Angular Flame Hybrid Stove with Auto Align Base Frame

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Abstract- Liquified petroleum gas, a non-renewable source of energy is used on a large scale as a fuel in cooking. Increasing amount of fuel consumption year after year will lead to the depletion of the fuel. In this article, author proposes to combine more than one energy for cooking purposes. Combining electromagnetic induction technique with the conventional liquified petroleum gas burners will remove the dependency on one kind of energy making it available for more time. The proposed smart stove will consume much less space and provide better cooking experience while keeping the non-renewable energy conserved and ensuring the safety of the user.

Key Words: Liquified petroleum gas, non-renewable energy, fuel, electromagnetic induction, smart stove, safety.

1. INTRODUCTION
Liquified petroleum gas (LPG) is used as cooking fuel all over the world. LPG consists of propane and butane gases which are abstracted from crude oil. Crude oil is a non-renewable source of energy which is being imported from other countries in India. India itself has a very large market for LPG as all the conventional gas stoves use LPG, to reduce the usage of the fuel electric cooktops came into existence but the power consumption was high in these cooktops, to reduce the power consumption and making cooking much safer induction stoves [1] were introduced. In a country like India where villages are still in the process of development and where literacy rate is not 100% removing conventional gas stove with induction stove is not possible to overcome this obstacle a gas stove with both induction and gas burner [2] is introduced but the main drawback of this design is that it occupies much space and as both the burners can work at same time double the energy is being wasted. In India where population is growing at a high rate and technology is getting smaller day by day the available space for a specific task is reducing.

The system proposed in this article consists of a single burner which works on both LPG and induction i.e. Electricity. By using both the energies in one stove we are reducing the size of the stove and as only one mode can work at one time energy is not getting wasted. the holes of the burner [3] are designed in such a way that no hot spot is seen on the utensil which makes cooking process faster and thus reducing the consumption of non-renewable source of energy.

To reduce the consumption of Liquified petroleum gas, electronic and induction stoves were invented but consumers are much dependent on domestic burner which uses liquified petroleum gas only to cook food. Completely removing gas stoves on which the whole population of country is dependent on for cooking is not a good idea. Besides replacing, both gas stove and electromagnetic induction stove are combined together in a single burner to reduce space and reducing the consumption of one kind of non-renewable energy.

To make the burner safe for user use an LPG sensor [4], metal detector, thermistor and Node MCU is used to make it smart and safe for the user as the user can monitor the system [5],[6].

2. PROBLEM STATEMENT
Population is increasing at a very high rate thus the demand for basic needs is also increasing. Food is the basic requirement of human body and cooking it is must to kill bacteria and other germs in food.
To cook food LPG is being used at a very high scale about 75% of crude oil from which LPG is extracted is being imported from other countries.

As this cooking fuel Liquified petroleum gas, is stored in closed cylinders there are times in our daily life where we are short of liquified petroleum gas which leads to unavailability of food and inconvenience in our daily life routine. People keep spare induction stoves to avoid such situations but it consumes more space and money just for solving an inconvenience.

Generation today is working towards preserving our mother earth by using less amount of non-renewable energy but due to one obstacle or other we are always one step behind for example: old age people have difficulty in understanding new induction stoves while youngsters easily understand and uses the technology here we have the technology gap which can be removed by combining both the techniques thus making it usable by old and young both and along with that using least amount of Non-renewable energy.

In restaurants where food is being prepared at a very large scale just to keep the food hot a lot of LPG is wasted making food costly and exhausting a non-renewable source of energy.

3. DETAILS OF THE SYSTEM
Working of hybrid induction smart gas stove has many processes to have a better understanding of the processes they are given below in detail:

1. Heating of utensils
In this hybrid induction smart stove, a switch is provided which has two operating modes. First – Induction mode, second - Gas mode. When the switch is turned to gas mode, a signal is received by microcontroller which commands the metal frame to move upwards to a length of 1.5cm. Motor is connected to the vertically upward moving frame (fig: 1) which rotates and moves the frame vertically upwards which is used to place the utensil while cooking on gas stove. The frame which is used to place the utensil for cooking is connected to an open circuit (fig: 2). When the utensil is placed on the frame the circuit gets closed giving signal to microcontroller which in return gives command to the valve to open for the flow of LPG. Parallelly microcontroller commands the gap igniter to ignite the gas coming out of valve, gap igniter used 5v dc to ignite the LPG. The holes through which the gas is coming out is not cut in circular mode but are cut in horizontal mode in a shape of rectangle(fig:3). There is a tube through which the gas comes out through rectangular holes which are inclined at an angle to increase the area which is exposed to the flames. There are 4 such lines from where gas can come out which can be controlled with a knob. The LPG coming out through horizontal holes deduces the time consumed to cook food thus reducing the consumption of LPG gas while working on Gas mode.
When the switch is turned to induction mode the frame which is connected to motor moves vertically downwards giving space to place the utensil on cook top on the copper coil which is isolated with the help of ceramic plate. As soon as we place the utensil on cooktop due to electromagnetic induction eddy currents will be produced which will start heating the utensil for cooking. There are two coils which are under the ceramic plate which can be used separately depending on the size of the utensil. We can use utensil of any size on the cook top as we are using two coils to produce electromagnetic induction.

A thermistor is placed in the centre of the plate to keep the temperature under control. A voltage-controlled oscillator is used to control the eddy current which produces heat in the utensil that is, a voltage-controlled oscillator is used to control the temperature of the utensil in which cooking takes place. There is a fan connected to micro controller, when there is rise in temperature which is detected by the thermistor the fan starts and reduce the temperature of the coils.

2. AUTOMATIC SENSING PROCESS

In hybrid induction gas smart stove sensors are connected to microcontroller to make the stove safe for the users. MQ-5 the liquified petroleum gas sensor is used to sense any leakage of LPG, when MQ-5 detects any leakage microcontroller commands the gas valve to close and send a message on phones with the help of Node MCU [5]. Thermistor is used to detect the temperature of the induction
copper coil, when temperature rises above a limit microcontroller sends a command to fan to start which reduces the temperature of the coil. Metal detector is used to detect on which coil the utensil is placed thus saving energy from being wasted, coil on which metal is detected is turned on and produces heating effect in the utensil. When an area of more than 50% is covered by the utensil only then the current in the coil moves thus producing heat in the utensil. Node MCU is connected to the micro controller to give user a wireless control of the knob to adjust the flame level among low, medium, high, full. To make the knob move automatically a servo motor is used connected to the knob which can be used manually and through mobile phones. The whole system is connected through Wi-Fi when the system is not connected then the motor will work like a simple knob to change the flame intensity [6].

3. SOURCE OF ENERGY
Cooking is highly dependent on Liquified petroleum, which with time is getting depleted thus to avoid any crisis we are integrating two types of energy together that are electricity and liquified petroleum gas. This burner is different from any burner till date available in market as it can work on both liquified petroleum gas and electricity that too on same burner without using up much space in the kitchen. Factor which makes it unique is whenever there is unavailability of one energy it will continue to work not producing any inconvenience in daily life. There are times if we want to switch from one energy to another, we have to change the whole burner but, in this burner, we can use it on electricity and gas both or either one of them without changing the burner.

4. WIRELESS CONTROLLING OF SMART STOVE BURNER
Node MCU is connected on micro controller (fig:4) which on the one end is connected to mobile phone and on the other with stepper motor to adjust the flame of the burner when on gas mode. This gives wireless control of burner to user making the stove smart and safer as the flames can be adjusted from a distance.

5. VERICAL MOVEMENT OF FRAME
The gas stove needs air to function properly and a stand to place utensil. In conventional stoves a fixed metal frame is given on which utensil is placed but, in this invention, fig:1 we are using movable 4 pillar like structures arranged in a circular pattern to give the utensil stability. Metal frame is moving vertically up and down to provide space for gas stove and induction stove as we need plain surface for induction stove while we need air between the utensil and gas in Gas stove. This mechanism is introduced to make the system convenient for the user. The frame is connected to a metal piece which is moving on a pole which has threads on it. One end of the thread pole is fixed and the other end is connected to motor, when motor rotates in clockwise direction the frame moves vertically up while
when the motor moves in anticlockwise direction the frame moves vertically downwards. Motor is connected to microcontroller which commands the motor to move when the switch is turned to Gas mode.

6. MOVEMENT OF LPG GAS
when the switch is on the gas mode and utensil is placed on the frame open circuit gets closed then only microcontroller commands the gas valve to open. Microcontroller commands flame to burn at low mode. If the user wants to cook at any other mode or increase the intensity of the gas flame it has to be done manually by rotating the knob. To increase the intensity of the flame 4 valves are connected separately to different rings from which gas comes out. After the gas moves from the valve holes are provided in the pipe at a regular distance for the flow to air in LPG without air burning of LPG does not take place thus for proper burning and flame exposure holes for air are provided. The pressure of gas is so high that no leakage is observed through these holes.

7. HORIZONTAL HOLES OF BURNER
In hybrid induction gas smart stove horizontal holes are used besides circular holes which would increase the contact surface of the flame with the utensil and thus preventing heat spots on the utensil. Horizontal holes will cover better area than the circular holes when utensil is placed over flames. As the area covered by the flame is more the heat distribution is more and faster as compared to the conventional burners [8]. Holes have a metal rectangular piece attached to it inside the pipe so that the gas which comes out is inclined at an angle to cover maximum area and provide better experience in cooking. The figures given below (fig-5) prove that the gas coming out of inclined horizontal opening will cover more area of a utensil than the gas coming out of circular holes cover.

Fig:5 Circular holes  

Fig:6 Horizontal Holes (proposed by author)
a) Block diagram of burner:

![Burner Diagram]

b) Block diagram of System:

![System Diagram]
c) Block diagram at receiver end:

![Block diagram at receiver end](image-url)

5. CHALLENGES AND FUTURE SCOPE:
The future work will be improving the system by joining it with machine learning for example: machine will learn from the continuous use of the burner when you reduce the flame or for which food item you use gas stove and induction stove, it can learn from the users daily routine and become smart day by day. One can also connect induction stove commands to the user phone making it ever easier to cook.

6. CONCLUSION
By implementing this hybrid induction smart gas stove not only space occupied by stoves reduced but it was very helpful in times when any one kind of energy either electricity or liquified petroleum gas were not available. Stitching modes from LPG to induction mode is very easy. The whole system is user friendly and very convenient to use.

7. REFERENCES
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