ADUSTABLE OVER CURRENT RELAY

Final Project Report

Group A8

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Introduction

Overcurrent Protective Devices

The purpose of an overcurrent protective device is to provide protection to service entrance, feeder and branch circuit conductors and equipment. The basic types of overcurrent protection devices include fusible switches and circuit breakers.

Fusible Switches

In a fusible switch, the overcurrent protection function is accomplished by the fuses installed in each pole of the switch. A fuse is aptly named–for it protects a circuit by fusing/melting open its current-responsive element when an overcurrent or short circuit passes through the element. Fuses are available in several different current limiting and non-current limiting types. When deciding which type of fuse to use, it's important to consider the fault stress that the system could be subjected to during a short circuit interruption.

Circuit Breaker

The circuit breaker is an essential device in the modern world, and one of the most important safety mechanisms in your home. A circuit breaker is a device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.

Whenever electrical wiring in a building has too much current flowing through it, these simple machines cut the power until somebody can fix the problem. A circuit breaker is also intended to act as a perfect conductor when closed, and a perfect insulator when open. Without circuit breakers (or the alternative, fuses), household electricity would be impractical because of the potential for fires and other mayhem resulting from simple wiring problems and equipment failures.

Circuit Breaker Types

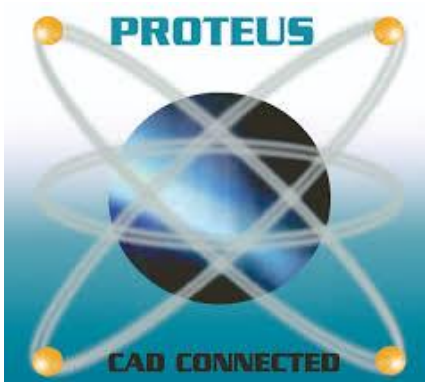
- Thermal-magnetic
- Electronic trip (withstand rated)
- Current limiting

Why Adjustable Circuit Breakers Need?

Mainly we use adjustable circuit breakers in laboratory experiments. When developing a research, to find the required quantities up to risk situation and prevent failures in the original design mostly these are used.

The software we are using?

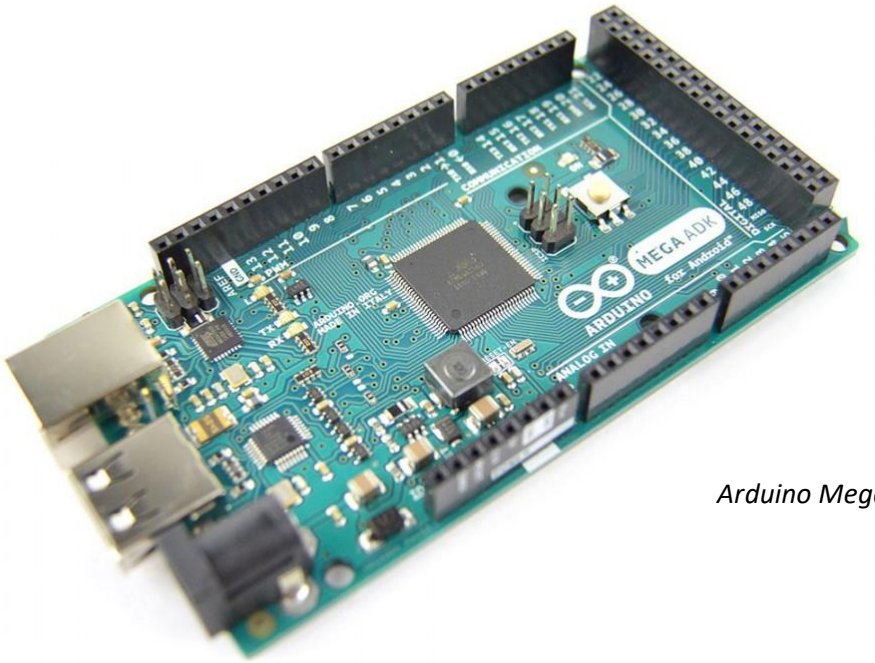
- Proteus



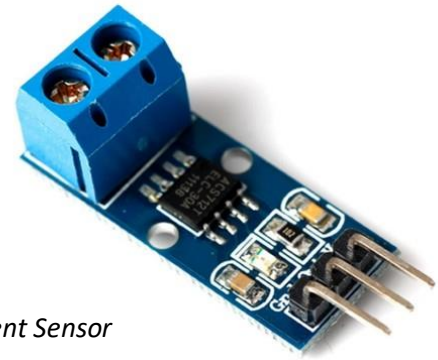
- Arduino

How Arduino is Encountered with Adjustable Circuit Breakers?

Arduino is a microprocessor so if we can read the current we can process it inside and take some action once it reaches to the maximum. There are some methods to read the current flow through a wire. Measuring flux or directly measuring current using current sensor. Our project we use the current sensor and all the processing part done by Arduino.



Arduino Mega



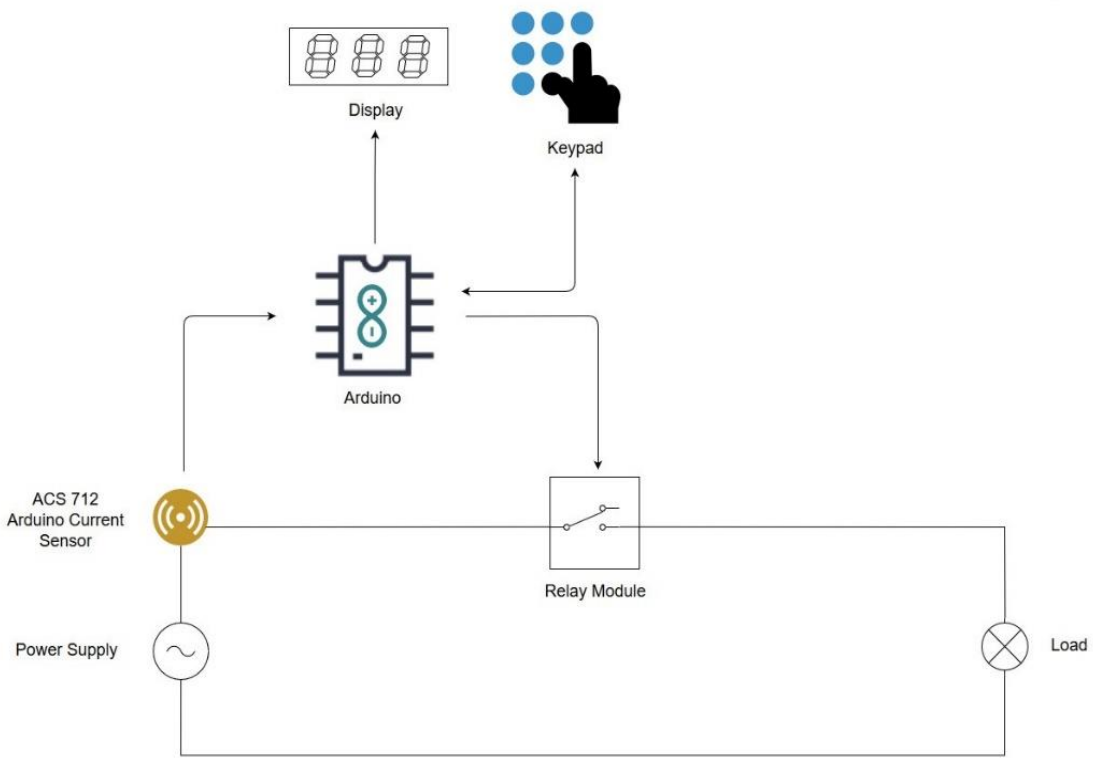
ACS712 Current Sensor

Objective of the Project

In traditional circuit breakers, a circuit will work properly below a certain specific current value which was predefined and can't adjust that specific current value (eg: - our objective is to develop an adjustable over current relay which supports 0-15 A range for laboratory and home use). The main advantage of using an adjustable circuit breaker is we can adjust the specific current value that the circuit should work without any risk situation according to our needs. (Mainly in research levels)

Proposed System

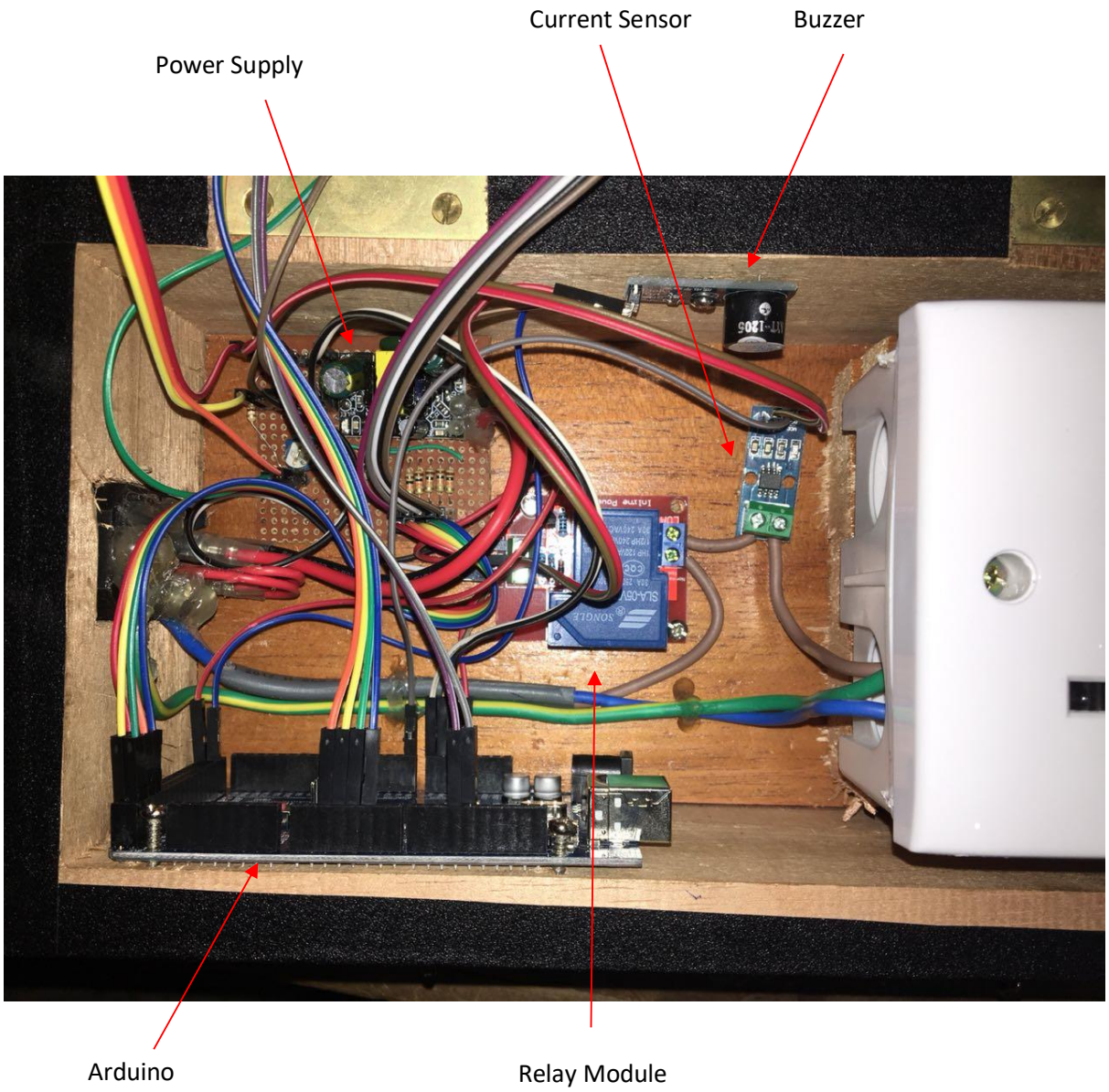
Circuit Diagram



Components

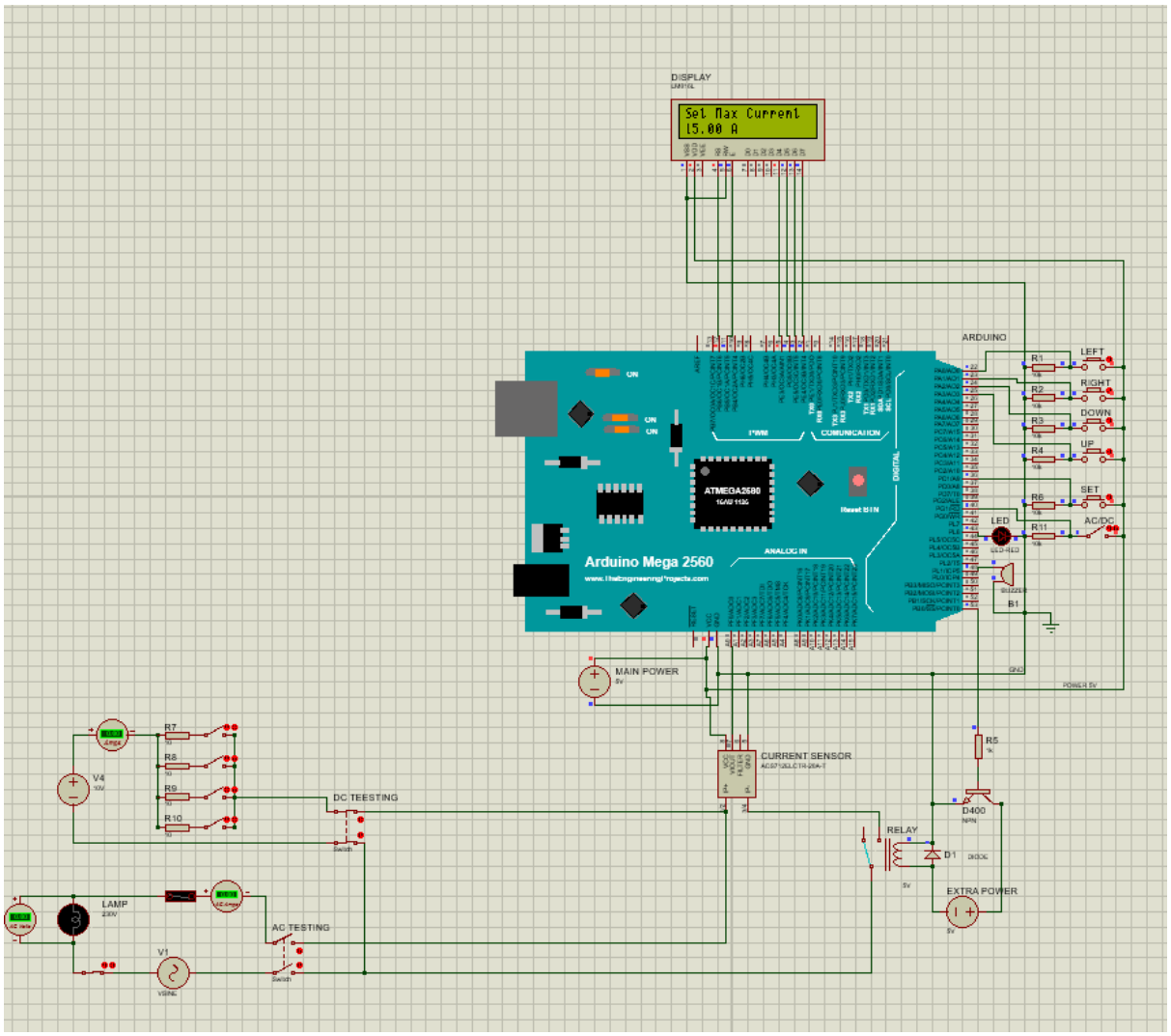
1. Arduino Mega
2. ACS712 20A Current Sensor
3. 20A Relay Module
4. 16 X 2 Liquid Crystal Display
5. Buzzer
6. 230V – 5V Power Supply
7. Keypad (Buttons)
8. Power Code & Socket

Internal Wiring



Simulation (Proteus)

We use Proteus Simulation software for simulate the process before build. We verify that our technique is working and can be build using the real components.



How to Operate

1. First switch on the device.
2. Then we have to give the maximum limit of current that we want to pass. We can use up down left right 4 buttons to change the maximum current.
3. Then you have to press confirm button.
4. Then this system automatically scan for zero error. And displays the zero error. Then we have to confirm it.
5. After confirming relays are on and power will be supplied to main socket.
6. Once the current of the power socket reaches to its limit it will automatically cut the power.

Challenges We Faced

1. The display burned because the power supply is above 5V. Solution is we put a resistor. Instead of 220 ohm resistor we put a 330 ohm resistor.
2. There is no zero error of the current sensor in data sheets. But in our system we got an error whether there is no device connected but there is a current. Solution for that is when we are doing the setup it calculates the zero error and that value reduce from the original reading.
3. Normally a switch is open at its normal condition. But the switches we bought are closed at their normal condition. So we had to change the code that we wrote before.
4. Some devices want a big current at their beginning and it goes above the limit that we have given. It is problem for this system. Because it will automatically switch off at its beginning. We put a ignore button as the solution of this problem. When we are pressing that button it will allow current to go above than our limit.

How Did We Make This as a Final Product?

1. We made a wooden box by using nuts. Made it from a wooden box for stopping current leak.
2. A proper way to give current from the outside.
3. Also, we applied glue for stop leaking current.
4. Pasted a baffle sticker on the wooden box for its finishing.
5. We tested this by using 100W bulbs.

   Testing types that we did for this

   - We kept by switching on this for a long time by giving 5A to see whether there are short circuit problems.
   - And tested by giving large currents.
6. We made this by fixing buttons. So, it is user friendly.

Sampling Algorithm

We created a sampling algorithm based on the ACS 712 current sensor characteristics. First, we get the sensor readings for 500 milliseconds and find the recorded maximum and minimum values during that period. Output principle of the sensor is like this. When -20A passing through the sensor it shows 0 as output. When 20A passing through the sensor it is showing 1023 as the output. With respective to this theory we calculated the respective peek to peek voltage for the output. Then we calculated Vrms in millivolts and divided it by the senility of the sensor. This gives us the Irms value passed through the sensor in a ½ second.

```
// Smplaing Algorithm for Sensor Readings
float getVppSample(){
  float result;
  int readValue;
  int maxValue = 0;
  int minValue = 1024;
  uint32_t start_time = millis();
  while((millis()-start_time) < 1000){
    readValue = analogRead(currentPin);
    if (readValue > maxValue) {
      maxValue = readValue;
    }
    if (readValue < minValue){
      minValue = readValue;
    }
  }
  result = ((maxValue - minValue) * 5.0)/1024.0;
  return result;
}

float calculateCurrent(){
  float voltage = getVppSample();
  float vRms = (voltage/2.0) * 0.707;
  float ampRms = (vRms * 1000) / 100; // Sensitivity Of The Sensor
  return ampRms;
}
```

Budget

Arduino Mega	- Rs 1650.00
ACS712 Sensor	- Rs 350.00
Liquid Crystal Display	- Rs 750.00
Relay Module	- Rs 600.00
Buzzer	- Rs 300.00
230V – 5V Converter	- Rs 300.00
Box and Design	- Rs 1000.00
Wires and Other	- Rs 500.00
GROSS COMPONENT COST	**- Rs 5450.00**

Timeline of the Project