

Project Abstract

The Dual Security System is an innovative embedded system designed to enhance residential safety through integrated environmental monitoring and intrusion detection. Utilizing an AVR microcontroller, the system operates in two modes: Protection Mode and Environmental Mode. In Protection Mode, an IR sensor detects unauthorized motion, triggering a buzzer and LED alerts to deter intruders. In Environmental Mode, the system monitors smoke concentration and ambient temperature using a gas sensor and LM35 sensor, respectively. Smoke levels exceeding 70% or temperatures above 30°C activate alarms and a DC fan for ventilation, with critical temperatures above 50°C triggering immediate warnings. The system features an LCD for real-time data display, external interrupts for mode switching, and ADC for precise sensor readings. Calibrated for accuracy, the system ensures reliable detection of hazards like smoke and fire while providing robust intrusion protection. This cost-effective, scalable solution is ideal for smart homes, offering seamless integration of safety and security functionalities.

1. Problem Statement

The Dual Security System addresses residential risks from fires, gas leaks, and intrusions. Many homes lack affordable, integrated solutions for real-time hazard and intruder detection. With high fire and burglary rates, this system's dual-mode monitoring and alerts are vital. Its cost-effective design enhances safety and accessibility for homeowners.

Objectives

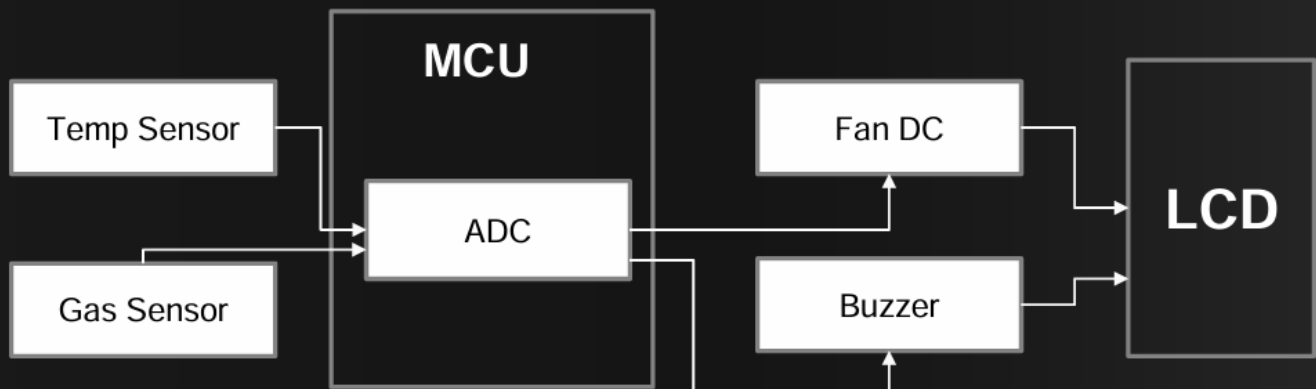
The main goals of the Dual Security System project are:

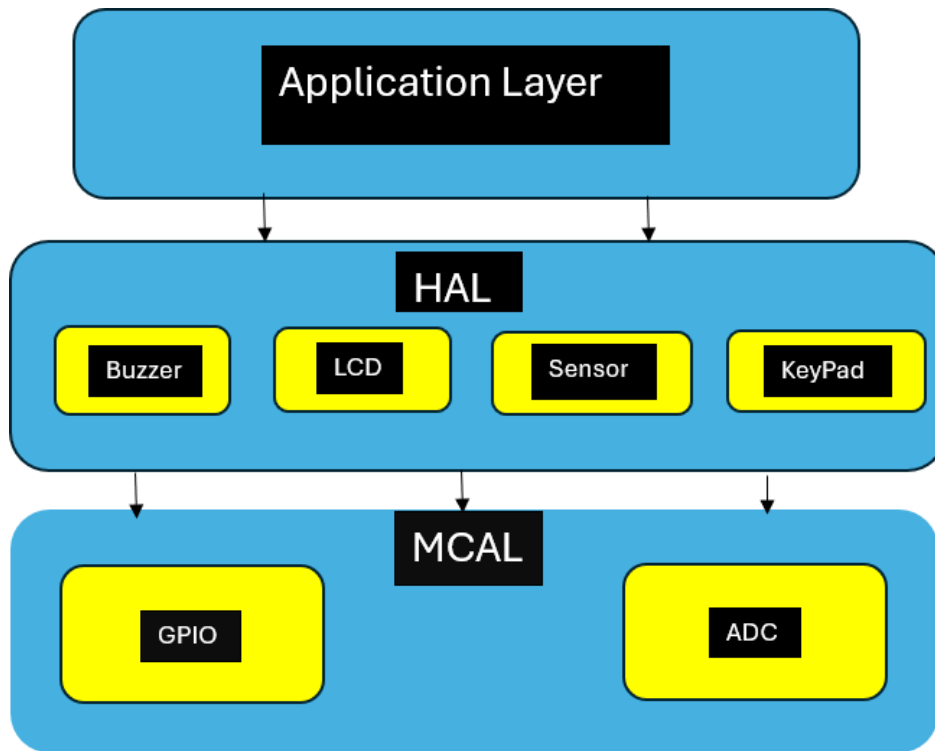
1. **Environmental Hazard Detection:** Accurately monitor smoke levels and temperature to detect potential fire or gas leak risks in real time.
 2. **Intrusion Detection:** Implement reliable motion detection to identify unauthorized intrusions and trigger immediate alerts.
 3. **Automated Response:** Activate alarms (buzzer, LEDs) and ventilation (DC fan) automatically based on detected hazards or intrusions.
 4. **User-Friendly Interface:** Provide clear, real-time feedback via an LCD display for system status, sensor readings, and mode indication.
 5. **Mode Flexibility:** Enable seamless switching between Protection Mode (intrusion focus) and Environmental Mode (hazard focus) using external interrupts.
 6. **Cost-Effective Design:** Develop an affordable, scalable system using an AVR microcontroller and standard components for broad accessibility.
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Proposed System Overview

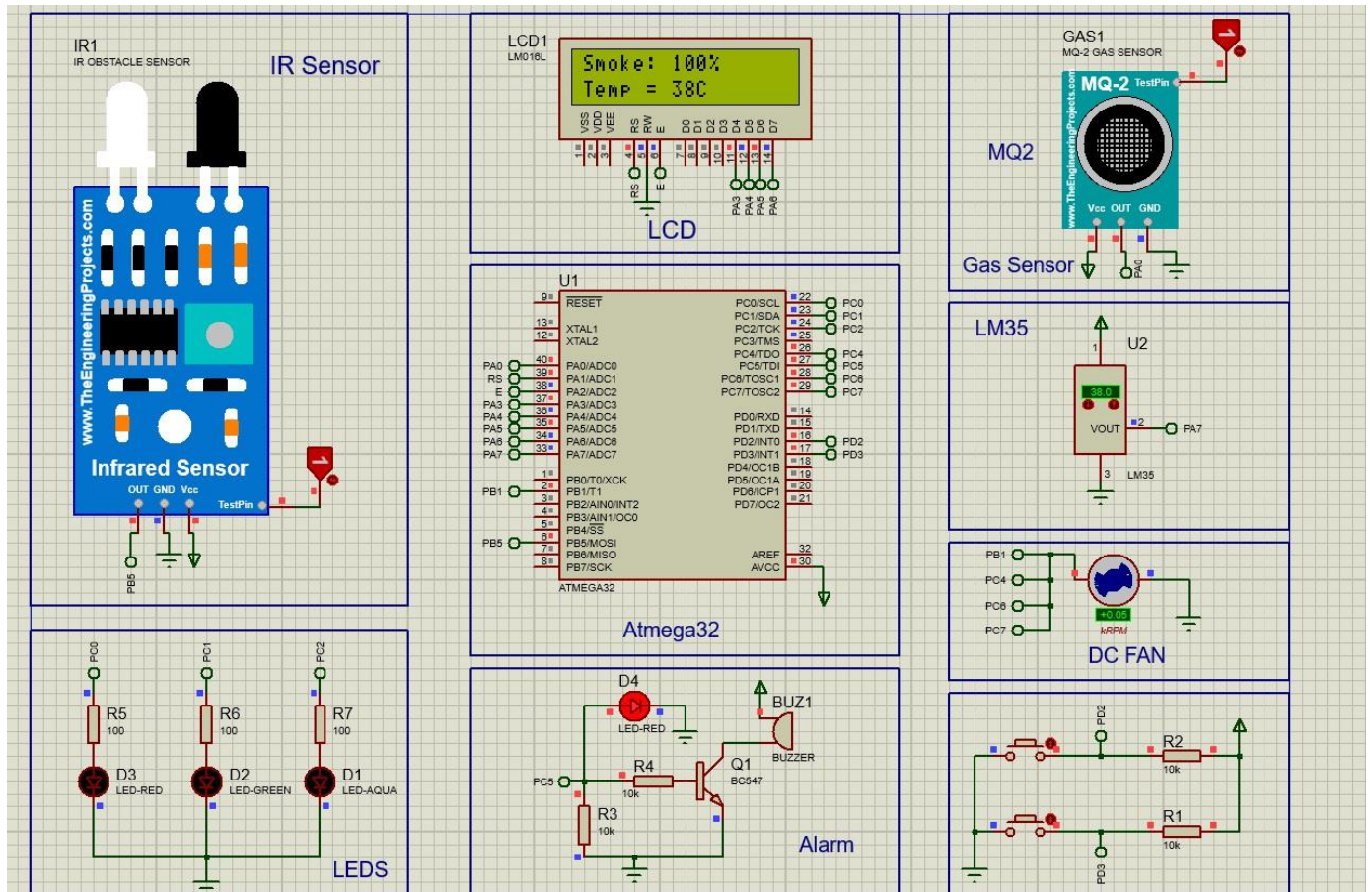
- **Description:** The Dual Security System uses an AVR microcontroller to monitor smoke, temperature, and motion in two modes: Protection and Environmental. In Protection Mode, IR sensors detect intrusions, triggering a buzzer and LEDs. In Environmental Mode, it tracks smoke (>70% triggers alarm) and temperature (>30°C activates fan, >50°C sounds alarm). An LCD displays real-time data, with interrupts enabling seamless mode switching.
- **Block Diagram:**

Block Diagram





• Schematic Diagram:



2. Hardware Components

Component	Specification	Purpose
IR Sensor	Digital Output, 5V	Detects motion/intrusion (used in Safety Mode)
LM35	Analog Temperature Sensor, 0–100°C	Measures ambient temperature
DC Fan (5V)	5V DC, 2-pin or 3-pin	Cools the environment when temperature exceeds threshold
Gas Sensor (MQ-2)	Analog Output, 5V, detects LPG/smoke	Measures smoke concentration in the air
LEDs	Red, Green, Blue – 5mm, 5V	Visual alerts (e.g. intrusion or status indication)
LCD	16x2 Alphanumeric, HD44780-based	Displays system messages, smoke levels, and temperature
Keypad / Switches	Push Buttons, normally open	Switch between Safety Mode and Monitoring Mode (via INT0/INT1)

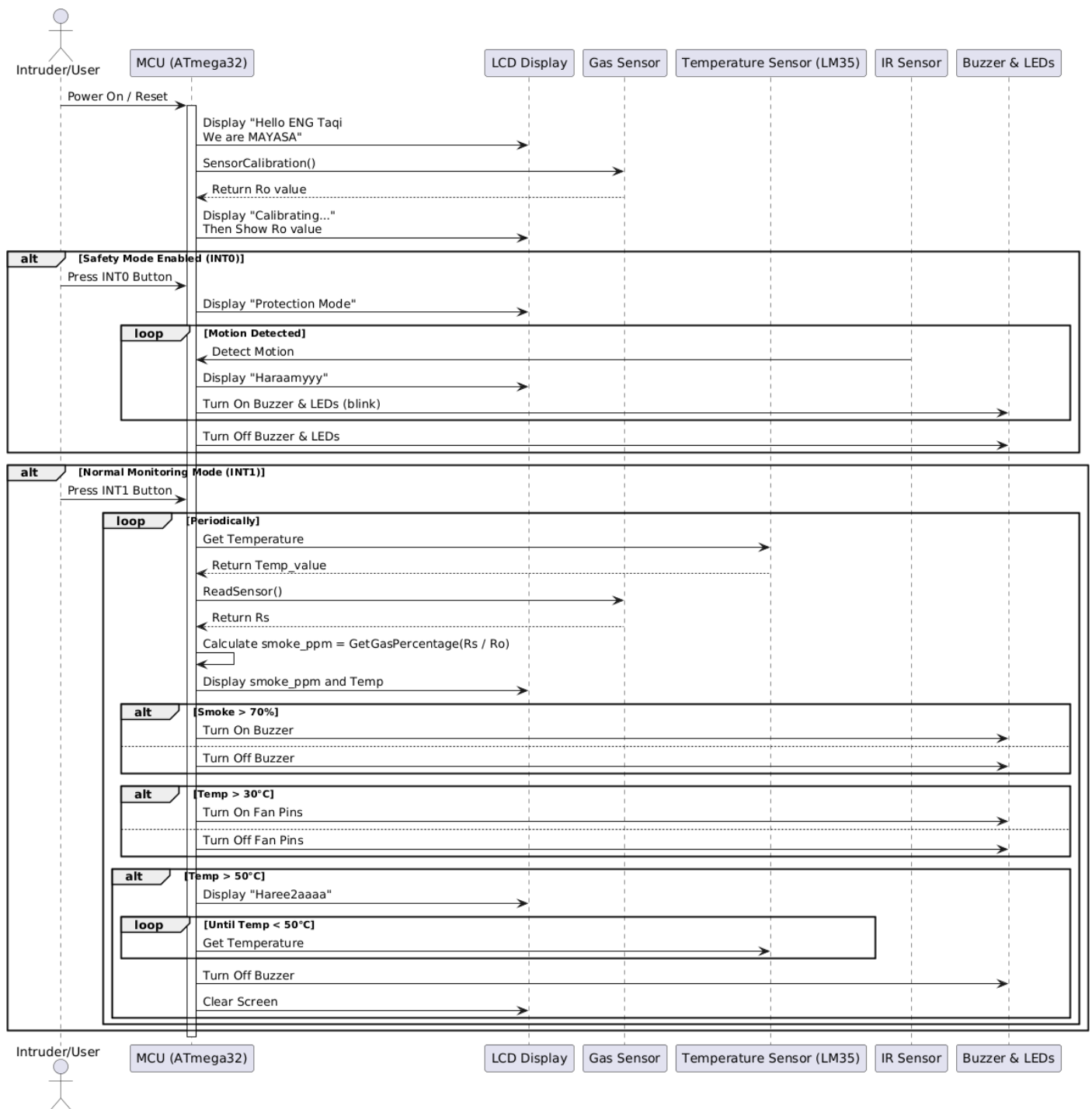
3. Microcontroller Details

- **Type/Model:** ATmega32
 - **Features Used:** GPIOs, ADC, Sensors, Buzzer, Interrupt, LCD, Keypad.
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4. Software Design

- **Programming Language/IDE:** C with Eclipse IDE using WinAVR
- **Code Overview:** The Dual Security System code operates on an AVR microcontroller, implementing two modes: Protection and Environmental, controlled by interrupts (INT0/INT1). It initializes GPIO for sensors (IR, LM35, gas), LCD, LEDs, buzzer, and a DC fan, and configures ADC for sensor readings. In Protection Mode, an IR sensor detects motion, triggering a flashing LED and buzzer alarm. In Environmental Mode, it measures smoke (via gas sensor) and temperature (via LM35), displaying results on the LCD; smoke >70% or temperature >30°C activates the buzzer and fan, with a critical alarm and loop at >50°C until the temperature drops. The code runs an infinite loop, updating sensors and responding to thresholds.

• Flowchart or State Diagram:



5. Communication Interfaces (if applicable)

6. Power Supply Requirements

5V Power

7. Expected Outputs

Expected Outputs of the Dual Security System

1. LCD Display:

- **Startup:** Displays "Hello ENG Taqi" and "We are MAYASA" for 1 second.
- **Calibration Phase:** Shows "Calibrating..." followed by "Ro = [value]" (scaled sensor calibration value).
- **Protection Mode:** Displays "Protection Mode" on the first row; "Haraamyyy" on the second row if motion is detected.
- **Environmental Mode:** Shows "Smoke: [value]%" on the first row and "Temp = [value]C" on the second row; "Haree2aaaa" if temperature exceeds 50°C.

2. Buzzer:

- **Protection Mode:** Activates continuously when motion is detected via the IR sensor.
- **Environmental Mode:** Turns on if smoke exceeds 70% or temperature exceeds 50°C; turns off otherwise or when temperature drops below 50°C.

3. LEDs:

- **Protection Mode:** Red, Blue, and Green LEDs flash (500ms on/off cycle) when motion is detected.
- **Environmental Mode:** LEDs remain off (no specific LED action defined for this mode).

4. DC Fan:

- **Environmental Mode:** Activates (via PORTB PIN1, PORTC PIN4, PIN6, PIN7 set to HIGH) if temperature exceeds 30°C; deactivates (set to LOW) if below 30°C.
- **Protection Mode:** Fan remains off (all fan pins set to LOW).

5. System Behavior:

- Switches between Protection and Environmental modes via INT0 (enables Protection) and INT1 (enables Environmental) interrupts.
 - Continuously monitors and updates sensor readings in Environmental Mode, with immediate response to thresholds (smoke >70%, temperature >30°C or >50°C).
 - Provides real-time alerts and automated responses (fan, buzzer, LEDs) to ensure safety and security.
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8. Timeline & Milestones

Task	Responsible Member
Drivers	Abdelrazek Moahmed
Drivers	Youssef Khaled
Hardware	Mohamed Hossam
Main Code	Abdallah Emad
Proteus	Ahmed Sami Mahmoud
Main Code	Ahmed Ebrahim

9. Challenges and Risks

Interface with gas sensor

10. References

Atmega32 Datasheet
