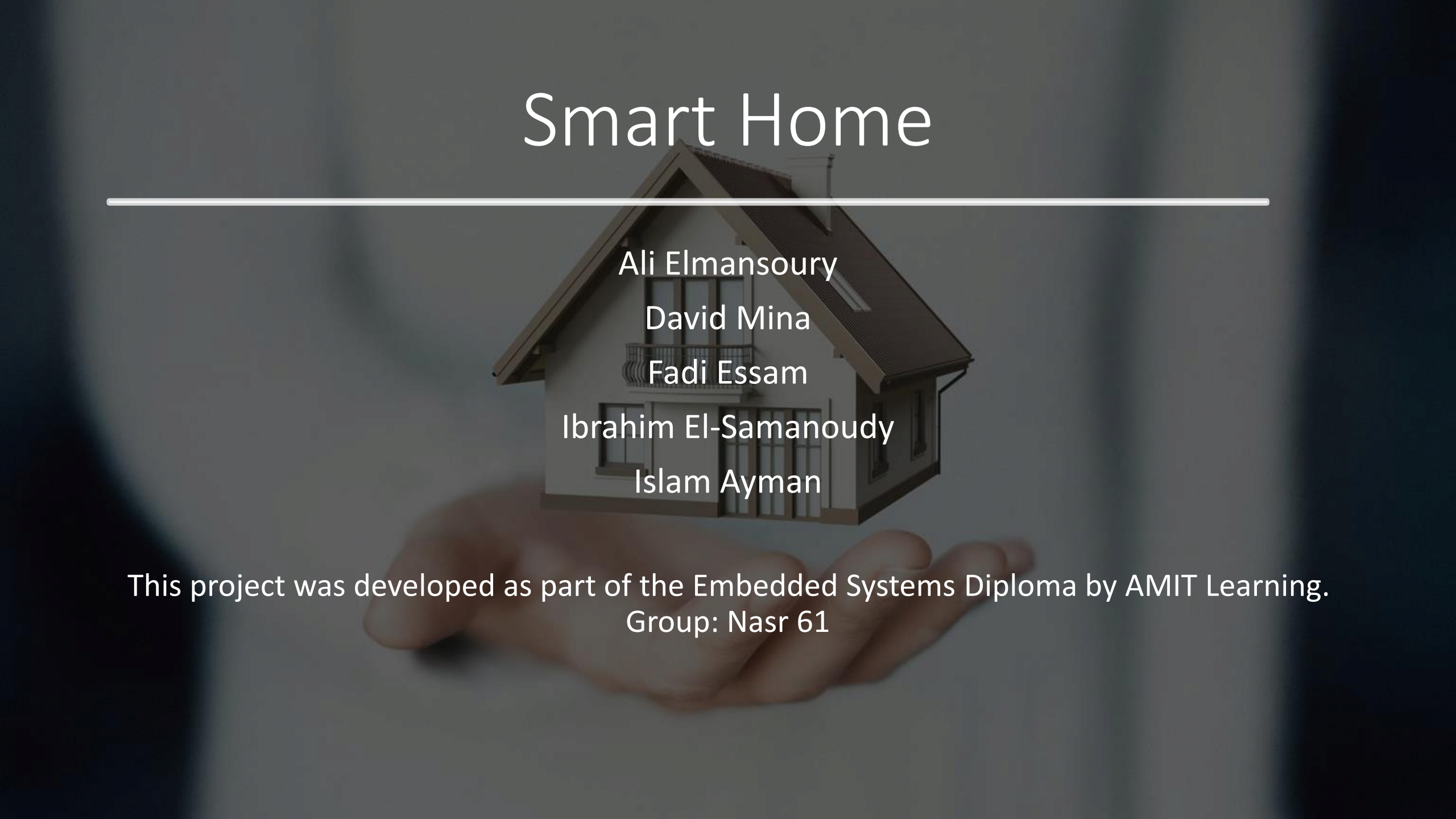
Smart Home



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This project was developed as part of the Embedded Systems Diploma by AMIT Learning.
Group: Nasr 61

1. Introduction

Overview of the Project:

- The Smart Home project aims to enhance the comfort and convenience of everyday living by transforming ordinary household items into smart, controllable devices.
- This project integrates various technologies to enable remote and local control of home appliances, improving energy efficiency, security, and user experience.

Goals:

- Develop a user-friendly system that allows remote control of home appliances via mobile devices or PCs.
- Implement an emergency control interface using an LCD and keypad for situations where mobile or PC access is unavailable.
- Ensure robust security measures, including a login system for both admin and user roles, and a fail-safe mechanism in case of unauthorized access attempts.

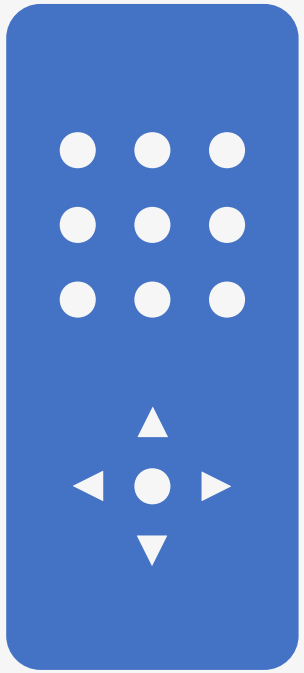
2. Project Scope

Description of the Smart Home Application:

- This smart home project focuses on creating a system that allows users to control various household devices both remotely and locally. The application aims to enhance the user's ability to manage their home environment efficiently and securely.

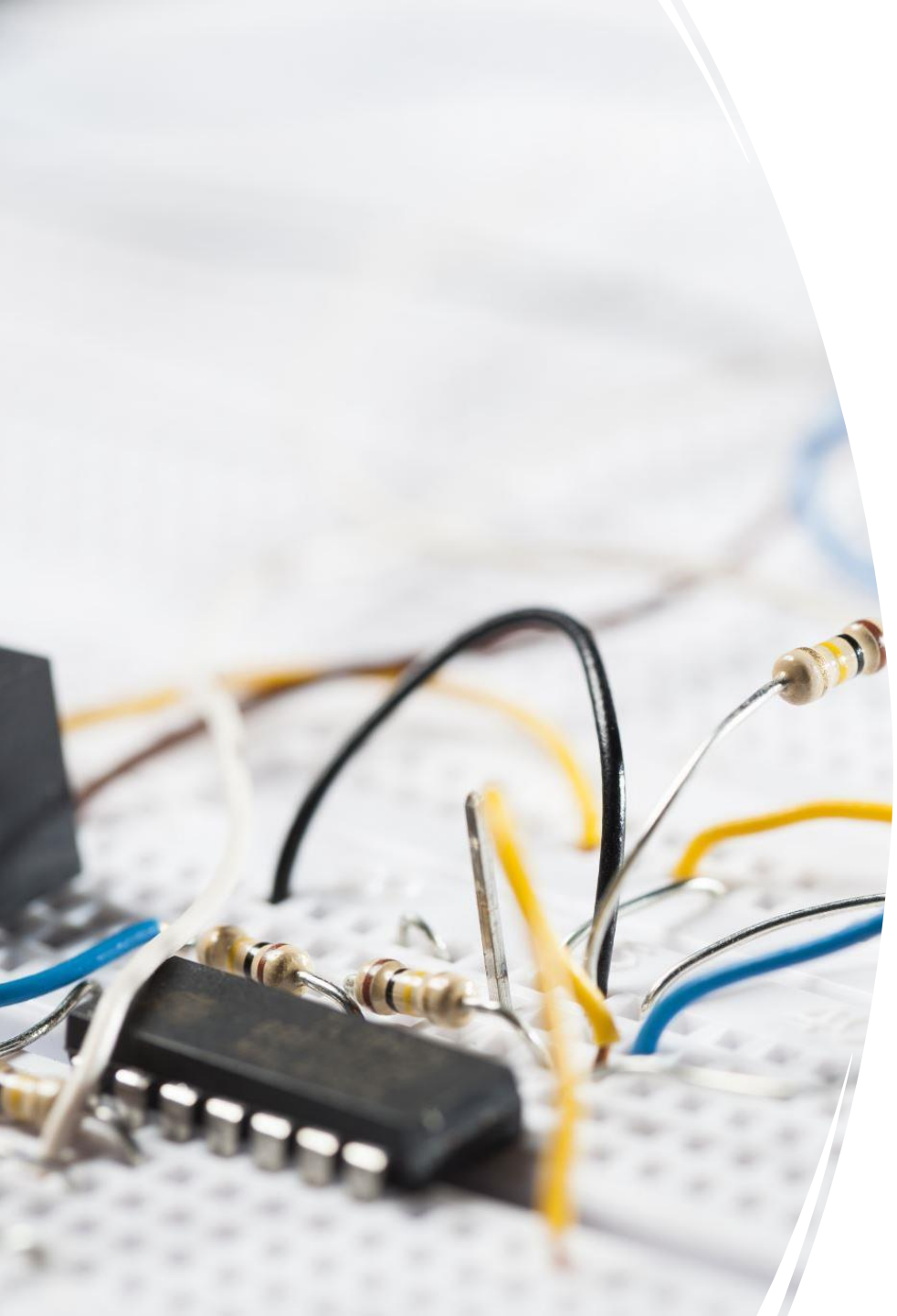
Key Functionalities Implemented:

- **Remote Control:**
  - Users can control home appliances via mobile devices or PCs, enabling management of the home environment from anywhere.
- **Local Control with LCD and Keypad:**
  - An emergency control interface using an LCD and keypad allows users to manage the system when mobile or PC access is not available.
- **Device Control:**
  - Six lamps, including five on/off lamps and one dimming lamp, can be controlled to adjust lighting as needed.
  - An air conditioning system is managed based on ambient temperature readings.
  - A door control system, accessible only to the admin, enhances home security.



- **Login System:**
  - A secure login system for both admin and user roles ensures controlled access. An air conditioning system is managed based on ambient temperature readings.
  - The admin can register and remove users and has exclusive control over certain features like door access.
  - User credentials are stored in memory to persist even after a power outage.

- **Security Features:**
  - The system includes a mechanism to lock down and trigger an alarm if incorrect login attempts exceed three trials, ensuring protection against unauthorized access.



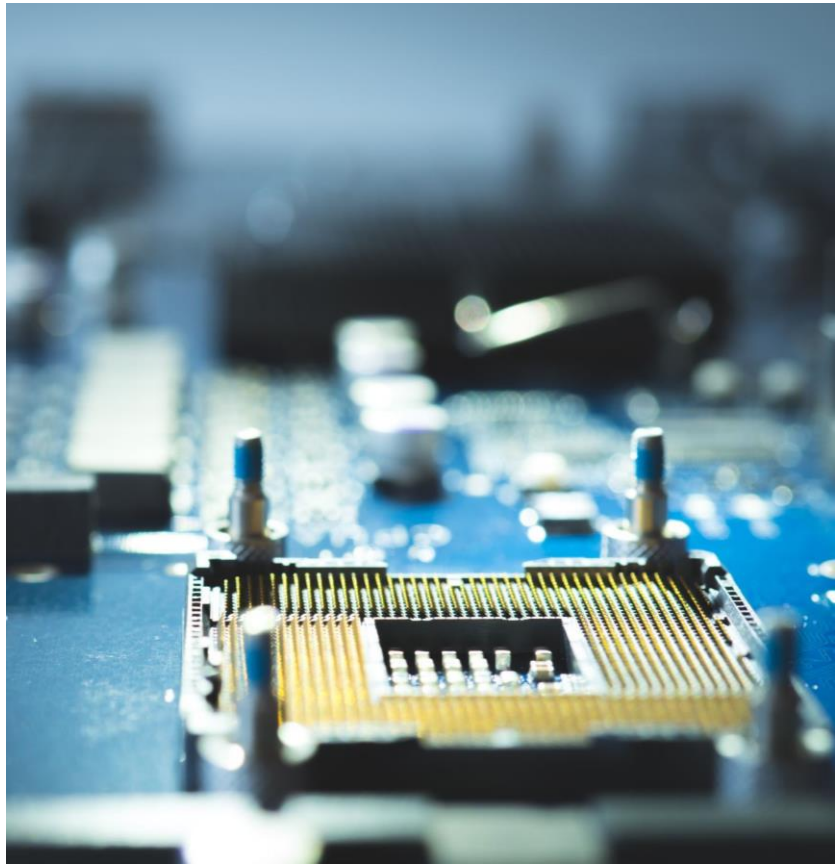
3. Hardware Components

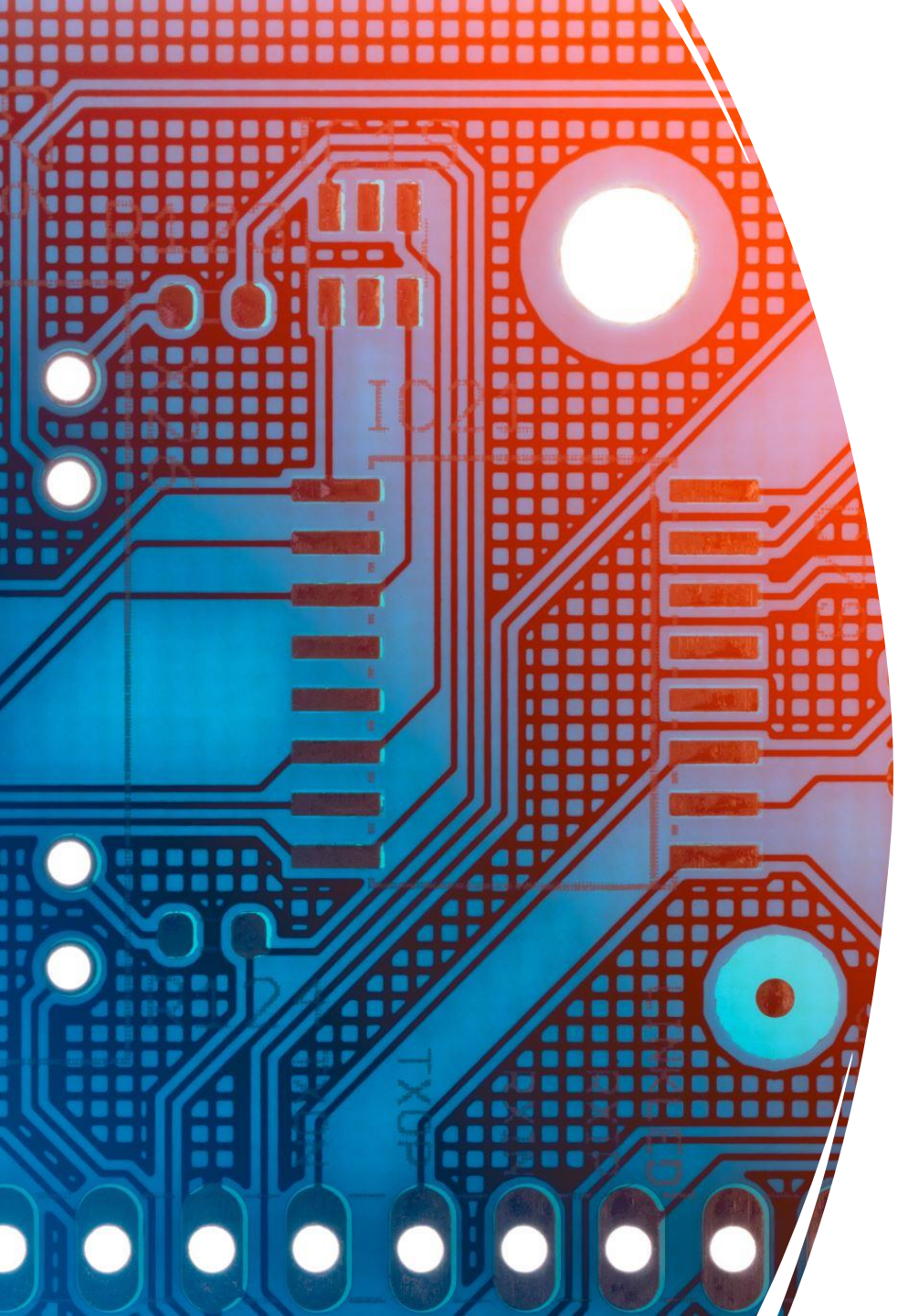
- **Microcontroller (e.g., ATmega32):**
  - Acts as the central processing unit, managing inputs from sensors and user interfaces, and controlling outputs to actuators.

- **Sensors:**
  - **Temperature Sensor:** Monitors ambient temperature to control the air conditioning system.

- **Actuators:**
- **Lamps and Relay Modules:** Control the on/off state and dimming of lamps.
- **DC Motor:** Operates the air conditioning system.
- **Servo Motor:** Controls the door mechanism.

- **User Interfaces:**
- **LCD and Keypad:** Allow local user login and control.
- **PC Interface:** Enable remote control via wireless communication.





- **Communication Modules:**
  - **TTL:** Facilitates communication between the microcontroller and PC.
- **Memory:**
  - **EEPROM:** Stores user credentials and system settings, ensuring data persistence across power cycles.

4. Software Design

- **The software is designed so as to be:**
  - Modular
  - Non-blocking: meaning that no service is to block the other.

5. PWM Calculations

- **Timer0 is used for PWM generation (Fast PWM Mode)**

The PWM frequency for the output can be calculated by the following equation:

$$f_{OCnPWM} = \frac{f_{clk\_I/O}}{N \cdot 256}$$

The N variable represents the prescale factor (1, 8, 64, 256, or 1024).

- **Duty cycle calculation:**

$$\text{Duty Cycle (In \%)} = \frac{T_{ON}}{TotalPeriod} * 100$$

6. Interrupts Used:

- **Timer1 interrupt**
  - ➢ Used for Servo motor position control
- **Timer2 interrupt**
  - ➢ Used for idle display countdown
- **External interrupt0**
  - ➢ Used for key press detection

7. Communication Protocols: UART

- **Universal Asynchronous Receiver/Transmitter (UART):**
  - A hardware communication protocol used for asynchronous serial communication.
- **Key features:**
  - Baud rate: Configurable up to 250 kbps (depending on the system clock frequency).
  - Data Bits: Supports 5 to 8 data bits.
  - Parity Bit: Optional (none, even, odd).
  - Stop Bits: 1 or 2.

8. Circuit Diagram