PROJECT ABSTRACT

Smart Mosquito Trap with CO2 and UV Attraction using ESP32

A smart mosquito trap that lures with CO2 and UV and captures with suction: a baking-soda/vinegar drip chamber generates a CO2 plume, a 395 nm UV ring adds the visual lure, a 12 V fan pulls insects into a mesh chamber, and an IR beam-break counter logs captures on an ESP32 with dusk-to-dawn automation. Delivered built-to-order with working prototype, firmware, assembly docs, report, PPT and viva kit.

01. Title

Smart Mosquito Trap with CO2 and UV Attraction using ESP32.

02. Introduction / Background

Mosquitoes locate people largely by sensing exhaled carbon dioxide, which is why CO2-baited traps outperform simple UV zappers — but commercial CO2 traps are expensive imports. A student-buildable alternative combines three well-understood mechanisms: a drip-fed baking-soda and vinegar reaction releasing a steady CO2 plume (the long-range attractant), a 395 nm UV LED ring (the short-range visual cue), and a suction fan that pulls approaching insects into an escape-proof mesh chamber. An IR beam-break counter and an ESP32 turn the trap into an instrumented system: every capture logged, the trap automated by ambient light, and bait life estimated — chemistry, airflow, optics, and embedded logging in one project.

03. Problem Statement

UV-only zappers mostly catch moths while the mosquitoes keep biting, and effective CO2 traps are unaffordable imports. Students need a build that demonstrates multi-modal attractant design, airflow capture, event-count sensing with debouncing, and light-triggered automation — with honest treatment of what determines real-world effectiveness (placement, species, density).

04. Objectives

- Generate a steady CO2 plume from a drip-fed baking-soda/vinegar chamber sized for roughly one night per fill.
- Add a 395 nm UV LED lure ring at the intake and a 12 V suction fan into a mesh catch chamber.
- Count every capture with an IR beam-break sensor, debounced in firmware, logged hourly to flash.
- Automate dusk-to-dawn operation with an LDR threshold, parking the system at dawn.
- Show live count, nightly total, fan status, and a bait-level estimate on an OLED.
- Document a buyer-run field-test procedure (trap vs. control counts over 7 nights) instead of claiming a catch rate.

05. Proposed Methodology

Stage one builds the trap mechanics: chamber geometry, fan selection for intake velocity, UV ring placement, and the CO2 drip chamber with an adjustable valve. Stage two implements the electronics — IR beam-break counting with debounce, LDR automation with hysteresis, OLED status — on the ESP32. Stage three adds the logging layer (hourly counts, 30-day ring buffer, bait estimator from runtime) and validates the full dusk-to-dawn cycle on the bench before any field test.

06. System Architecture / Working

At dusk the LDR crosses its threshold; the ESP32 starts the fan, powers the UV ring, and opens the drip valve, releasing the CO_2 plume. Mosquitoes following the plume reach the intake where UV and airflow pull them into the mesh chamber. Each insect crossing the intake breaks the IR beam; firmware debounces and counts it, accumulating hourly totals in flash. The OLED shows live count, nightly total, and bait estimate. At dawn the LDR parks the system — fan and UV off, drip closed — and the bait estimator updates remaining charge.

07. Hardware / Software Requirements

- ESP32 development board
- 12 V DC fan; 395 nm UV LED strip; mesh catch chamber
- IR beam-break sensor module; LDR light sensor
- 0.96-inch OLED display (I2C)
- Baking soda, vinegar, drip chamber with valve; 12 V DC 2 A adapter
- Arduino IDE, C/C++ firmware

08. Expected Outcomes

A working smart trap that runs itself dusk to dawn, counts captures automatically, and reports nightly totals — plus a documented field-test procedure the student runs to measure effectiveness honestly against a control. The student can explain attractant biology, beam-break sensing, hysteresis automation, and embedded logging.

09. Applications

- Homes: verandas, courtyards, and outdoor seating areas
- Farms and poultry sheds: reducing biting-insect pressure on livestock
- Community spaces: night markets and outdoor event venues

10. Future Scope

- Octenol or lactic-acid lure cartridges as a second chemical attractant
- Solar+battery variant for off-grid placement
- Species-differentiating counter using wingbeat frequency analysis