

Intelligent Residential System

Group Number: A17

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Introduction—A project about some feasible residential applications is constructed in this simulation project, it mainly combines 4 independent modules: **4-digit password lock**, **light-control LED array**, **automatic temperature controller** and **fire alarm**, which coordinate with Arduino to implement functionality such as **triggering components**, **reading data**, **receiving and writing digital and analog signals** according to preset program.

Background / Objective

The idea of this open project was firstly formed since **residential scenarios** are usually consistent with more feasible applications and multiple areas are suitable for optimized methods and innovative thinking.

With this fundament and inspired by a few characteristic components like **4×4 keypad**, **photoresistor**, **buzzer**, **temperature and gas sensor**, 4 modules initially took shape, their functions were identified as **enhancing security**, **saving energy**, **environmental conditioning** and **safety facilities**, so that the direction of the design and improvement afterwards was determined.

Methodology

To achieve a more intelligent residential experience, both **active module** and **passive modules** are considered.

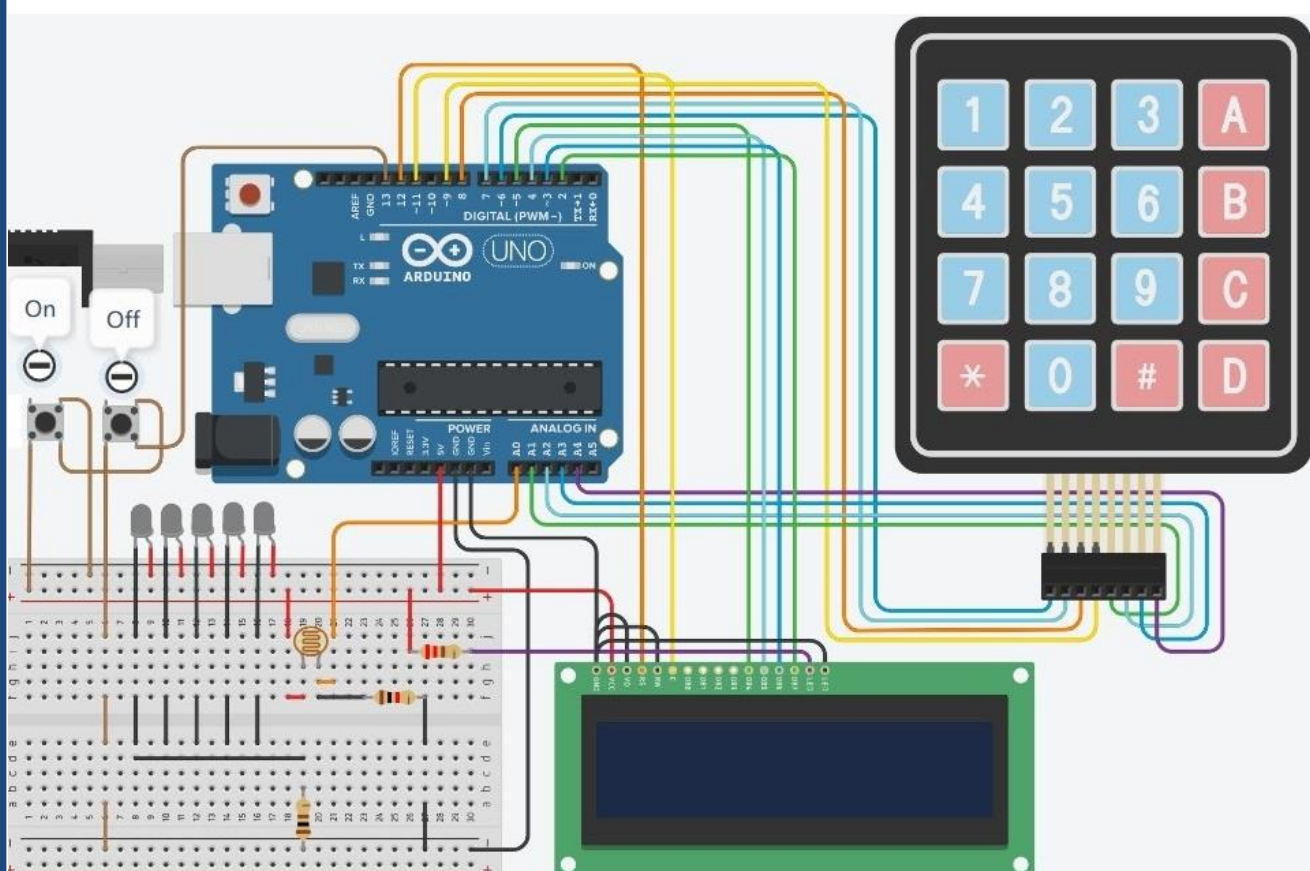
1 Active Module: 4-digit Password Lock:

- require **user interaction**;
- display **prompt messages**;
- return visual feedback in real time.

3 Passive Modules: Light-Control LED array & Automatic Temperature Controller & Fire alarm:

- **automatically detect** arguments by sensors;
- only work under **specific circumstances**.

Additionally, one module containing **photoresistor** and **illuminating LEDs** are specially designed for the consideration of **energy-saving**, which **embodies the idea of sustainability**.



Results and Discussion

Module 1. 4-Digits Password Lock:

4×4 keypad: receive entered digit and function keys “*” and “#” can operate the system as “Lock” and “Password Reset” command;

LCD: display basic prompts as visual feedback for each condition.

Module 2. Light-Control LED Array:

Photoresistor: operate the 5 illuminating LEDs based on real time light intensity it detected;

Only linearly turn the lights on when natural light gradually becomes dim for the aim of **energy-saving**.

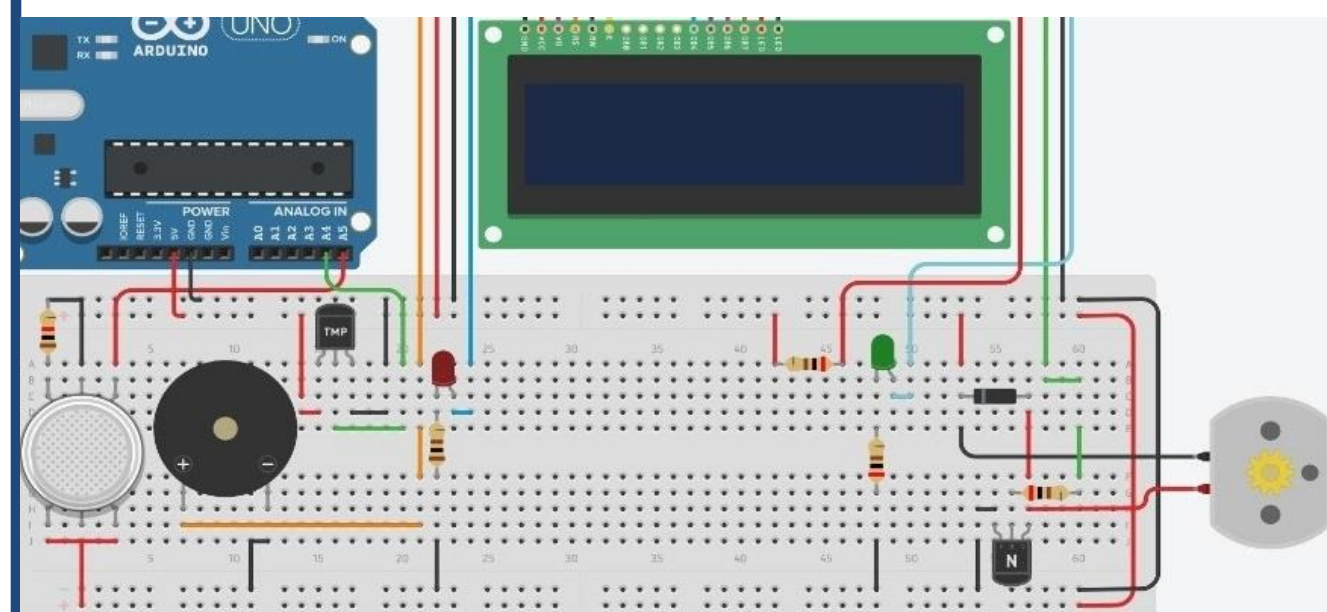
Module 3. Automatic Temperature Controller:

Electrical fan and heater: work normally according to **current temperature** detected by sensor and **interval rules**;

LCD: display **current temperature** expressed in Celsius and Fahrenheit form and **appliances starting prompt** when it reaches preset temperature thresholds.

Module 4. Fire Alarm: instant auditory feedback and **visual signal**;

Gas sensor: sensitively detect the concentration of harmful gas and trigger **buzzer and LED** when gas is near it.



Conclusion

From the whole simulation, we could summarize the Arduino design project as follows:

- ✓ the total of four active and passive modules could be **operated stably** as expected;
- ✓ they can **uniformly achieve requirements** based on program code as a intelligent residential system;
- ✓ experimental results **meet the objectives** as expected;
- ✓ proves the **feasibility**, **practicability** and **feasibility** of the circuit;
- ✓ **robust code** programmed in Arduino board correctly manipulated all components in different scenarios;
- ✓ light-control LED array effectively realizes purpose of **energy-saving**, embody the idea of **sustainability**.

We could conclude that:

This intelligent residential system as a whole is consistent with **sustainable development** and is able to work **properly and intelligently** as designed.