# TEMPERATURE CONTROLLED AUTOMATED CHARCOAL STOVE

Team Do-Gooders;
Dimagi D.H.P. -210131N
Gamage S.B.P. -210178M
Hansindu K.A.A. -210204R
Sirimanna N.T.W. -210610H

# Problem Description

The cost of gas is gradually rising because of the world's upcoming energy crisis. As a result of that, high inflation has occurred, and the prices have become unaffordable for many people. Therefore, people are looking for alternative ways for cooking rather than using gas at a high cost. When it comes to other energy sources, there are some extremely overpriced cookers in the market. For example, the initial cost of electric cookers and induction cookers are very high. Though we can find some charcoal stoves currently available on the market, they are not functionable as electric cookers. Some downsides are,

- Temperature controlling is difficult.
- Precise timing isn't used.
- Don't have multiple cooking methods.
- Uneven heat distribution.

Due to these problems, people are seeking for cost effective, proper functioning cookers for their daily use.

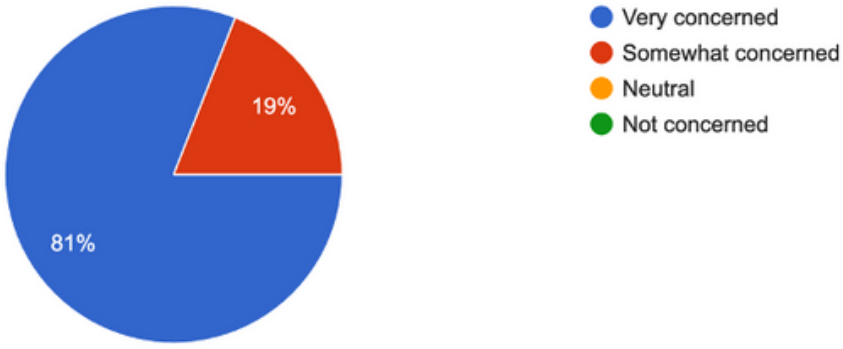
# Motivation and Justification

Our proposed design for the Temperature Controlled Automated Charcoal Stove aims to address the increasing demand for affordable and sustainable cooking solutions considering rising gas prices and the world's upcoming energy crisis. This project proves really helpful in power outages, as the fan will be powered by a rechargeable battery. This automated fan system regulates the temperature by controlling the oxygen supply to the charcoal, ensuring efficient and precise control of the cooking process. Indicators can be very useful to identify the issues which can arise in the burning process or if there isn't sufficient charcoal to avoid any damage to the cooker. The stove's design will also include an ashtray for easy cleaning and maintenance.

The accuracy and simplicity of this product are our top priorities in this instance, and we work to produce it at the lowest possible cost because everyone needs it. After considering this huge demand for alternative energy sources, we did a little survey to justify our problem selection and validate our solution. The results showed that many gas users are willing to move to alternate energy sources as the prices of gas have become unaffordable for them.

How concerned are you about the rising gas prices and the potential impact of the upcoming energy crisis on your daily life?

42 responses

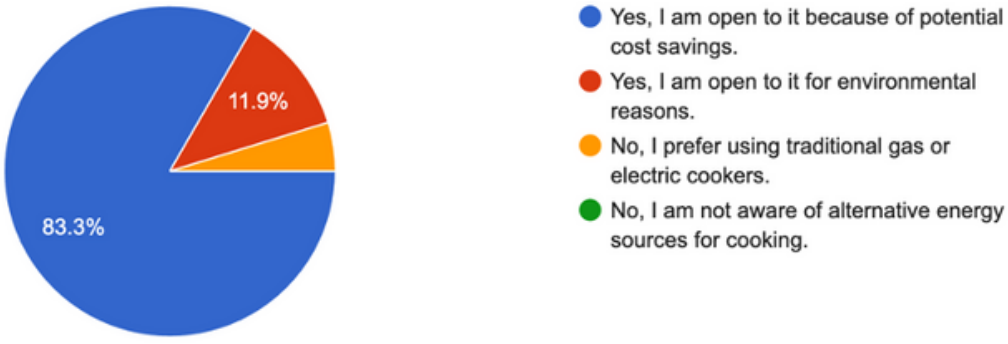



Have you personally experienced any difficulties or financial strain due to the increase in energy prices?

42 responses

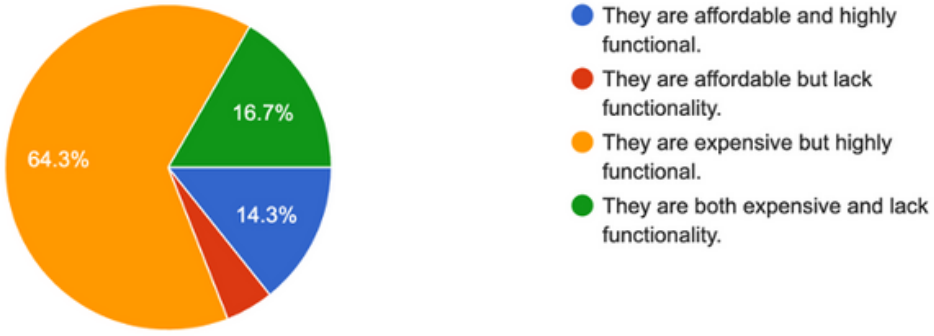

Are you open to using alternative energy sources for cooking? Why or why not?

42 responses



What are your thoughts on the currently available electric cookers in terms of their affordability and functionality?

42 responses

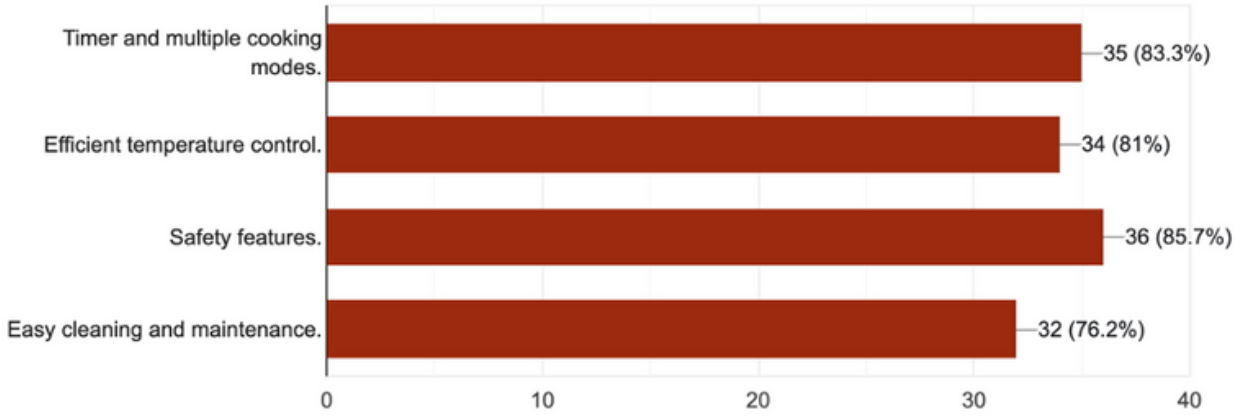



Are you familiar with charcoal stoves as an alternative energy source for cooking? If yes, please share your experiences or opinions about them.

42 responses

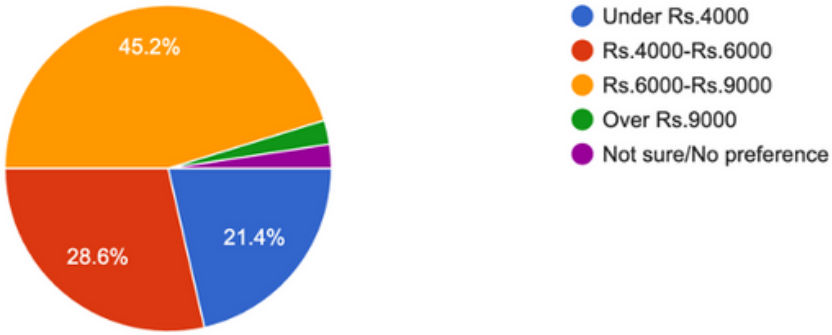

What features do you consider essential for a cost-effective charcoal stove to be a viable option for cooking in your household?

42 responses




What price range would you consider affordable for a cost-effective charcoal stove?

42 responses



# Technical Feasibility •••••

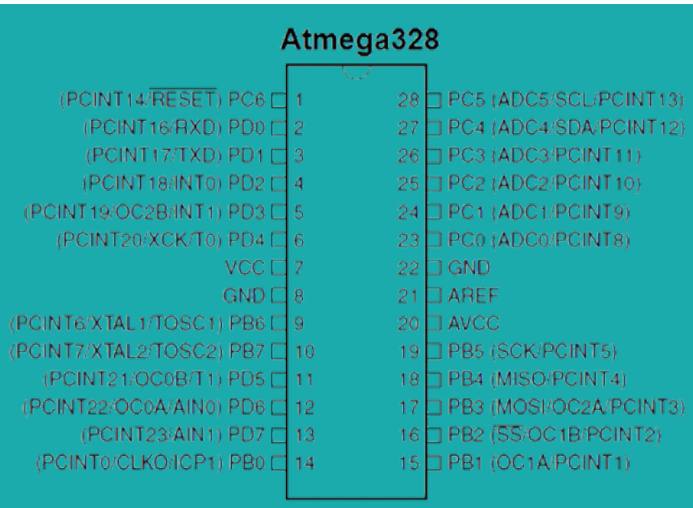
## HARDWARE REQUIREMENTS

### 1. ATmega328P Microcontroller

ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture.

**Parametrics**

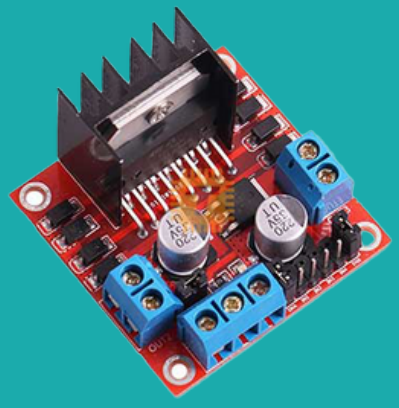
| | |
|---|---|
| Program Memory Type | Flash |
| Program Memory Size | 32K bytes |
| SRAM (KB) | 2048 |
| Data EEPROM/HEF (bytes) | 1024 |
| Number of Pins | 28 |
| Number of programmable I/O lines | 23 |




### 2.L298N Motor Driver Module

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

| | |
|---|---|
| Driver Chip | Double H Bridge L298N |
| Logic voltage | 5V |
| Logic current | 0mA-36mA |
| Storage Temperature | -20 ℃ to ℃ to +135 |
| Drive voltage | 5V-35V |
| Drive current | 2A (MAX single bridge) |
| Maximum power | 25W |
| Dimensions | 43x43x27mm |



## 3.HT-NTC 100K Thermistor Temperature Sensor

The HT-NTC100K thermistor temperature sensor is a small, accurate, and low-cost sensor that can be easily integrated into various electronic circuits. The thermistor is a type of resistor that changes its resistance with temperature. It is compatible with a wide range of microcontrollers and can be easily interfaced with them using analog-to-digital converters (ADCs). Its compact size and high accuracy make it the best choice for our project.

| | |
|---|---|
| Operating voltage (v) | 2.5 ~ 5.5 |
| Temperature sense range (°C) | -50 ~ +260 |
| Length (m) | 1 |
| Head diameter(mm) | 3 |
| Head length(mm) | 15 |

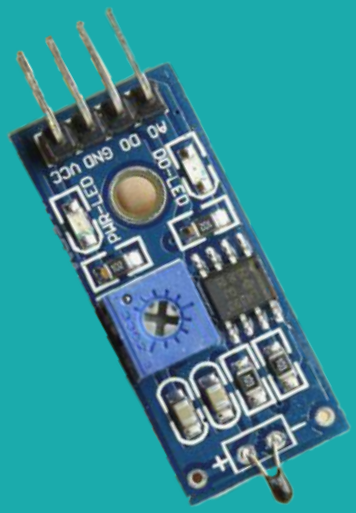
## 4. NTC Temperature Sensor Module

NTC Thermistor temperature sensor module is very sensitive to ambient temperature. The temperature detection threshold is adjustable via a potentiometer. The module consists of a Negative Temperature Coefficient (NTC) thermistor, a pull-up resistor, and a comparator circuit that converts the temperature variation into a digital and analog output signals.

Features:

- Using an NTC thermistor sensor, the sensitivity is good
- Comparator output: clean signal, good waveform, strong driving ability, more than 15 mA.
- Value of Temperature Detection for Distribution Potentiometer Adjustment.

| | |
|---|---|
| Operating voltage (v) | 3.3 ~ 5 DC |
| Output Digital (V) | 0 ~ 5, Adjustable trigger level from preset |
| Output Analog (V) | 0 ~ 5, Based on temperature on ambience |
| PCB Size | 3.2cm x 1.4cm |
| Output Current | 15 mA |

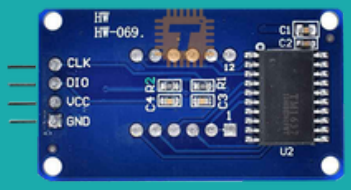



## 5.TM1637 4-Digit Digital LED Tube

The module is based on a decimal point display module, it displays four digital tube (0.36 inches), and driver IC is TM1637, only two signal lines can make MCU control four Digit 8-segment LED. Can be used to display decimal, letters and so on.

Features:

- 4 digit red alpha-numeric display with decimal point
- 8 adjustable gray
- Working voltage: 3.3~5.5V DC
- Working current: 80mA (MAX)




**6.Resistors**
**7.Capacitors**
**8.Transistors**
**9.Diodes**
**10.LEDs**
**11.PCB**
**12.Cables and connectors**
**13.Crystal Oscillator**
**14.IC**

## SOFTWARE REQUIREMENTS

1.C++ programming Language
2.Arduino IDE

We'll be using the Arduino IDE to program the microcontroller. For communication between the microcontroller and the computer, we'll utilize a USB to serial adapter. This adapter converts data signals from USB to serial and vice versa, allowing the microcontroller to communicate with the Arduino IDE on the PC.

## PERFORMANCE REQUIREMENTS

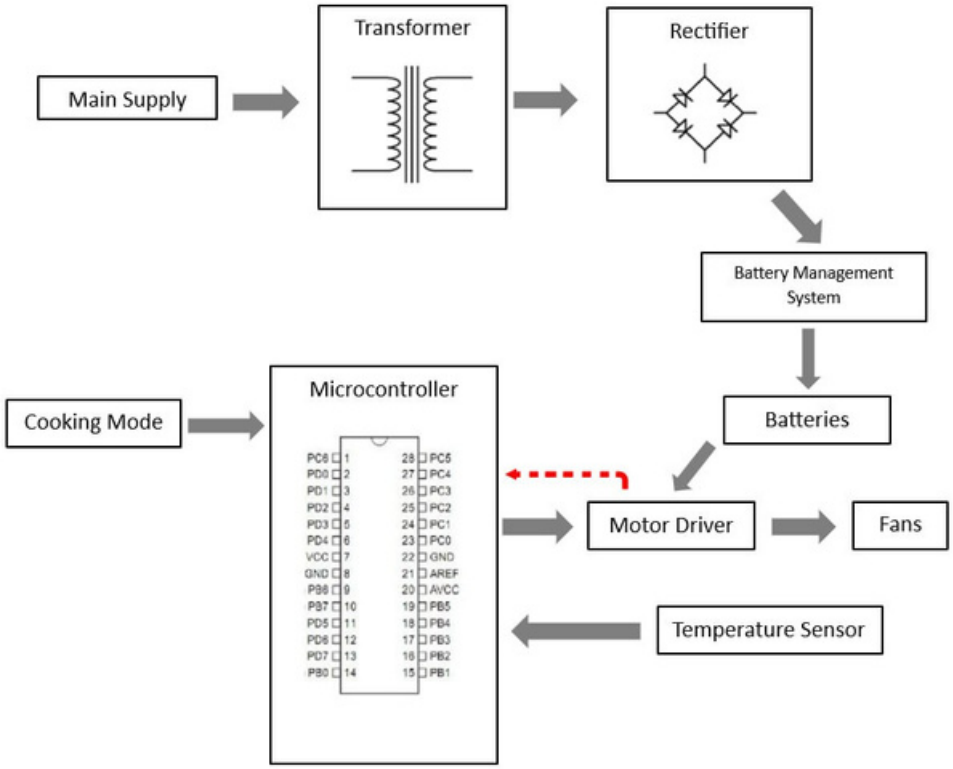
The stove offers features comparable to electric cookers but at an affordable price, ensuring efficient and precise cooking control. To achieve this, the design will incorporate a timer and multiple cooking modes, providing users with a range of cooking options. An automated fan system will regulate the temperature by controlling the oxygen supply to the charcoal, enabling efficient and precise control of the cooking process. This system will be powered by a rechargeable battery, allowing uninterrupted usage even during power cuts. Additionally, an indicator will be included to alert users of any issues with the burning process or insufficient charcoal. The stove will also incorporate an ashtray for easy cleaning and maintenance.

# Technical Specifications •••••

| | |
|---|---|
| Operating Voltage | DC 12-14V |
| Charging Voltage | AC 230V |
| Operating temperature | 25 ℃ to 240℃ |
| Power consumption | About 4.5 W |
| Dimensions | 45 x 30 x 13 Centimeters |
| Weight | 6 kg |
| Warranty term | 1 year |

# Product Architecture

## Block Diagram



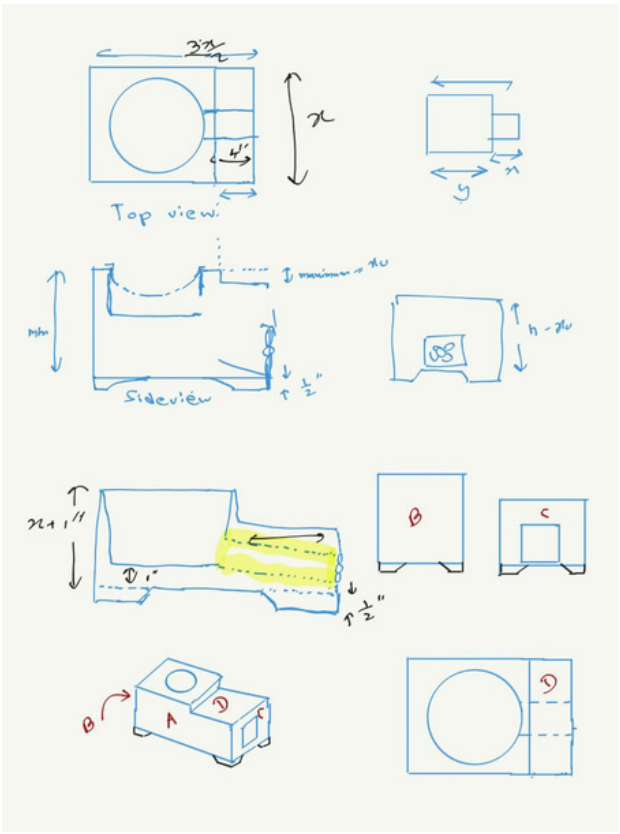

### Alternative and why choose specific components

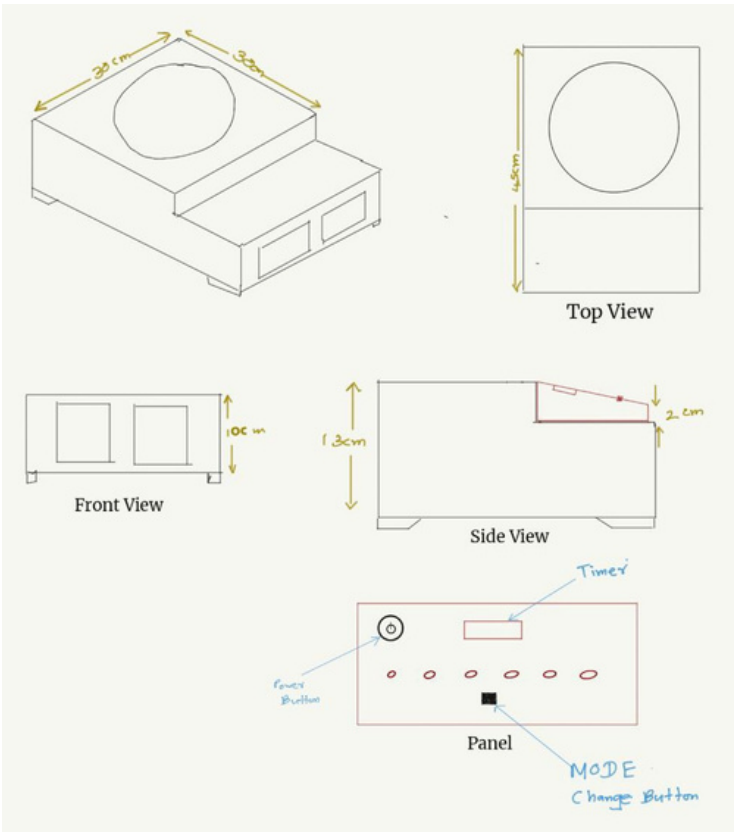
The ATMega328p-pu microcontroller was selected for its versatility, reliability, and ease of programming. The temperature sensor was chosen for its accuracy and sensitivity, making it a good choice for measuring temperature variations in the stove's environment. The L298N motor driver was chosen for its ability to control the current of fans.

# Product Enclosure

- Weight – 4kg
- Item dimensions – 30cm x 45cm x 13 cm
- Operating Voltage – 12V
- Color – Black & Brown
- Material – Wood, Plastic & Clay
- Power Consumption – about 5W

Opting for a wooden enclosure can lower the overall cost of the product while also providing the benefit of thermal insulation. The insulating properties of wood can effectively reduce the external temperature of the stove, making it a desirable option.




Initial Sketches

Final Sketches

# Project Budget and BOQ

| COMPONENTS | QUANTITY | PRICE (RS.) |
|---|---|---|
| L298N MOTOR DRIVER MODULE | 1 | 560 |
| ATMEGA328P MICROCONTROLLER | 1 | 1400 |
| HT-NTC 100K Thermistor Temperature Sensor | 1 | 340 |
| NTC Temperature Sensor Module- MD0410 | 1 | 200 |
| OSCILLATOR | 1 | 40 |
| LED LIGHTS | 6 | 60 |
| RESISTORS | 10 | 60 |
| ENCLOSURE | 1 | 2000 |
| PCB | 1 | 2000 |
| CAPACITORS | 4 | 80 |
| DIODES | 3 | 40 |
| TOTAL COST | | 6780 |

For the prototype it will cost Rs.6740. But when we produce 50 units it will cost approximately Rs.6000 per unit. We can fix the price to Rs.7500 for per unit with profit.

## User Interface

The user interface will feature a prominently placed display panel that showcases the timer and provides visual indications for the different cooking modes. The display will be designed with clarity in mind, ensuring that users can easily read the timer and understand the selected cooking mode at a glance. The cooking modes will be represented by intuitive icons or labels, accompanied by indicator lights that illuminate to provide a visual confirmation of the active mode. To enhance user convenience, we will include a power button that allows users to easily turn the stove on or off. Additionally, the stove will be equipped with a rechargeable battery pack, enabling users to utilize the stove even during power outages or when an electrical outlet is not available. The battery pack will provide a reliable power source, ensuring uninterrupted usage and enhancing the stove's portability.

## Marketing, Sales and Beyond

Our project aims to address the imminent rise in gas prices and the resulting energy crisis by developing a cost-effective charcoal stove that offers exceptional functionality. The current market presents overpriced electric cookers and low-functioning charcoal stoves as the primary alternatives for households. So we think our product can find a good market. Initially, we strive for prototype success. Then we decided to produce 50 units first. After that, according to market demand, we have decide to increase the production up to 200 units. We discussed that after the success of the product, we would try to get support from several microcontroller manufacturing companies.

# Our Team & Task Allocation

Dimagi D.H.P.
-210131N

PCB Design / Programming

Gamage S.B.P.
-210178M

Circuit Design


Hansindu K.A.A.
-210204R

PCB Design / Programming

Sirimanna N.T.W.
-210610H

Enclosure Design