SMART GAS STOVE

By

GUGAN K. 18BLC1089
ANIRUDH M. 18BLC1135
TARUN R. 18BLC1160

A project report submitted to

Prof. Prakash V

SCHOOL OF ELECTRONICS ENGINEERING

in partial fulfilment of the requirements for the course of

ECE4003 – EMBEDDED SYSTEM DESIGN

in

B. Tech. ELECTRONICS AND COMPUTER ENGINEERING

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Vandalur – Kelambakkam Road

Chennai – 600127

NOVEMBER 2020

BONAFIDE CERTIFICATE

Certified that this project report entitled "**SMART GAS STOVE"** is a bonafide work of **GUGAN K. 18BLC1089 and ANIRUDH M. 18BLC1135 and TARUN R. 18BLC1160 who** carried out the Project work under my supervision and guidance for **ECE4003 – EMBEDDED SYSTEM DESIGN.**

Prof. Prakash V

Associate Professor

School of Electronics Engineering (SENSE),

VIT University, Chennai

Chennai – 600 127.

ABSTRACT

This report documents the design and simulation of an embedded device enabled Smart gas stove with gas leak detection capabilities.

The inspiration of our project comes from attempting to make the kitchen, specifically a stove, a safer environment.

The system will detect if there is a gas leak and will immediately set off the alarm, with the help of multiple sensors.

The system will check the following cases and undertake the necessary resolving methods.

- Stove knob status (open or closed), if open system will correspondingly turn the knob off.
- Persistent leak alert even after knob is closed will result in Pipe leak alert
- Detecting abnormal heating or fires by temperature sensor based on specified heat threshold levels.

We hope that this is something that can be easily implemented in most home to make the lives of people safer.

ACKNOWLEDGEMENT

We wish to express our sincere thanks and deep sense of gratitude to our project guide, **Prof. Prakash V,** Associate Professor, School of Electronics Engineering, for his consistent encouragement and valuable guidance offered to us in a pleasant manner throughout the course of the project work.

We are extremely grateful to **Dr. Sivasubramanian. A,** Dean of School of Electronics Engineering, VIT Chennai, for extending the facilities of the School towards our project and for his unstinting support.

We express our thanks to our Head of the Department **Dr D Thiripurasundari** for her support throughout the course of this project.

We also take this opportunity to thank all the faculty of the School for their support and their wisdom imparted to us throughout the course.

We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.

NAME WITH SIGNATURE **NAME WITH SIGNATURE**

Gugan K

Tarun Rahul

Anirudh M

TABLE OF CONTENTS

1.TOOLS REQUIRED

- **Arduino Uno**
- **Gas Sensor – MQ3**
- **Temp Sensor (TMP 36)**
- **16x2 LCD display**
- **Micro Servo**
- **Piezo buzzer**
- **Potentiometer**

2.EMBEDDED DESIGN PROCESS

2.1 PHASE 1 – PRODUCT SPECIFICATION

- The vision of the project is create the system based on the specifications of the customer (problem statement in this case).
- For this problem, we would try to create a system that can be easily added to present day stovetops.
- The system must also be tested on all possible use-cases and should not have any manufacturing errors as the issues caused otherwise have serious consequences

2.2 PHASE 2 HARDWARE AND SOFTWARE PARTITIONING

- This project is to be implemented in the Tinkercad software entirely.
- Even if hardware implementations are required, the computations that happen in the system are simple digital I/O steps or very trivial analog outputs that can be implemented in the software.

2.3 PHASE 3- ITERATION AND IMPLEMENTATION

- The entire testing process both initial and final is to be done on the tinkercad simulator.
- Initially each component will be integrated sequentially into the circuit after testing out them step by step in combination.

2.4 PHASE 4- DETAILED HARDWARE AND SOFTWARE DESIGN

- HARDWARE DESIGN:

Detection of Gas Leak is done using a Gas sensor connected to an analog input in the Arduino. The piezo and LCD also connected as an output will set of an alarm as well as an alerting message respectively in the case of a gas leak.

The 5V Arduino power is used to supply a servo motor connected to the Arduino as output which is used to turn the gas knob at specific conditions.

A Potentiometer is connected to the LCD to set the brightness and contrast of the display.

A heat sensor connected to Arduino as an input is used to detect if the temperature passes the max temperature limit.

- SOFTWARE DESIGN:

The code is simulated within Tinkercad's own console for the Arduino Uno.

2.5 PHASE 5 - HARDWARE/SOFTWARE INTEGRATION

- Both Hardware and Software integration is done virtually in the TinkerCad Platform.

- Debugging and Identification of errors is carried out in the simulation and coding console.

2.6 PHASE 6- PRODUCT TESTING AND RELEASE

- Due to unavailability of hardware components, all testing and reliability requirements can not be carried out at the moment.
- The simulations in tinkercad will determine the expected performance of the system if carried in the hardware level.

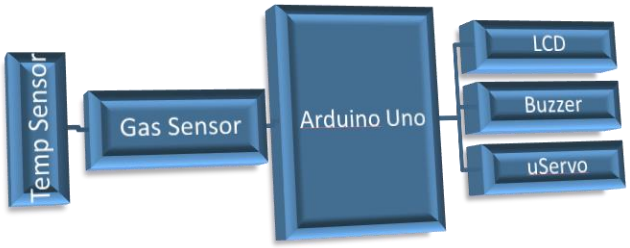
2.7 PHASE 7 - 7- MAINTAINING AND UPGRADING EXISTING PRODUCTS

- Frequent checking and monitoring is required, as a small failure in the system could have severe consequences.
- After carrying out rigorous testing to examine the system's performance in the hardware level, additional features can be integrated by implementing IoT to the existing product design.

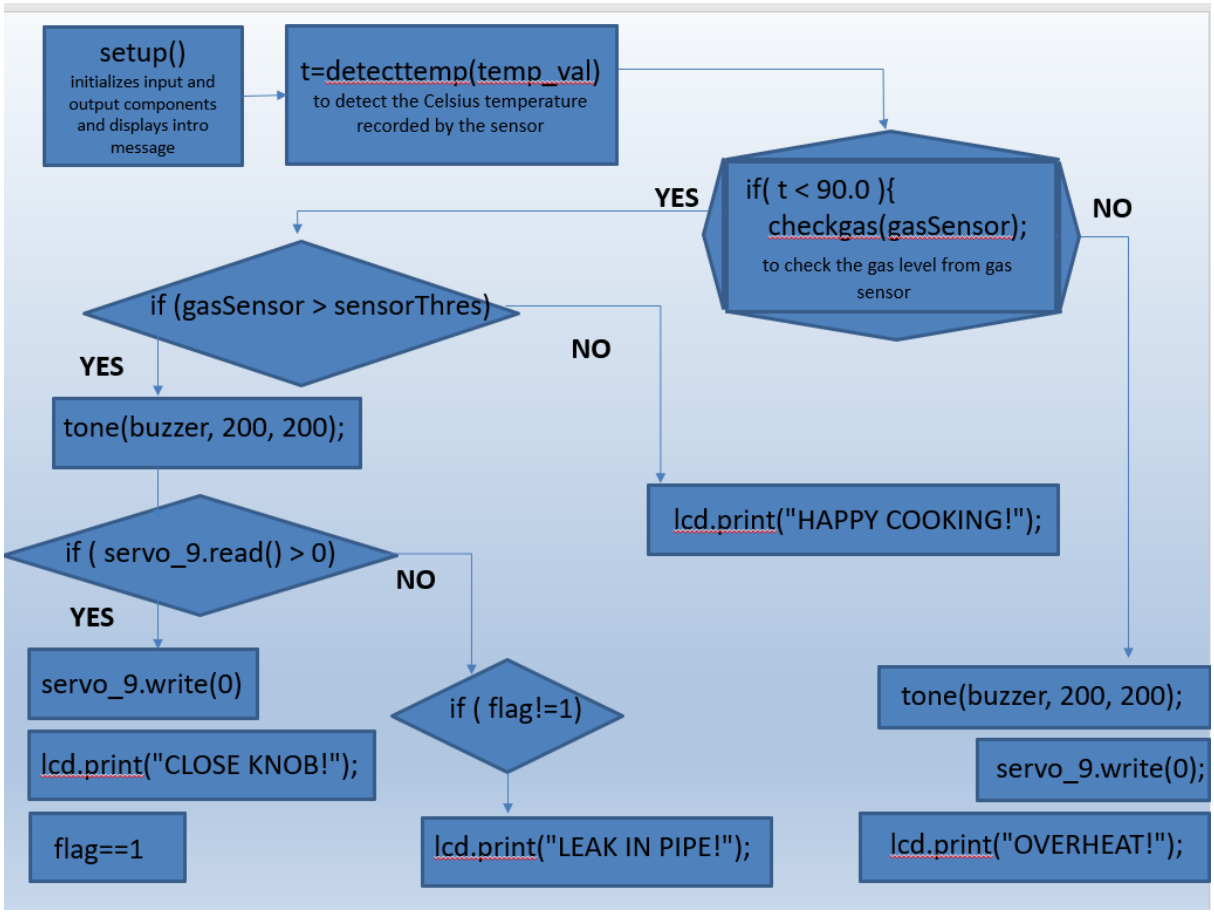
3. DIAGRAMS

3.1 BLOCK DIAGRAM

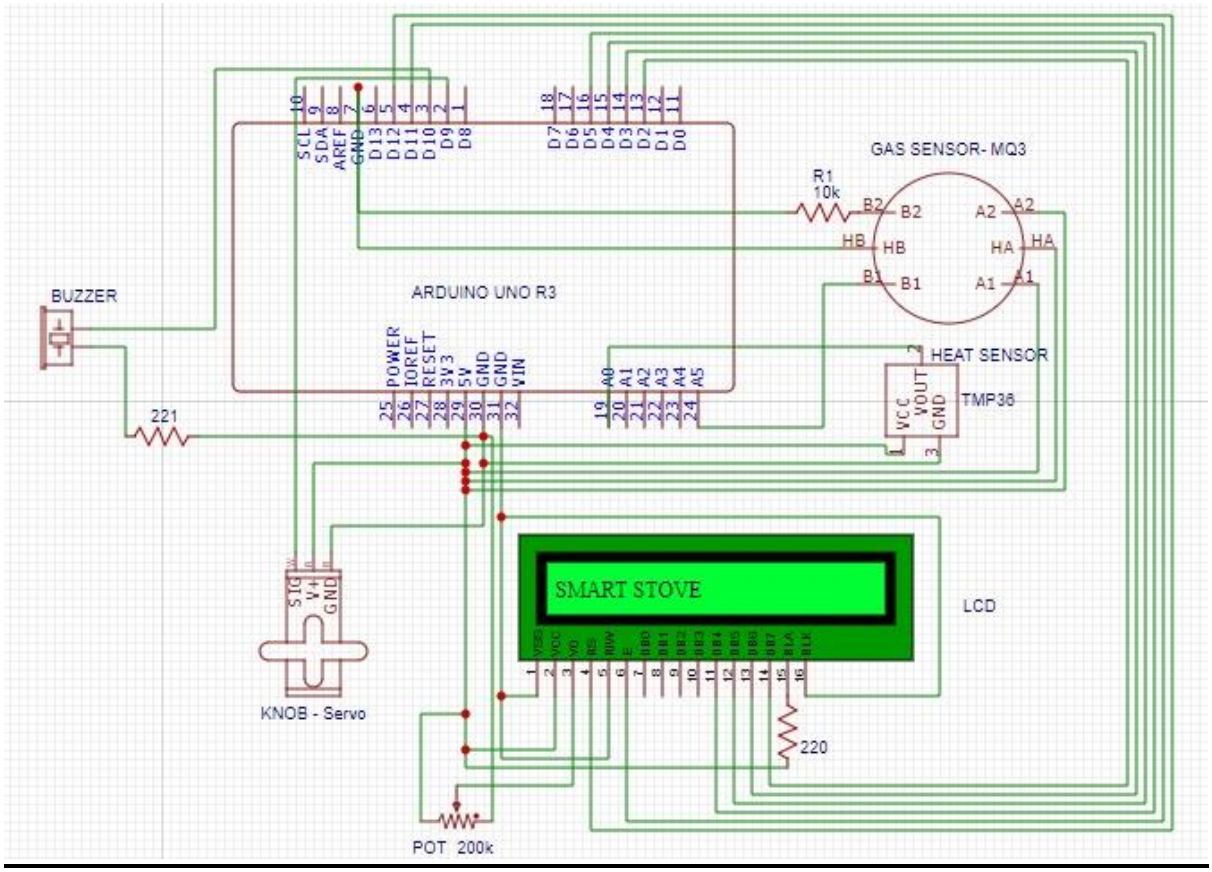
BLOCK DIAGRAM- HARDWARE



BLOCK DIAGRAM – SOFTWARE

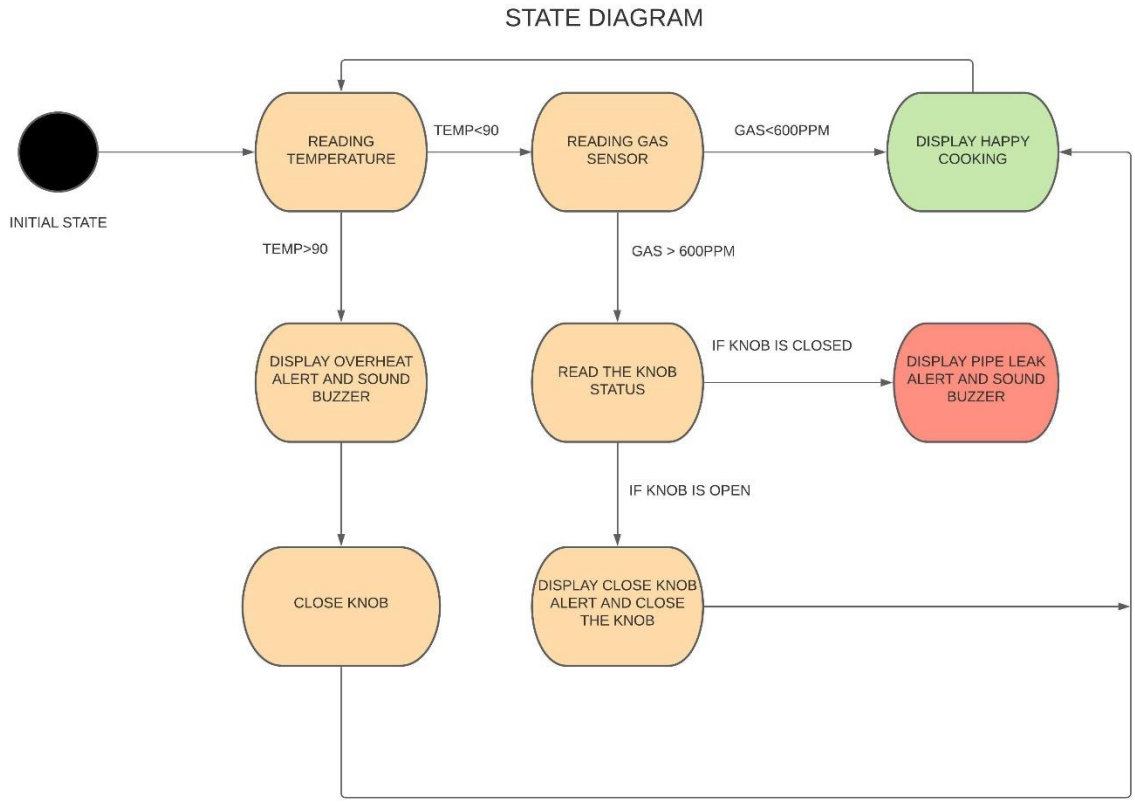


3.2 SCHEMATIC

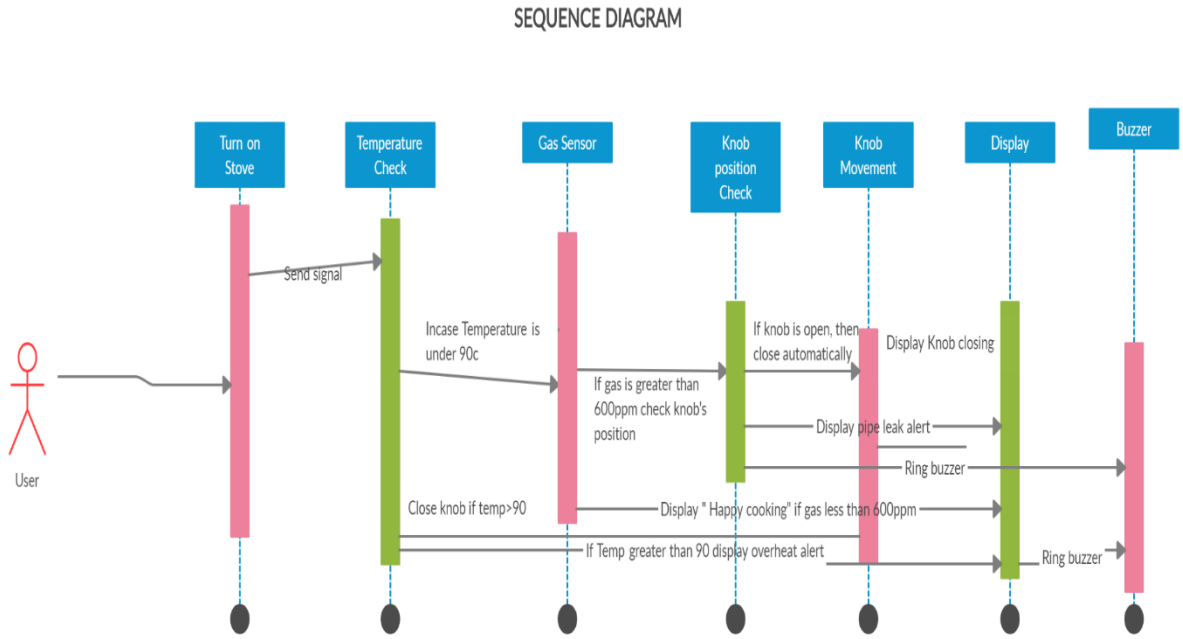


3.3 UML DIAGRAMS

STATE DIAGRAM:



SEQUENCE DIAGRAM:



4. CODE AND COST

4.1 CODE

```
#include <LiquidCrystal.h>
#include <Servo.h>
int buzzer = 10;
int smoke = A5;
int temp=A0;
// Threshold value
int sensorThres = 600;
Servo servo_9;
int flag;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup() {
  lcd.begin(16, 2);
  lcd.print("SMART STOVE");
 pinMode(buzzer, OUTPUT);
 pinMode(smoke, INPUT);
 servo_9.attach(9);
 servo_9.write(0);
 Serial.begin(9600);
}
#include <LiquidCrystal.h>
#include <Servo.h>
int buzzer = 10;
```

```
int smoke = A5;
int temp=A0;
// Threshold value
int sensorThres = 600;
Servo servo_9;
int flag;
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup() {
   lcd.begin(16, 2);
   lcd.print("SMART STOVE");
  pinMode(buzzer, OUTPUT);
  pinMode(smoke, INPUT);
  servo_9.attach(9);
  servo_9.write(0);
  Serial.begin(9600);
}

void loop() {
  lcd.setCursor(0, 1);

  int gasSensor = analogRead(smoke);
  int temp_val = analogRead(temp);
  float t=detecttemp(temp_val);
  Serial.print("Pin A0: ");
```

```
  Serial.println(gasSensor);


  if( t < 90.0 ){
    checkgas(gasSensor);
    delay(100);
  }
  else{
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("OVERHEAT!");
    Serial.print("Temperature = ");
    Serial.print(t);
    tone(buzzer, 200, 200);
    servo_9.write(0);
    delay(100);}
}
```

4.2 COST ANALYSIS

COMPONENT	COST (Rs)
Arduino ATMEGA328	259
TMP36	222
MQ3	95
Micro Servo	73
LCD	205
10k POT	79
Resistor x 3	~15
Connecting Wires	190

Future additions to the project (as discussed in section 6) could add further costs to the design.

For example,

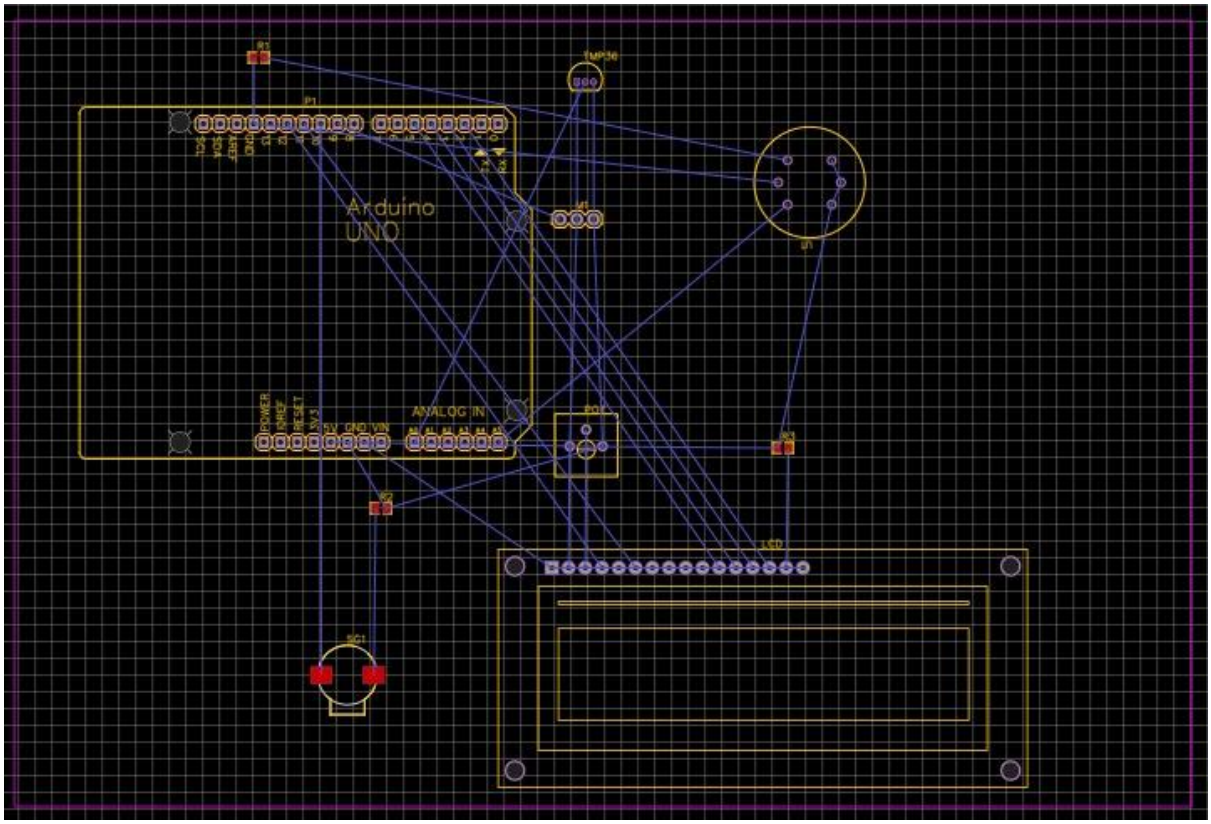
Wifi Module – Rs. 118

Water sprinkler nozzle (excluding installation costs) – Rs. 110

Total Cost of present embedded device without any additions

Rs. 1138 /-

4.3 PCB DESIGN



5. CONCLUSION:

Finally our Smart Stove was simulated successfully with the help of TinkerCad simulator and all Phases of the Embedded Design Process for the Smart Stove System was carefully looked at.

We have properly answered all the objectives set for the object and included all the necessary functions and components for its working.

UML and Schematic Diagrams have also been created for easy implementation and the design of the System and its circuit.

6. FUTURE WORK:

We would like to include IoT aspect to our project which would help us send a notification to the user's phone in the case of a fire. The system could also include its own sprinklers to extinguish the fire early, before it starts spreading.

Creating an app to include more functionality, such as being able to display the temperature of the stove at all times and to remotely switch of the stove or cut of the link to the Gas pipe.

7. REFERENCES

[1] Saar, Natalie. “Electric Stove Hazards.” Hunker.com, Hunker, 21 Sept. 2010. [Online]. Available: www.hunker.com/12003838/electric-stove-hazards. [

[2]https://www.kidde.com/home-safety/en/us/support/help-center/browse-articles/articles/what_are_the_carbon_monoxide_levels_that_will_sound_the_alarm_.html

LIST OF PUBLICATIONS

INTERNATIONAL JOURNALS

[1] IOT Based Smart Gas Monitoring System Anandhakrishnan S, Deepesh Nair, Rakesh K, Sampath K,Gayathri S Nair IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) http://iosrjournals.org/iosr-jeee/Papers/Conf.17017/Volume-3/13.%2082-87.pdf?id=7590

[2] Arduino Based LPG gas Monitoring & Automatic Cylinder booking with Alert System**,** IOSR Journal of Electronics and Communication Engineering https://www.researchgate.net/publication/306070470_Arduino_Based_LPG_gas_Monitoring_Automatic_Cylinder_booking_with_Alert_System

INTERNATIONAL CONFERENCES

[1] Programmable Gas Stove Arun S Nair 1 ,ChristyIdiculla Thomas 2 , Jemimah Merin Saji 3 ,Neha Reji Joseph4 National Conference on Recent Trends in VLSI, Communication and Networks 2018

8. BIODATA

Name : Gugan Kathiresan

Mobile Number : 7338702777

E-mail : gugans.kathiresan2018@vitstudent.ac.in

Permanent Address: Neelankarai, Chennai - 600115

Name : Anirudh M

Mobile Number : 7708713160

E-mail : anirudh.muthuswamy2018@vitstudent.ac.in

Permanent Address: Velachery, Chennai -600042

Name : Tarun Rahul

Mobile Number : 9790814894

E-mail : tarun.rahul2018@vitstudent.ac.in

Permanent Address: Shollinganalur, Chennai-600119