

A Smart Monitoring System to Sense Short Circuit and Gas Leakage using IOT

Sruthi Anand¹

Department of Information Technology
SKCET, Coimbatore – India

S. Lavanya²

Department of Information Technology
SKCET, Coimbatore – India

T. Eswari³

Department of Information Technology
SKCET, Coimbatore – India

Abstract: In today's modern arena of technological world, Internet of Things (IoT) has become an emerging technology to monitor and make lives easy. The Internet of Things is considered as the third wave of information technology right after Internet and mobile communication network, which is characterized by more comprehensive interoperability and intelligence. By this technological advancement, it enables us to keep track of the activities through our smart phones, to share information. In this paper, we propose a system that controls and signals accidents that are caused due to gas leakages and short circuits in our homes, thereby saving life and property. We make use of certain sensors and relays, so that any deviation in the threshold value gives an alarm, alerting the residents and the person concerned, thereby making use of IOT Technology.

Keywords: interoperability, sensors, relays.

I. INTRODUCTION

The Internet of things (IoT) is an innovative IT technology that interconnects the physical devices, vehicles by means of sensors, actuators and enables these to exchange and send data. These are being embedded as software or hardware to exchange and control information. IOT not only features the era of Internet but also considers about the cloud storage management, security, etc[1]. With the continuous advancements, IoT is coming down the road, as a global computing network. Devices availing internet services is increasing every day. The main idea behind IOT is to enable communication between the intelligent systems with Internet in smart spaces [1]. The IoT incorporates everything from a miniscule to big machines, appliances to building, body sensors to cloud computing which comprises major types of networks, for instance, distributed, grid, ubiquitous, and vehicular networks. With the demand of automation, it will be more helpful to develop smart systems that could reduce the burden of human. Till day approx 1% of things around us is connected such Refrigerator, car washing machine, heater, air-condition, garage door, should connect but still not connected [2]. Having the boon of IoT, everything in this world is made with a single click, which makes us to help in prioritizing our tasks and move to digitized society. It consists of integrating sensors and devices into everyday objects. Furthermore, in the IoT, any object can be a data source. The Internet of Things (IoT) promises to unsettle the notion of a traditional home security system including the risks it mitigates. Home security systems are at the forefront of this movement. It starts from notifying us the date of the dues to regulating the lights and fans off and on. With all these at our fingertips, we can easily take control of our entire home system. IOT is a technology that works r with feedback from motion sensors, and the smart objects becoming the brains of the coming IoT revolution, sensors are its five senses, and harvesting collected information by channeling it back to devices for interpretation. Making the Internet control our overall system that we are associated with is highly surprising the idea that the internet will be working hand in hand with so

many of our home devices is astounding. The reason for the involvement of IOT in our homes, is to prevent the damage that is caused and keep going with this fast world. The home security system is designed to detect and prevent the damages that are caused in the residential houses due to gas leakage and short circuit.

Generally, the IoT covers many areas ranging from enabling technologies and components to several mechanisms to effectively integrate these low level components. Software is then a discriminant factor for IoT systems. Data security and privacy will play an important role in IoT deployments. Because IoT systems will produce and deal with personally identifiable information, data security and privacy will be critical from the very beginning. Services and applications will be built on top of this powerful and secure platform to satisfy business needs. This outcome will require new, viable business models for IoT and its related ecosystems of stakeholders. Finally, IoT have an impact on people and the society they live in, and so it must be conceived and conducted within the constraints and regulations of each country.

Internet of things is a new internet application which leads to an era of smart technology where there exists thing-thing communication rather than human-human communication. Through IOT, each and every object in this world can be identified, connected and take decisions independently. It has taken its birth from mobile computing and ubiquitous computing. Technologies such as RFID, wireless sensor networks and embedded systems play a vital role in forming an IOT application. It is used in many applications in healthcare, agriculture, smart buildings, transportations etc. Though IOT is used in many domains, its path to success is not smooth. There are many privacy and security issues that need to be addressed. If these issues are addressed, then Internet of Things will definitely be the global mantra.

Internet has been part and parcel of the social animal's life. It's a huge space of information and people. The internet first evolved as "internet of computers". It is a global platform where many services like the World Wide Web could be implemented on top of it. It was an era of information exchange. As the days passed by, people started emerging into the internet- "Internet of people". Many social websites came into picture which kept people connected all the time. This has led to internet being filled with people rather than information. On the other hand, technology has been advancing day by day and simultaneously an era of "MobiComp" (mobile computing) had begun. Mobile helped man to be always connected to the internet on the move. Nowadays 3G and 4G mobile internet connections have led to faster internet access and deliver better quality in video calls. Wireless technologies and mobile computing have become cheap and have gained more popularity. Hence a new computing had emerged- Ubiquitous computing. This computing focuses on smart, intelligent space and minimal user involvement. Advancement in technology led to mobile and other hand-held devices to diminish in size. Smart phones, I pads, tablets and notebooks replaced ordinary mobiles and PCs. Hence there was a change in the device with which people access the internet. This in turn resulted in sophisticated features being configured in devices such as sensors, Global Positioning system (GPS) and actuators. In such a scenario devices were not only connected to the internet but also sense, compute and perform intelligent tasks. Later physical objects were configured with identification tags such as bar code and RFID so that they could be scanned by devices like smart phones and upload their information into the internet. This way of connecting the physical world with cyberspace with the help of a smart device led to internet being called as "Internet of Things". Hence IOT has its roots from Mobile computing, ubiquitous computing and information technology. IOT connects the objects in an intelligent way. The "thing" here refers to the physical object's information read through sensors and RFID reader and uploaded into the internet. The physical object can be anything from smart phones to objects at home. The International telecommunications Union (ITU) has pointed out four dimensions of IOT: object identification ("tagging things"), sensors and wireless sensor networks ("feeling things"), embedded systems ("thinking things") and nanotechnology ("shrinking things"). Hence from the above, IOT changes the connectivity view from "any-time, any-place" for "any-one" into "any-time, any-place" for "any-thing". These things once connected to the internet provide smart services beneficial to the environment and society. They play a major role in supply chain, energy, defence, health care and other useful applications.

II. BACKGROUND STUDY

There are various works which co-relates the project. The concept of detection of short circuits was done by monitoring the temperature, voltage and current and in cases of may deviation, the same would be intimated to the electricity board by the use of GSM. The distance from pole to pole fails at times. Certain other cases also increase the level of the current which cause stress on the equipment, leading to damage on the equipment. Hence, this experiences tripping causing short circuits. By this the load is disconnected from the supply and equipment is protected. Looking onto the problem of gas leakages, the existing system would detect the gas and close the knob of the system setting it right, not clearing up the gas in the environment.

III. PROPOSED WORK

In this system, the methodology is designed to safeguard our lives and our assets from the major fire accidents that are caused by gas leakage and short circuit. The system monitors the level of the gas and detects, when the LPG concentration in the air exceeds than the threshold value. When the exceeded value is detected, it performs two operations: i)the controller in the device automatically switches on the exhaust fan to expel the gas that has already been leaked into the room, ii) It uses a knob which is manipulated with the help of the step up motor to close the gas valve in the cylinder to prevent further leakage. These operations are done to control the accident that may occur. At the same time it immediately alerts the user or the owner by sending a notification via sms, which would help them know the status of their home. When a short circuit is detected, the alert is sent to the user and the power supply is automatically stopped with the help of PLC. The main advantage of this system is that it combines the preventive measures for both gas leakage and short circuit, which makes it cost efficient when compared to the existing systems. It also brings an additional work of cleaning the gas that is already been leaked. Without human intervention, the system detects and prevents the sudden accidents that are caused by gas leakage and short circuiting.

The various components that are used in this research are:

- Raspberry Pi
- Gas sensor
- Short circuit detection switch
- Driver circuit
- Exhaust fan
- PLC
- Orcad design
- Languages: Python

Working module:

Short Circuit Detection

Detection using driver circuit

Relay and a plc is used in the short circuit detection. Short circuit is said to occur when the load and the neutral line combines together. Hence this output is given to the relay which in turn gives it as an input to the lamp. When short circuit occurs the lamp is switched on to indicate the occurrence of short circuit. To give an intimation , a notification is sent in the form of an sms to the resident as well as the maintenance officer.

Gas Leakage Detection

Detection using gas sensor

Gas sensor used in the system to detect the leakage when the gas level in air increases beyond the threshold value. By using these type of sensors, damages caused are avoided. After the detection, the system stimulates the knob which closes the gas valve in the cylinder automatically in order to prevent further leakage of gas. Simultaneously the exhaust fan is also switched on to expel the gas that is leaked from the room in order to prevent the accidents that might occur due to the circulating leaked gas. As the case is detected, notification is sent in the form of a SMS to the resident.

Architecture:

The system mainly consists of LP gas leakage detection system, and the short circuit detection system along with Raspberry, the Wi-Fi module and protection circuitry. The main function of gas leakage detection module is to continuously detect the gas leakage in the air. For the gas leakage detection, a solid state gas sensor MQ5 is used. The main function of short circuit detection module is to detect any short circuit in the wirings and then stop the whole power supply with the help of the miniature circuit breaker. When the concentration of gas in the air exceeds the certain level then simultaneously the exhaust fan is turned on and the stepper motor is started to turn off the gas valve in the cylinder. At the same time, it activates the Buzzer which is in the maintenance incharge and also notifies to the owner.

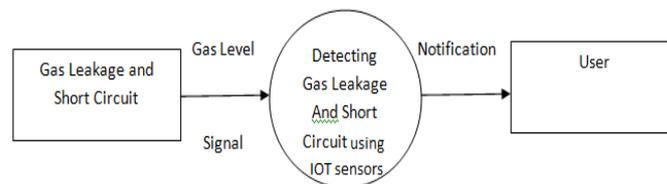


Fig 1. Architecture Diagram

Algorithm 1: Transmission

```

VOID SETUP(VOID){
Serial.begin(9600);
}
void loop(void){
delay(1000);
int a=analogRead(A0);
Serial.print("Smoke: ");
Serial.println(a);

```

Algorithm 2: RECEPTION

```

import RPi.GPIO as GPIO
import serial
GPIO.setmode(GPIO.BOARD)
GPIO.setup(7,GPIO.OUT)
GPIO.setup(16,GPIO.OUT)
GPIO.setup(18,GPIO.OUT)
GPIO.setup(22,GPIO.OUT)
while 1:
arduinoSerialData = serial.Serial('/dev/ttyACM0',9600)
if(arduinoSerialData.inWaiting())

```

```
myData = arduinoSerialData.readline()
myData=int(myData.rstrip().lstrip())
print(myData)
if(myData>600):
#notification
print("NOTify user")
GPIO.output(7,True)
GPIO.output(16,GPIO.HIGH)
GPIO.output(18,GPIO.LOW)
GPIO.output(22,GPIO.HIGH)
else:
print("Normal condition")
GPIO.output(22,GPIO.LOW)
GPIO.output(7,False)
```

IV. EXPERIMENTAL RESULTS

This system is designed to safe guard our lives and our asserts from the major fire accidents caused by gas leakage and short circuit. This system monitors and detects the LPG concentration in the air. When it exceeds automatically switches on the exhaust fan and the stepper motor is switched on. The stepper motor helps to close the knob of the gas cylinder. At the same time it immediately alerts the people by sending them alert.

The proposed system is implemented using Python Programming language and the IOT device is controlled using Raspberry Pi.

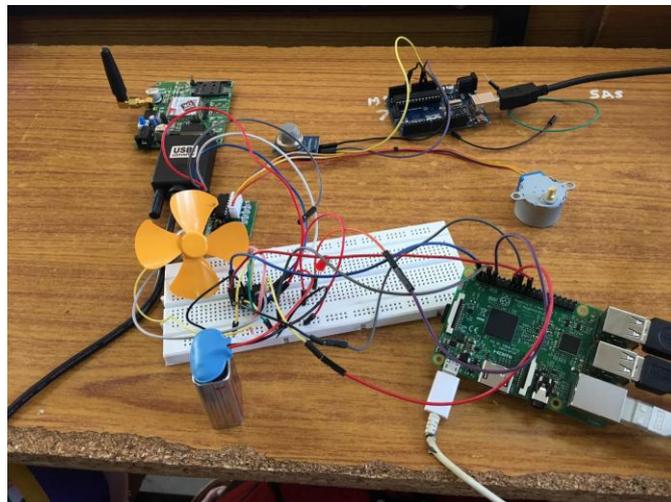


FIG 2. SYSTEM IMPLEMENTATION

V. CONCLUSION

Overall system is designed to detect and prevent the damages that are caused in houses due to gas leakage and short circuit. Existing systems to detect and prevent gas leakage and short circuit are comparatively costly. Moreover the combination of gas leakage and short circuit detection system makes it more efficient. The devices used in both the phases are promising regarding their functions and efficiency. Hence, the device thus designed can solve many real life problems and can be majorly believed upon its economical reliability, which the consumers expect.

References

1. Hitendra Rawat, Ashish Kushwah, Khyati Asthana, Akanksha Shivhare "LPG Gas Leakage Detection & Control System", National Conference on Synergetic Trends in engineering and Technology International Journal of Engineering and Technical Research 2014.
2. S.Rajitha,T.Swapna, "Security alert system using gsm for gas leakage", International Journal of VLSI and Embedded System(2012)ISSN: 2249 – 6556.
3. B.R. Gupta, "Microcontroller based Fault Detector", International Journal of Advancements in Research & Technology, Volume 1, Issue 5, October-2012.
4. Chandra shekar. P,"Transmission Line Fault Detection & Indication through GSM", International Journal of Recent Advances in Engineering & Technology (IJRAET).
5. Sarma, Sanjay E., Stephen A. Weis, and Daniel W. Engels. "RFID systems and security and privacy implications." In Cryptographic Hardware and Embedded SystemsICHES 2002, pp. 454I469. Springer Berlin Heidelberg, 2003.
6. Brock, David L. "The Electronic Product Code (EPC)." AutoIID Center White Paper MITI AUTOIDIWHI002 (2001).
7. B.B.P. Rao, P.Saluia, N.Sharma, A.Mittal, S.V.Sharma, "Cloud computing for Internet of Things & sensing based ap- plications," in Sensing Technology (ICST), 2012 Sixth Inter- national Conference, IEEE 36.
8. X.Xiaohui,"Study on Security Problems and Key Technologies of The Internet of Things," Computational and Information Sciences (ICCIS), 2013, pp. 407-410.
9. O.Vermesan, P.Friess, "Internet of Things ? From Research and Innovation to Market Deployment," River Publishers. Yinghui Huang, Guanyu Li,"Descriptive Models for Internet of Things", International Conference on Intelligent Control and Information Processing, August, 2010 - Dalian, China.
10. Lu Tan, Neng Wang, "Future Internet: The Internet of Things", 3rd International Conference on Advanced Computer Theory and Engineering (ICACTE), 2010.
11. Louis Coetzee, Johan Eksteen, "The Internet of Things – Promise for the Future? An Introduction ", IST-Africa 2011 Conference Proceedings Paul Cunningham and Miriam Cunningham (Eds) IIMC International Information Management Corporation, ISBN: 978-1-905824-24-3, 2011.
12. Guicheng Shen, Bingwu Liu,"The visions, technologies, applications and security issues of Internet of Things", IEEE, 2011.
13. Qian Zhu, Ruicong Wang, Qi Chen, Yan Liu and Weijun Qiny,"IOT Gateway: Bridging Wireless Sensor Networks into Internet of Things, IEEE/IFIP International Conference on Embedded and Ubiquitous Computing, 2010 .
14. A. J. Jara, M. A. Zamora and A. F. G. Skarmeta." An ambient assisted living system for telemedicine with detection of symptoms". Third International Work-Conference on the Interplay between Natural and Artificial Computation. Lecture Notes, pp.75-84, 2009.
15. Ning Huansheng, and Wang Binghui, "RFID major engineering and Internet of Things", Beijing: China Machine Press, pp.13-16. (in Chinese), 2009.