A Microcontroller Based Electric Cooker/Oven with Temperature and Time Control for the Developing Countries.

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Abstract

This article presents the development of a novel microcontroller based electric cooker/Oven with time and temperature control. It employs the rich application of ATmega8-microcontroller as the core component. The system is software driven through the C-language code written to the microcontroller. Temperature control is achieved using a temperature sensor (LM35). The sensor monitors and measures the temperature of the system, keeping it at a preset value. The internal timing function of the microcontroller is used to time the cooking, baking or drying process. This whole cycle of temperature and time control is repeated until the set time elapses or until the item being cooked, dried or baked is ready (that is when the time is set to infinity mode). These processes conserve power and essential food nutrients. The cooker/oven is a cutting edge innovation and it is efficient, reliable and user friendly.

Keywords: *Energy conservation, microcontroller, control, efficiency*

Introduction

Energy has been identified as an indispensable factor that enhances the socioeconomic development of a country (Rahman, M. M. et al) 2012. Socio-economic prosperity is said to dependent largely upon energy conservation (Yong, K. P et al). Satisfying the need of required energy to be consumed in any given society will require that while the Government and private organizations are making effort to generate sufficient electricity, as much as possible the citizenry must devise means for optimum utilization (Rahman, M. M. et al) 2012. Most electric cookers available today lack the vital aspect of control, which has led to several losses ranging from food burning, power wastage, human losses etc. This among other factors has inspired the need of integrating control in electric cookers in a bid to reduce to the barest minimum or completely eliminate some these losses. The major parameters that can often be controlled in an electric cooker or oven are the cooking temperature and time.

Generally, control of temperature and time can be realized in two ways; either using analogue designs or digital designs. Analogue designs generally make use of simple timers and thermostats to regulate the time and temperature respectively where as digital designs make use of components such as microcontrollers, sensors, integrated circuits etc.

Digital designs generally offer the advantages of more precision and accuracy, cheaper cost, less susceptibility to noise and interference from the circuit, easy troubleshooting, more flexibility etc over analogue designs (Bany Wooland G) 1984.

This paper continues in the following pattern: part 2 presents a review of related works, part 3 describes the concept of microcontroller based electric cooker/oven, part 4 deals with

Performance evaluation, part 5 presents discussion of results, and the conclusion is presented in part 6.

2. Related works

Md. M. Rahman et al (2012) in their work titled Microcontroller Based Smart Natural Gas Oven recommended that meeting energy demand at desired level requires taking initiative to increase gas supply and ensuring its optimum utilization.

3. Description of Micro-Controller Based Electric Cooker/Oven

On switching on the device, it is required that the user set the temperature, and afterwards the time is required to be inputted by the user. The LCD is used to communicate with the user as an output device (Hitachi Semiconductors and inctegrated circuits, 1998). The user can decide to set the time to infinity mode if he or she does not want to set time limits. The relay then switches on the hot plate element and the temperature sensor LM35 begins to measure and monitor the temperature of the system (National Semiconductor) 2008. As soon as the temperature exceeds the set temperature, the coil of the relay is energized and the relay operates and switches off the hot plate element. It remains off until the internal temperature of the system drops again and the relay is energized once more and it switches on the hotplate element once more. While all this is going on, the time continues to decrease (that is if not set to infinity mode) and as long as the set time has not elapsed, the whole cycle continues to repeat itself until the set time elapsed. This control is achieved by means of the C language code written to the microcontroller (ATMEL Corporation, 2011). The flow chart for this programme is as shown in figure 1.

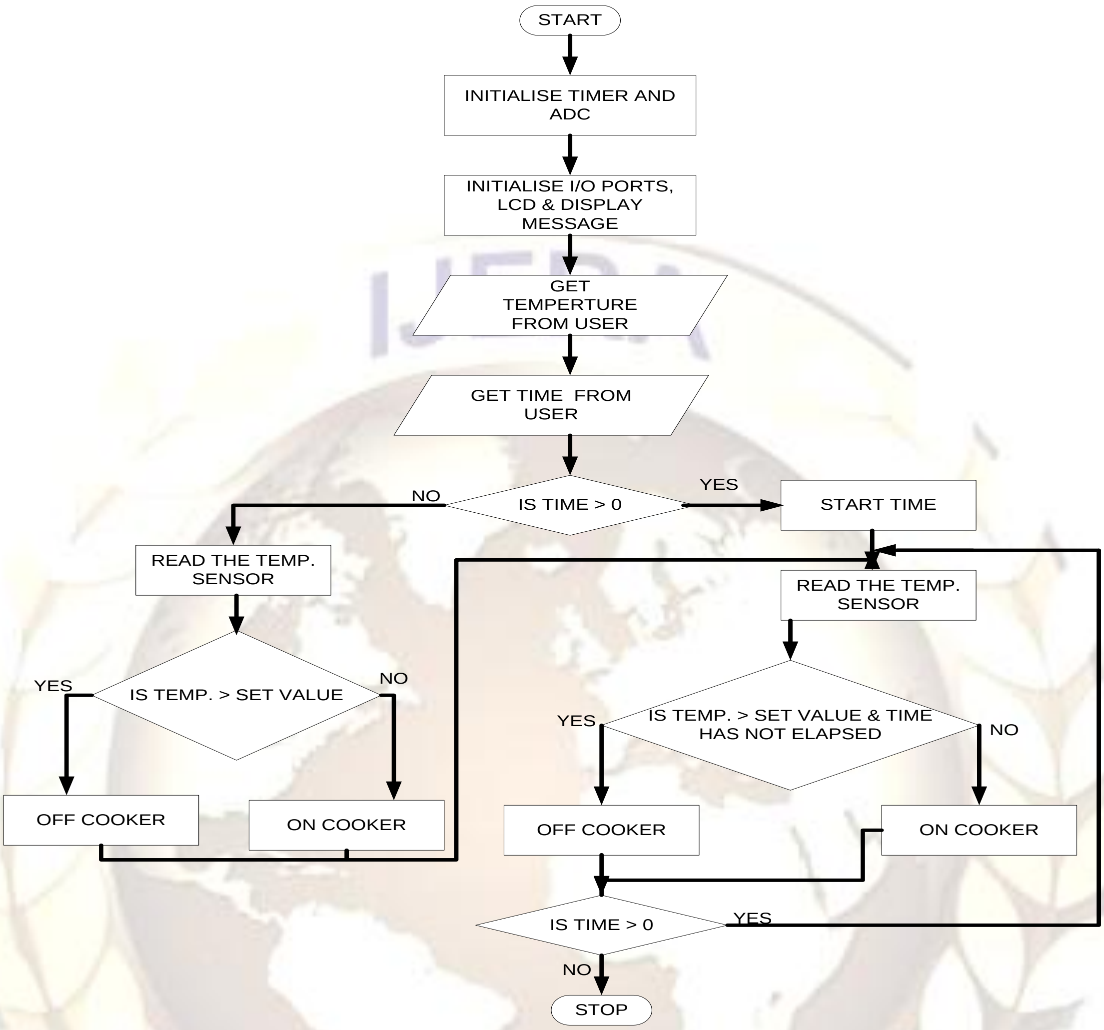

Fig 1: flowchart of program cycle.

4. Performance Evaluation

In this section, an evaluation of the performance of the microcontroller based electric cooker/ oven was computed. The cooker/oven operated well as expected. The cooker switched off at intervals indicating that the set temperature had been exceeded and thus saving power. When the set time elapsed, the cooker went off automatically indicating that the program cycle worked properly. The tests were carried out at a voltage of 230 V.

5. Results and Discussion

The bar chart of figure 2 compares the duration of cooking some selected items using both the micro-controller based electric cooker/oven and unregulated hot plate under temperature and time control. It is observed that the unregulated hot plate element cooks faster than the microcontroller based electric cooker/oven. However, as can be seen the time difference is very small. The difference is minutes.

NB: On the vertical axis time is measured in minutes.

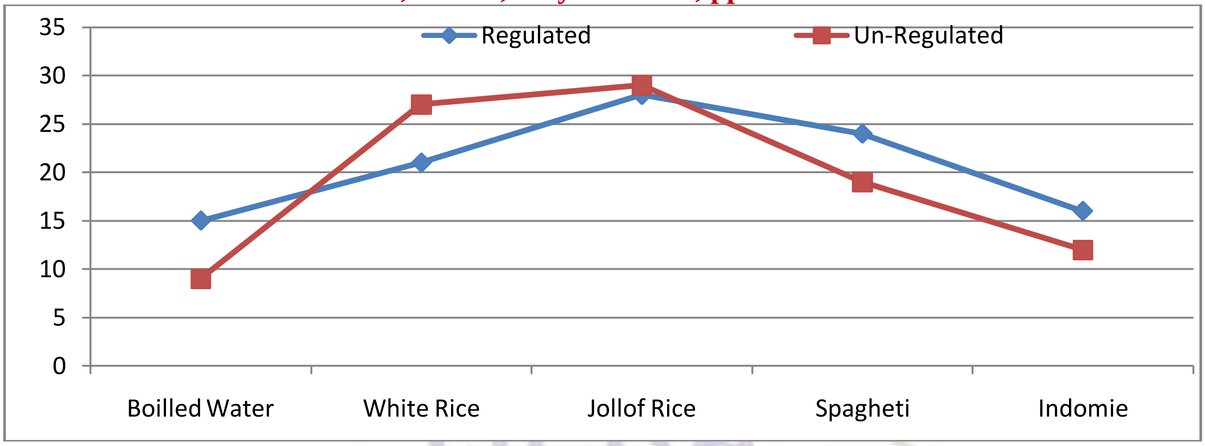

Fig 2 Bar Chart comparing time taken to cook

6 CONCLUSION

From the tests and analysis carried out, the time lag in cooking ranges between 1 to 6 minutes approximately. For two of the items, the cooker/oven outperformed the hot plate while for the rest the hot plate did better. However, electrical energy is conserved due to the fact that without monitoring the cooker/oven goes off at the time set; while the unregulated hot plate except continually monitored, goes on dissipating energy even after the item on it is ready for use or consumption. Hence we conclude that the cooker/oven is an efficient energy conserver.

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