

Automation of a Conventional Gas Stove

Tejveer Singh Goraya ¹, Abhinav Sridhar ²

^{1&2} Under graduate Student, Dept. of Electronics Engineering, Vivekanand Education society's Institute of Technology, Chembur, Mumbai-74

Abstract - An automated Gas Stove is a product that can be incorporated to the conventional gas stove to give it the gift of automation. It uses a microcontroller, servo motors and some sensor units. The user only needs to enter the number of intervals, the time in each interval, and the amount of flame required in each time interval and then the complete process is then automated. This finds great use for working individuals, households with small children, where looking at the stove for the complete time is not a feasible option. It also provides a safety feature in case of a gas leakage.

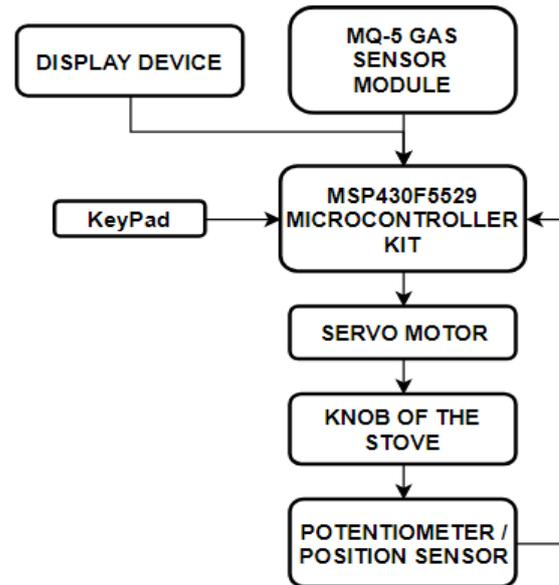
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1. INTRODUCTION

Over the course of time, almost all household appliances like the mixer, washing machine, television have been automated to an extent and the only constant in the last 25 years has been the gas stove. There are induction stoves and microwaves available but it does not satisfy the purist. Moreover, the occurrence of people leaving their food on the stove unattended, is not uncommon, which results in wastage or inferior quality of prepared food and also damages the utensils in certain cases. The main aim of the project is to incorporate an automatic extension to the normal gas stove using simple apparatus like servo motors to avoid such situations.

The project was realised using an MSP430F5529^[1] Launchpad microcontroller board manufactured by Texas Instruments, MG996R Servo Motors^[2], MQ-5 LPG Sensor modules^[3], 16*2 LCD Display, 4*4 keypad and a potentiometer. A knob from an old gas stove was taken for testing purposes.

1.1 Block Diagram



The working is divided into 3 sections: 1) Motor interfacing and working 2) Configuring I/O devices 3) Additional protection features

1.2 Motor Interfacing And Working

The motor used in this application is an MG996R servo motor, capable of giving a torque of 10 Newton- Metres, along with 360° rotation. It weighs around 55 grams, and works in 6V DC voltage. One of the PWM enabled pins on the MSP430F5529 Microcontroller is used to drive the servo motor. There are 4 possible positions of the knob possible which is 0°, which corresponds to off, 90° which corresponds to low flame, 135° which corresponds to medium flame and 180° which corresponds to high flame. Since the 360 degree variant of a servo motor only takes velocity and not position as the input, appropriate negative feedback was introduced. A potentiometer is connected to the motor which indicates the current motor position, and by determining the value of that variable and the desired position, the direction and duration of rotation was decided. When the desired position of the motor and the current position are different, the motor moves in the

direction in which the difference starts reducing. This is how the direction of rotation was determined.

Except for 0° or the off position, once the motor reached within a 5° band of the desired value, it was considered satisfactory. Precaution was taken such that if the knob is not at off position whenever the system is turned on, it is brought back to zero before implementing any other functions. Also, the last position of the motor is set by default as off, to avoid hazards. In order to operate the Servo Motor, the library Servo.h^[4] was included in the IDE.

1.2 Input / Output Devices

A 4*4 Keypad HEX keypad is used as a keyboard to enter the values as the number and flame type, and a 16*2 LCD Display was used to display the current status and to convey to the user what input is next required. The number of stages in which the cooking is to be done, say a particular amount of time in the required flame level, and the same specifications for the next levels are defined first by the user using the keypad and LCD display provided. Once the user presses start, the values of time and the corresponding values of the required value of flame is stored and the stove is kept at the required flame till the delay counter finishes counting. As soon as the last set of flame and delay is completed, the position of the knob comes back to zero. The keypad operation and LCD display operations were carried out by invoking their respective header files, Keypad.h^[5] and LCD.h^[6], in the IDE

The code was uploaded to the microcontroller board using Energia^[7], an open source IDE which can be used to upload code in high level languages to the microcontroller boards manufactured by Texas Instruments.

2. Additional Protection Features

An additional safety feature given is the use of MQ-5 sensor, which detects the presence of LPG. In case the user does not light the stove in case of non auto ignition stoves or the flame gets extinguished at some point due to various reasons, this will save the place from a possibly hazardous explosion. As soon as the sensor senses presence of LPG beyond a limit in the air, it will set the position of the knob to zero again, irrespective of the current processes that are taking place.

3. Future Scope

The current system was incorporated on a single burner stove. The further plan of action is to expand the system to

work also on a multiple burner stove. We also intend to incorporate semi autonomy to the system, which would mean that the user does not need to always depend on the command of the machine to change the position of the knob. However, the position of the knob will be registered at all times, and the protection mechanism will always be on. We also intend to make a mobile application for this purpose, using which, the system can be controlled from another room, using Wi-Fi, and certain user preferred patterns can be saved as favourite, which would also save the time to input all details. Also data like gas consumption, time for which the stove was used, can be recorded on that application, thereby making the system IoT enabled, having the potential to be a part of the next generation smart home.

4. CONCLUSIONS

As everything around is undergoing automation and being redesigned with a modern approach. We have tried our best to automate a conventional gas stove to best of our abilities and prepared a working prototype for the same.

ACKNOWLEDGEMENT

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