

The Smart Electric Grate with Microcontroller and Energy Regulator Based Temperature Control and Automatic Tripping

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Abstract: This project reviews the Design of the Smart Electric Grate along with a resistive coil and with self-timer controlling operation which works on the “Law of Energy Conservation & the Joule’s law”. Nowadays, as we have seen that the Conventional Resistance Grate has some problems like poor efficiency, high power consumption problem and also no temperature controlling, no automation technique or else. Also we have seen that the Induction Heater has been widely used for the domestic purpose like cooking and for some other heating purposes. But due to its high costing, people sometimes hesitate to purchase Induction Grate. By providing some more advanced facilities for the benefit of customer like providing it in low cost than other Grates (Induction) which are available in market. For this, we used a resistance coil (Nichrome coil) in place of induction coil. Also we had modified the grate by controlling the temperature with the help of Energy Regulator. Microcontroller provides the time for the operation of Grate and also it provides the obtained temperature of the resistive coil to be shown on the display.

KEYWORDS:

Grate, Nichrome Coil, Energy Regulator, Microcontroller, Temperature Sensor, Relay Module.

I. INTRODUCTION:

Today is the modern civilization era. In present century, Electricity plays an important role for Human Development and new invention came in day to day life. Electricity and its day to day uses in various task makes Human life easier and comfort.

The goal of saving energy and having as constant reference the quality, the efficacy, as well as production costs is essential in order to make products on a large scale so that is easily accepted among the people. The increasing use of microcontrollers makes the integration of the new blocks easier because of their affordability and simplicity of implementation.

We have done such a project as the basis of making Human life easier, comfort and pollutant free of electrical grate which is daily in use in Human’s life. The problem of estimating the thermal state of an induction cooking system is analyzed. It must be emphasized that the reliability of the estimate depends not only on type of observer implemented, but also on the whole process.

As the price of the resistive coil is very less as compared to that of the induction coil, which provides them an Electric Grate in minimum price to human being rather than high prices of Electric heaters available.

We provide single phase, AC supply to an Electric Grate by the Single phase transformer that can step down as per our requirement. The output power of the step down transformer is then fed to the resistive type heating coil connecting with the temperature controlling regulator in series with it. According to the Joule’s law, when we apply voltage that cause the current to flow and when it flows through high resistive coil, the energy losses in the form of heat which is given by the eqⁿ,

$$Q = I^2 R t,$$

which is used in our project for the production of heat. To make an Electric Grate work smartly, we have used a microcontroller to the operation of the digital electronic display to show the produced temperature which is produced by the coil and that produced temperature sensed by the temperature sensor and trip Off the circuit according to its automated programming which makes this Grate as a Smart Electric Grate.

II. OPERATION:

Firstly, we have applied single phase 230V supply to an Electric Grate with the help of Energy Regulator that we can vary the voltage as per the requirement. In proportion with voltage, current will

flow in the coil which is resistive in nature. The high amount of heat produced in the coil by Joule’s law i.e., I^2Rt . This produces high heat that we can use for various purposes.

A microcontroller is placed here to provide an automatic operation according to the time, and the required voltage for the microcontroller is taken from supply voltage through step down transformer and rectified it by full wave rectifier filter and regulated IC to provide the required output voltage of 5V to the microcontroller circuit. Along with the microcontroller, a temperature sensor is interfaced whose function is to sense the temperature generated by the resistance coil and takes a reading of generated temperature and shown directly on the Liquid Crystal Display (LCD).

When the proper temperature is obtained then it sets that particular temperature for instant of time and after that time interval, the temperature sensor senses and gives a feedback signal to the trip circuit through the microcontroller and power supply is cut off by the trip switch i.e., Relay module which is connected just after the Energy Regulator in the circuit.

The main function of the microcontroller is to provide a continuous supply to the Grate by the relay module coming from the supply and make a Grate work continuously. A timing input keypad connected with microcontroller is used to insert the time to which the Grate is to be operated for a particular time setting and after the decided specific period of time, the microcontroller gives the feedback signal to the relay module and trips the circuit and steps the function of the Grate.

III. BLOCK DIAGRAM:

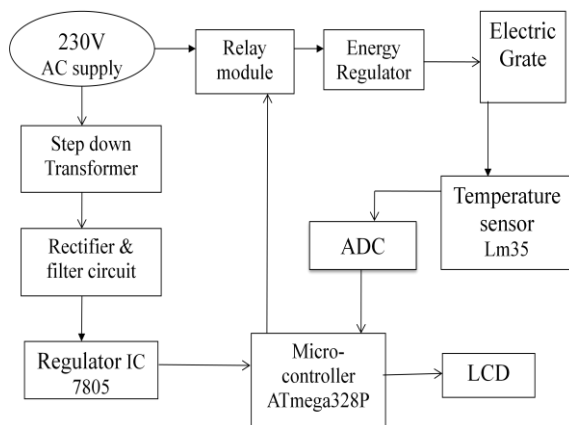


Fig 1. The block diagram of the Smart Electric Grate

IV. CIRCUIT DIAGRAM:

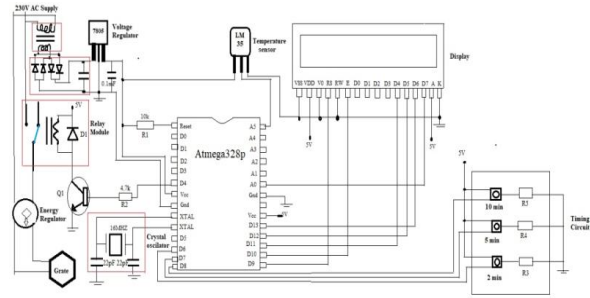


Fig 2. The circuit diagram of the Smart Electric Grate

V. COMPARISON:

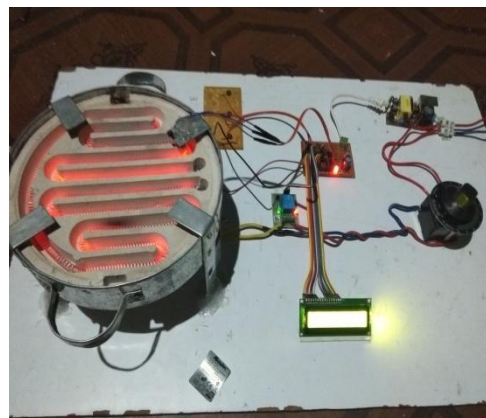
In market, there are some similar products are available like Previous Electric Grate models, Induction Heaters (Grates). These have the function of generating heat which is been used for cooking purpose. Moreover these Heaters/Grates have high cost price and consume more electric power.

As the newly designed Smart Electric Grate which is quite cheaper than other products, having a facility of temperature controlling and automatically tripping which helps to save the electric power and available at low cost and with maximum efficiency and reliability.

VI. RESULTS:

This Smart Electric Grate project model is done successfully and works accordingly as we have discussed in operation like giving controlled temperature as an output and functioned automatically according to time basis whatever the time we provide to the Grate, it will automatically trips after the command is completed successfully.

VII. THE SMART ELECTRIC GRATE:



VIII. FUTURE SCOPE:

As we have designed Smart Electric Grate having some smart function in addition of more work

and research some modification can be done in this Grate like we can study the temperature ranges for cooking various food items/dishes like for milk boiling, water boiling, preparation of rice, etc. and can directly set the temperature of above mentioned foods and many more. So the human efforts will be less. Just person have to switch ON the Grate and go back and can do their work, the Grate will functions smartly and will automatically switched OFF.

IX. CONCLUSION:

The smart operations of Resistance Electric Grate is explained in this paper which makes human life better and ease to operate such inventions in this era of technology and invention.

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