High-Level Specification for House Temperature Control System

1. Overall Architecture

The system architecture is modular and consists of:

Room Modules: These are individual units placed in every room responsible for measuring, receiving, and sending temperature and presence information.

Central Control Unit: This is the brain of the system that takes information from all Room Modules, processes it, and controls the A/C system.

User Interface: A smartphone app and dedicated control panel to interact with the Central Control Unit.

2. Components and Their Behavior

a. Room Modules:

- Temperature Sensor: Measures the current room temperature.

- Presence Detector: Utilizes passive infrared (PIR) sensors to detect the presence of people.

- Microcontroller: Processes the sensor information, receives temperature setpoints, and sends information to the Central Control Unit.

- RF Transceiver: To communicate wirelessly with the Central Control Unit.

b. Central Control Unit (CCU):

- Microcontroller: Collects information from Room Modules, determines A/C operation based on house-wide and individual room data, and provides feedback to the User Interface.

- RF Transceiver: Communicates with all Room Modules.

- Memory: To store user preferences, room habits, and temperature hysteresis data.

- Control Relay: Directly controls the A/C system operations (on/off, mode, and temperature settings).

c. User Interface:

- Smartphone App: Provides real-time feedback and control. It connects directly to the CCU over a local Wi-Fi or Bluetooth connection.

- Dedicated Control Panel: Installed at a central location, allows users to manually control the system, especially if the smartphone app is unavailable.

3. Communication Technologies

RF Communication: For Room Modules to communicate with the Central Control Unit. These technologies offer low power consumption, good range, and mesh capabilities.

Bluetooth or Wi-Fi: For the User Interface (smartphone app) to communicate with the Central Control Unit.

4. Information Exchange

Room Modules send:

Current room temperature

Presence status

------- Battery status -------

CCU sends to Room Modules:

Desired room temperature setpoint

User Interface receives from CCU:

House-wide presence status

Individual room temperatures

A/C system status

Room habits and preferences

----- Battery status --------

User Interface sends to CCU:

Desired temperature setpoints

Manual overrides

New user preferences or habits

5. Information Encoding for Transmission

Use a simple JSON format for data exchange. For example:

json

Copy code

{

"room": "Kitchen",

"currentTemp": 22.5,

"presence": true,

--------- "batteryStatus": 90 -------------

}

6. Security

Implement end-to-end encryption for all communications to ensure no unauthorized access.

Use strong authentication methods to avoid unwanted changes from unauthorized devices.

Periodically update the system firmware to handle security vulnerabilities.

7. Power Management

Utilize low-power components, especially for Room Modules.

Implement a sleep mode for Room Modules, waking up at regular intervals to send data or when presence is detected.

The CCU also analyses presence habits and room temperature habits, turning off the A/C units on dead hours and re-climatizing the house on live hours.

These options maybe be overridden, turned off/on in the user interfaces.

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or remain HYSTERESIS HYSTERESIS

| | |

V V V

[ OFF ]---------------->[ COOLING ]<-------------->[ HEATING ]

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TIMER\_EXPIRED T\_CURRENT <= T\_SET T\_CURRENT >= T\_SET

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