi-unit group messaging with addressing extensions.
- GPS position sharing between units.
- Store-and-forward relaying for beyond-line-of-sight coverage.