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Voice Enabled Gas Controller

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Abstract
Indian middle class aged women sometimes suffer from the body ailments restricting them to work in the kitchen handling the LPG gas stove. It is observed they often forget to timely control the Gas Stove functions; such as keeping the items in high flame, simmer adjustments of the knob, switching off at night makes them unhappy as the taste of the food changes. They prefer technical assistance of to perform such functions makes life easy. This project aims to meet the above requirements, viz, using smart phone, Bluetooth module, GUI, DC Motor to operate the gas knob for the positions High, Simmer and Off.

Keywords; *LPG gas stove, ArduinoNano, Bluetooth(BT) module, GUI, DC motor*

INTRODUCTION

Voice enabled gas controller controls the gas knob using wireless communication. Wireless communication devices like Bluetooth, Wi-Fi module controls the system using Smart phone. Elderly people usually forgot to control the gas stove. This may lead to gas leakage. Implementation of this system notifies the user in the form of status which improves comfort and safety to the user. [1]

Smart home automation is a technology which allows the user to control the home appliances using wireless communication devices. Implementation of the smart home automation improves comfort and safety to the user. System with automatic gas booking and safety of the user is also implemented by notifying the level of gas in cylinder and book the gas according to it and alerts the user if any gas leakage occurs to the system. [2,3].

It is necessary to spend most of the time in kitchen for cooking food. Various activities are performed which increase temperature in kitchen. It is very difficult for elderly people to monitor the gas stove continuously by staying in the kitchen. A dire need to design a system with low cost and high reliability to monitor and control the gas stove [4].

In today's scenario Smart Phone is a very essential component. It contains various wireless protocols like Wi-Fi, Bluetooth.etc. Using these protocols with Android application helps to control the system using Smart phone. Notification in the form of SMS alert is given to the user and gas connection can be switched off from the main supply when the gas leakage is detected. [5, 6]. This system is designed for automatic controlling of gas knob shaft with the help of DC motor as per the commands received from the Controller Engine. System with low cost, user friendly high end gas stove unit is developed for controlling the application [7].

Mostly, elderly people find difficulty in timely control of the LPG gas stove. Elderly people usually forget to control the gas stove. This spoils the taste of the food. It is also very difficult to be always in kitchen observing food. To avoid this Smart gas knob controller helps to control the gas knob using smart phone. Home appliances communicate with controller unit using wireless communication. Controller unit commands are send to wireless communication device. It is necessary to have a Bluetooth technology, which acts as a best wireless device to control home appliances from remote places [8].

The proposed solution implements a voice enabled gas controller consisting of a n ArduinoNano board and Bluetooth module (with built in Bluetooth stack) to

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control Gas Stove Unit and to monitor the position of Gas stove. Position control algorithm is developed to send the control commands from Bluetooth module. The shaft of gas knob is controlled mechanically using a DC motor according to received control commands.

Conventional system of Automatic safety gas stove is designed for elderly, people with special abilities or in any specialization. It can be easily implemented in existing home improves comfort, safety and making use of high end gas stove in more convenient manner [9]. Electricity from gas stove is designed to generate electricity from the heat utilized in gas stove. Heat energy is converted to voltage by Thermo-electric module helps to generate the voltage while cooking in the kitchen. [10].

1. SYSTEM OVERVIEW

Overall system functionality diagram is shown in Fig1.

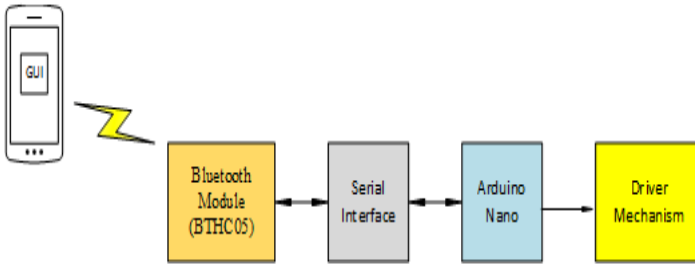

Fig.1. System Functionality diagram

A. Mobile : Smart phone with Android operating system is used to send the user commands:

i) Manual mode: High, Simmer, Off

ii) Auto mode: Time period for high-sim, sim-off, Time reset, Time period reedit.

B. BT module: It has Bluetooth stack with a serial interface. It has master, slave configuration modes. [11]

Initialization process:

i) The module set, act as a master mode and mobile acts as slave mode.
ii) Bind and Pair commands are used for pairing with the Mobile unit.
iii) The module is set as slave mode.

The baud rate for the initialization process is 38.4kbps and the baud rate for data transfer is 9.6kbps. Initialization has to be done during impairing of the Bluetooth module.

C. GUI: It is developed using "Bluetooth Electronics" app loaded in the BT module. It is used to send control commands from mobile unit to controller engine using Bluetooth module. The GUI is shown in Fig.2.

Fig.2. Graphical User Interface (GUI)

D. Controller Engine: It controls the DC motor according to the commands received from the mobile unit and communicates the LPG shaft position to the user.

E. DC Motor: It is a geared bipolar DC motor with a torque of 8kgcm. Controlling of the gas valve after detection of the gas leakage from the microcontroller unit is presented in this paper. In this project DC motor controls, the shaft of the gas knob at various positions. [11, 12].

2. CONTROLLER ENGINE

Block diagram of the controller engine is shown in Fig3 and the explanation of subblocks is shown below.

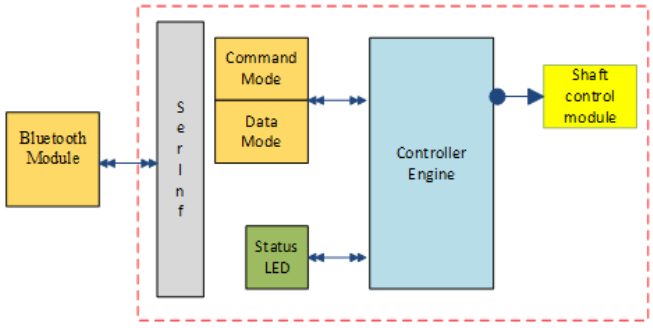

Fig.3. Block Diagram of Controller Engine

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SerInf: It receives control commands (High, Simmer, Off) from the mobile unit. It transmits shaft position status to the mobile unit

Command and Data mode: It is responsible for Bluetooth module initialization and establishes the communication data link with the user.

i) Command mode: It is used for configuration of the Bluetooth module. Required baud rate is 38.4kbps.

ii) Data mode: It is used for exchange of data at a baud rate of 9.6Kbps.

Controller engine: Arduino Nano module is used here as a controller engine [13]. It receives commands from Bluetooth module via Serial interface.

It controls the Relay unit. Supply given to the relay unit controls the driver module of the DC motor. The DC motor rotates according to the control commands issued by the user.

Relay and Driver control logic: Relay is an electromagnetic switch which operates in lower voltages and it can power a high voltage or high current devices. It controls the driver logic of DC motor.

H-Bridge: The Driver module switches the polarity of a voltage applied to load. It is designed to accept standard TTL voltage levels and drive inductive loads (Relay, DC motor, etc). It acts as a bridge between the controller and the motor. The function of the H-Bridge is to drive the DC motor and switch the polarity of the voltage applied.

3. POSITION CONTROL ALGORITHM

Upon sending wireless commands through smart phone, it first checks the initialization of the Bluetooth module. After binding and pairing of Bluetooth module, it is confirmed that the device is indeed a transceiver. Pairing password has to be entered for the establishment of connection. The flow chart is shown in Fig4.

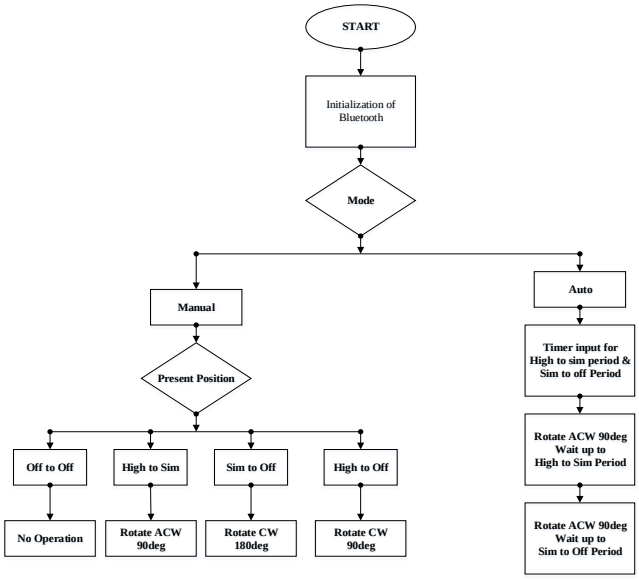

Fig.4 : Flow chart for Voice controlled gas stove

Terms : ACW- Anti clock wise, CW- Clock wise

Position control commands to be issued from the Mobile unit is shown in Table 1.

TABLE 1: POSITION CONTROL COMMANDS

S.No	Position of the gas knob	Control commands
1	SIM	sim or 0
2	HIGH	high or 1
3	OFF	of or 2

"Bluetooth Electronics" is the application of Android OS will be processed after establishment of Bluetooth connection. It is used to send control command from the mobile unit using the features such as Button, Slider, Indicator, etc. Initially, select the mode of the system in which it is going to be operated. It mainly consists of two modes: 1) Manual mode, 2) Auto mode

After choosing mode of the system control commands are sent as per the required position of the user. These commands are sent to the controller engine via Bluetooth module. Controller engine controls the position of the gas stove unit using DC motor.

1) Manual Mode: Initially, notifies the present position of the gas stove. As per the control commands received from the mobile unit, DC motor rotates the shaft of the gas knob to required position (High, Simmer,Off). Manual mode is shwon in Fig5 .

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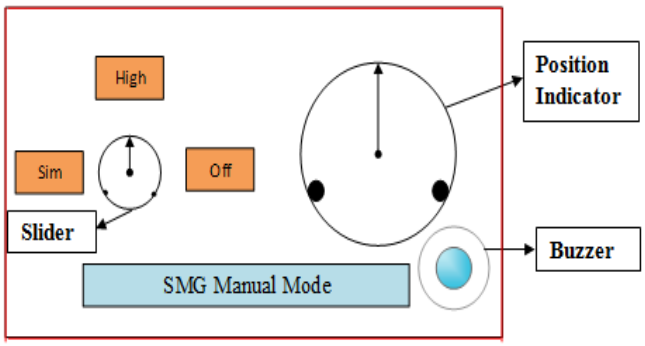

Fig.5: Manual Mode

2) Auto Mode: In Auto mode user initially sends auto command to keep it in High position. Later, time period has to be given for positioning it in High-Sim and Sim-Off positions. Motor automatically goes to Off position after completion of the time. Auto mode is shown in Fig6.

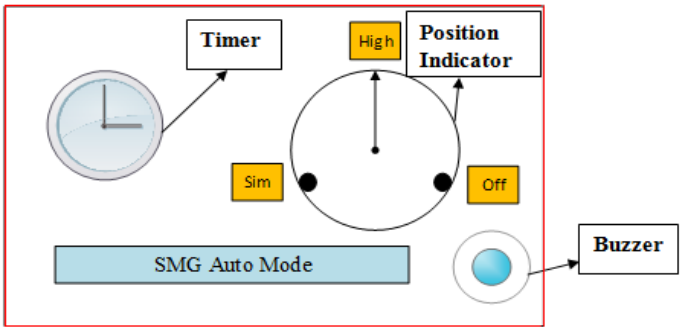

Fig.6: Auto Mode

4. RESULTS AND ANALYSIS

The design is developed using Arduino Nano board. Hardware setup for validation along with the Gas stove unit is shown in the Fig.7 and Fig 8.

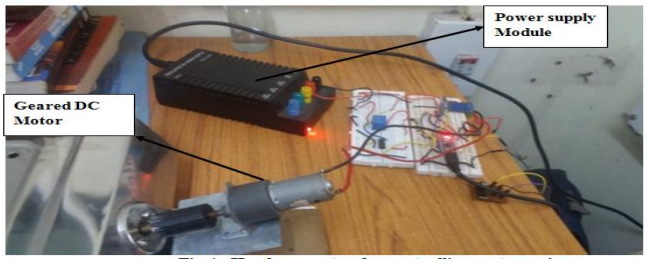

Fig.7: Hardware setup for controlling system

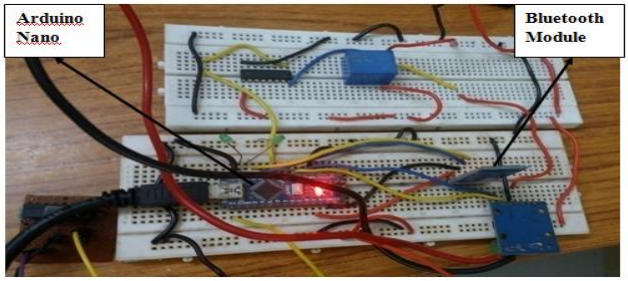

Fig.8: Bread board with Hardware components

5. CONCLUSION

In this paper, we proposed a voice enabled gas controller and its architecture. Hardware setup results are tested using Arduino Nano board. LPG shaft controller unit is successfully operated with the design. LPG gas stove unit is operated in Voice enabled, Manual and Automatic modes using GUI. This system is validated in Indian LPG gas stove. The design incorporates gas leakage sensor integration which leads to smaller foot print, design miniaturization and price.

6. FUTURESCOPE

With sufficient care in the design IoT could be incorporated in the design. However, we foresee a risk of controlling the gas stove with IoT. Unless sufficient care is taken to control and to monitor the gas, the gas inflow may lead to catastrophe. The design could also be used for controlling other House hold home appliances.

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BIOGRAPHY

K. R. K. Sastry received his B.E in 1986 in Electronics and communication Engineering, Andhra University, Visakhapatnam, India. He completed his M.Tech in 1989 in Opto Electronics and Optical communications, IIT New Delhi, India. He has Rich industrial experience in Telecomm and VLSI. He has Authored many IP cores in VLSI. His main interests are in VLSI based designs and validation. He is working as an Associate Professor, in the Department of Electronics and communication. Engineering, Gayatri Vidya Parishad College of Engineering, Visakhapatnam, India

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