An Intelligent Robotic Home Security System

[1]A.R.Revathi, [2]B.Sathyanarayanan [3]M.Raja, [4]J.Sathish, [5]D.Suresh,

[1] Assistant Professor (Sl.G), [2][3][4][5] UG Student

[1][2][3][4][5] Department of Information Technology, SRM- Valliammai Engineering College.

[1] revathi96@gmail.com

Abstract:-- **The security needed for humans and their belongings is more important in the day-to-day life. In the growing technological world many automated systems are being developed to alert the user about any hazards taken place in the home environment. Normally this kind of automated system will alert the user within a particular area, this can be made through using Extended Infrastructure Network. Even if user needs to be communicated wirelessly it's more expensive. Considering all these factors we design the smart home security system which can be controlled by Android Application through the Internet. This robot gives live surveillance streaming about the home environment to the user Android Application. Live surveillance streaming is made possible with the help of IP Camera controlled by Arduino board. However, this robot can functioned by two modes either user mode or automatic mode. In addition to Home Security System, the robot can detect LPG gas leakage and fire accident happen in the home environment with minimum cost. Home Security System can alert the user through email and Android App notification. User address will be send to the nearest fire station, if fire accident is occurred.**

Index Terms - **Android, Live surveillance, Trigger, Arduino.**

I. INTRODUCTION

In the growing world, electronic components are being popular due to comfort and convenience. In obvious to which, many people pay a lot of attention on the electronic things in recent years. Automation plays major role in many fields but security is the more important concern. Many experts and companies are trying to provide good automated solution to the user and even various researches are going on in the security aspect. Therefore, we suggest best solution as the robotic technology with the security system, because the issue of the safe living environment for human beings is more important. The robots can be designed in such a way to identify potential hazards to warn human beings in advance.

Now a day's smart phones are being popular among the mobile handset users. According to data from the International Data Corporation (IDC) in 2015,

Android conquered the smart phone market with a share of 82.8%, where IOS has 13.9%, where Blackberry has 0.3%, where windows has 2.6% and where other phones has 0.4% share. Android users are more in number [19]. Considering all these aspects, this paper discusses an approach where a robot is operated with Android Application to provide security in the home environment. Home Security System can monitor private, public and even dangerous areas through the Internet anytime, anywhere remotely. Android Applications are developed using Object Oriented Programming language. The android app developed with internet support. A new type of Home Security System developed in which there is a moving wireless robot in home which has IP Camera and various sensors like ultrasonic sensor, gas sensor and temperature sensor are connected with it and the robot needs Internet for remote accessing. The internet for robot is provided with the help of Wi-Fi chip. The robot is fixed with an IP Camera that can be used for live surveillance in home environment. The robot operated over two modes, either User mode or Automatic mode. During the live surveillance process, if any LPG Gas leakage or fire accident happens, it can send the alert to the user through E-mail and Android App notification and as well in case of fire accident, it sends the user address to the fire station. In this paper section II provides information literature survey and section III explains about the proposed methodology. It describes about the live video surveillance, hazards detection and notification process. The section IV deals with technical aspects needed and section V is about experimental result. Finally, section VI will conclude the work.

II. LITERATURE SURVEY

Many experts and organizations where concentrating in the development of Home Security System. In smart way, different methodologies proposed at different fields. However, Home Security System using

Smart phones is still ongoing research field. Some of existing projects are discussed below. Rupam Kumar Sharma [1] looks into the development of an Android application which alerts (message) the mobile device on possible intrusion and subsequently a reply message needs to be send through SMS to trigger alarm/buzzer. The AuthorRen C. Luo[2] looks the multiple remote interface security system can senseunusual and risky situation and notify userover internet, or send the message to mobile phone overGSM module.The appliance module can feedback response result to the user through mobile phone. In the existing work [1] [2] they works with GSM module to send notification, whereas Ch.ManoharRaju [3] uses Bluetooth module to send notification; they look into the development of a prototype of an autonomous android based mobile robot for detecting gas leakage in large industrial facilities. The robot may be used for continuous inspections of facilities or for scheduled inspections of specific system components. Lim[4] explains the development of, the PC hosts a Java program that connects wirelessly with a mobile robot using the ZigBee module and shows a live video stream from a wireless camera on the robot. The robot gets commands from the PC and it then sends instructions to switches wirelessly to turn on or off. It also deals with switches controlled by robot through video stream. Dr.Shantanu K. Dixit[5] deals with the video feed for human detection;the robot will help in rescue operation and user can access the video feed from the remote location such as the high sensitive areas or areas which are beyond our reach. The total system comprises mobile robot, controlled over the Internet. The robot has camera and PIR sensor for living body detection. Mr.Vishnoo.S.K[6]providesthe location information of remote zones and even helps the military personnel in fighting terrorism. The robot used in the borders where terrorist presence may be high and human being cannot be risked in such areas. The author[7] Wen- Chung Chang, mainly focused into a novel approach to develop mobile based localization robot and navigation in a huge unknown workspace with a set of vision sensors based on an effective on-line calibration strategy. They control the mobile robot to aggressively perform calibration with any static IP camera. The above existing technology were using GSM and Bluetooth module which cost more and even it cannot access remotely.

III. PROPOSED METHODOLOGY

A Multi-purpose intelligent robot is designed with multiple sensors (ultrasonic sensor, Gas sensor and Temperature sensor) connected with Arduino circuit board. Ultrasonic Sensor (HC-SR04) is used to find the distance of the targeting object. The major benefit of this sensor is transparent to sunlight and black material but remains

affected to clothes. Gas sensor detects the gas leakage in the home environment. Here MQ-6 gas sensor is used to detect the LPG gas. It has heater coil made up of NI-CR alloy which detect LPG quickly in the atmospheric air.
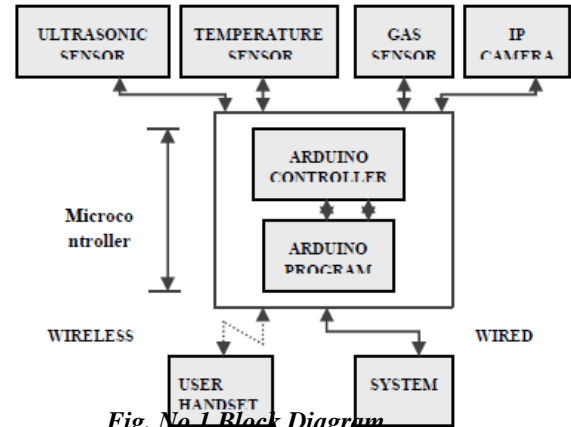

Fig. No.1 Block Diagram

The temperature in the house is calculated using Temperature sensor (LM35), it has benefit over linear temperature sensors generated in kelvin as it provides calibrated centigrade scaling. If the detected value exceeds 120 degree centigrade [16], fire alert will be send to the user. The notification is send by Email and also through Android App. Code which is used for the functioning of the robot is stored in the Microcontroller (i.e.Arduino mega 2560). The entire robot system can be controlled remotely, (through internet) either by User mode or Automatic mode.IP camera is used to give the live video feed to Android App. Block diagram is shown in the Fig. no.1
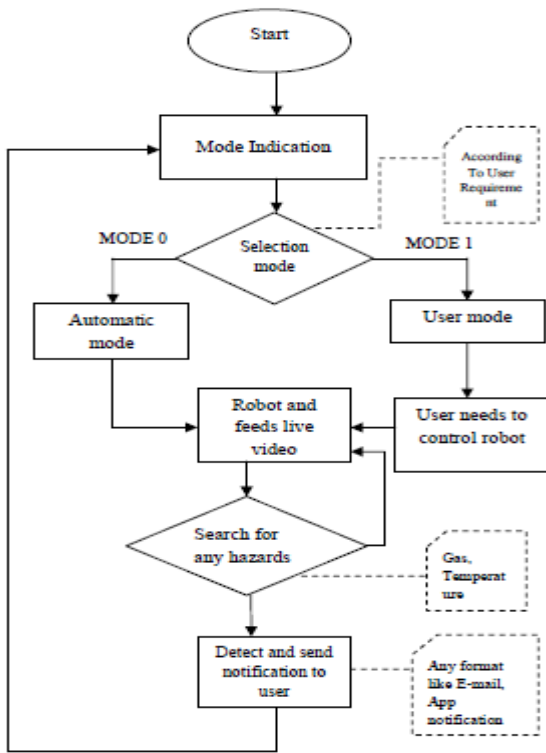
Fig. no 3 Arduino Microcontroller Board

Arduino Microcontroller Board is shown in Fig no 3. It has 54 input and output pins of which includes 16 analog input, 4 UARTs, a 16MHz crystal oscillator, a power jack, an ICSP header, a USB connection, and a reset button. Datasheet for Arduino MEGA is shown in Table no.1.

4.2 MQ6 Gas Sensor

This implementation hasMQ6 gas sensor. MQ6 gas sensor has a 6 pin device and it requires 5 voltage DC supply. Whenever the sensor senses gas leakage among 100 to 1000ppm, in the atmospheric air, its output turns high and triggers the buzzer[10].

Fig. no.4 MQ-6 Gas Sensor

Fig. no. 2 Flow Diagram

a). User Mode: In the user mode, user needs to control the robot through user handset with help of Android Application. As per the user direction robot give live video feed to the user application. According to user requirement robot navigate the home environment. It described in flow diagram (Fig.no.2).

b). Automatic Mode: In this mode, user don't have access to control the robot. Using ultrasonic sensor the robot automatically avoid the obstacles interfered in its path. So, the live video stream feed to the user application.

IV. TECHNICAL BACKGROUND

4.1 Arduino Mega

In this work implemented by microcontroller board(Arduino Mega 2560).The Arduino Mega 2560 is a microcontroller Board and it is based on ATmega 2560 [8].

Table no.1 Arduino Datasheet [9]

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage	7-12V
Digital I/O Pins	54
Analog Input Pins	16
Length	101.52 mm

Table no.2 MQ6 Datasheet [10]

IFERP
connecting engineers... developing research

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 3, Issue 3, March 2016

Sensor Type	Semiconductor
Detection Gas	Isobutane, LPG, Butane
Concentration	100-10000ppm
Heater Voltage(VH)	5.0V±0.2V AC (or) DC
Heater Resistance(RH)	31Ω±3Ω Room Tem.
Heater consumption(PH)	≤900Mw
Preheat time	Over 48 hours

Parameter	Condition	Lm35		
		Typical	Tested Limit	Design Limit
Accuracy	TA=+25°c	±0.2	±0.5	
	TA=-10°c	±0.3		
	TA=TMAX	±0.4	±1.0	
	TA=TMIN	±0.4	±1.0	
Sensor gain	TMIN≤ TA≤ TMAX	±10.0	±9.9 ±10.1	
Minimum Temperature For rated accuracy	IL=0	±1.5		±2.0
Long term stability	Tj=TMAX, for 1000 hours	±0.06		

It is widely used in domestic gas leakage alarm and portable gas detector. MQ-6 gas sensor is shown in fig. no.4. Datasheet for gas sensor is shown in Table no.2.

4.3 Temperature Sensor LM35

We require LM35 temperature sensor for this work. LM35 is a precision integrated circuit temperature device. It has an advantage over linear temperature sensors generated in kelvin as it provides calibrated centigrade scaling [12].
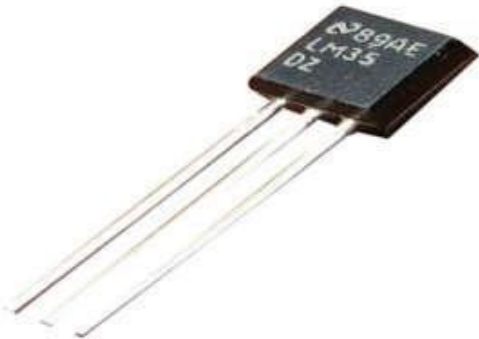

Fig. no 5 Temperature Sensor LM35

The main feature of LM35 is it calibrates directly to Celsius. It is mainly applicable in remote applications. Temperature Sensor LM35 is shown in fig. no.5. Datasheet for LM35 is shown in Table no.3.

Table no.3 Temperature Sensor LM35 Datasheet [13]

4.4 Ultrasonic Sensor

In this implementation HC-SR04 ultrasonic sensor is used. The HC-SR04 ultrasonic sensor that makes use of sonar device.

Fig. no 6 Ultrasonic Sensor

It is used to calculate the distance to an object. It offers non-contact range detection with high accuracy and it produces stable readings [11].It is transparent to sunlight and black materials but remains affected to clothes. Ultrasonic Sensor is shown in fig. no. 6. Datasheet for Ultrasonic sensor is shown in Table no.4.

Table no. 4 Ultrasonic Datasheet

Electrical Parameters	HC-SR04 Ultrasonic module
Operating Voltage	DC-5V
Operating Current	15mA
Operating Frequency	40KHZ
Farthest Range	4m
Nearest Range	2cm
Input Trigger Signal	10μs TTL pulse
Output Echo Signal	Output TTL level signal, proportional with range
Dimensions	45*20*15mm

4.5 IP Camera

For live surveillance IP camera is used. IP camera is a high definition, full functionality video endpoint device with high image quality and better processing power.

Fig. no 7 IP camera

The camera can produce full HD 1080p resolution by processing 30 frames per second [14]. It optimizes network usage with MJPEG compression. IP Camera is shown in fig. no. 7. Datasheet for IP Camera is shown in Table no.5.

Table no. 5 IP Camera Datasheet [14]

Item	Specification
Lens selection	P-Iris lens
Shutter speed	1/5 to 1/32,000 sec
Video compression	H.264 and MJPEG
Video Resolution	2MP HD
Video streaming	Single-stream H.264 or MJPEG up to 1080p Dual-stream H.264 and MJPEG
Power consumption (max)	DC: 4.7W AC: 6.3W

4.6 ESP8266

To interact with internet we used ESP8266. ESP8266 offers a complete Wi-Fi networking solutions which either act as a host application or from another application processor.

Fig. no 8 ESP8266 Circuit Board

Whenever ESP8266 acts as a host application it boots up directly from the external flash memory. It improves the performance of the system and minimize the memory requirements.[15] It also serves as a Wi-Fi adapter. It is mainly applicable in smart power plugs and IP cameras. ESP8266 is shown in fig. no.8. Datasheet for ESP8266 is shown in Table no.6.

Table no.6 ESP8266 Datasheet [15]

Wi-Fi Chip/Module	ESP8266
Wi-Fi Standards	802.11b/g/n
Packets	TCP and UDP
Modes	Client and Server
Size	25 *38 mm
Digital Pins	9
Analog Pins	1
Programmable Microcontroller	Yes

V. EXPERIMENTAL RESULT

5.1 Component & Software Specification

Arduino microcontroller is integrated with many sensors, MQ6 (Gas Sensor) operates normally in 5V and maximum of $5V\pm0.2V$. The possible component for MQ6 sensor is MQ2 sensor. HC-SR04 (ultrasonic sensor) works normally in 5V and other alternate component is IR sensor. LM35 (temperature sensor) takes input of 4V normally and it can operates upto 20V. It can be replaced with IR Flame sensor. ESP6682 (Wi-Fi chip) and IP Camera inputs with 5V and 4.7V respectively. Arduino MEGA normally operates with 5V and it works upto 12V and other substitute microcontroller is RASPBERRY PI.

This entire work was implemented with Arduino 1.6.5 and Android Studio 1.5.1 software. The program is coded in Arduino 1.6.5 using Arduino 'C' Programming.Sensor inputs detected by using analog Read function which is coded as, sensor Value = analog Read(sensor); The digital Read function reads the digital value outputted from LM35 sensor which is programmed below, intsensorReading = digitalRead(2); The above given, is a sample lines which is used in the gas and flame detection module.

```
servo.write(90); scan();
FrontDistance = distance;
if(FrontDistance> 40 || FrontDistance == 0)
{ moveForward(); }
Else
{ CollisionCounter = CollisionCounter + 1;
moveStop(); navigate(); }
```

The given code is used for the robot movement during live surveillance operation. The result for gas detection value is shown in Fig. no. 9. The reading has taken in both normal and leakage conditions.
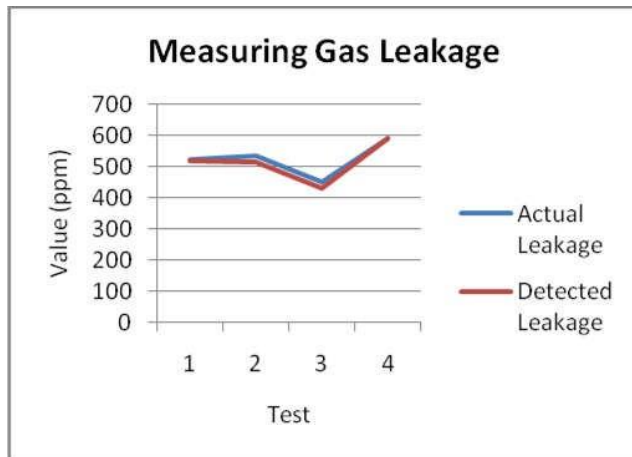
Fig. no. 9 Measuring Gas Leakage

VI. CONCLUSION

A Multipurpose Intelligent Robot is used in home security system, which is controlled by Android Application through the Internet. It is used for the purpose of remote surveillance system and for the detection of gas and temperature. This robot can functioned by two modes either user mode or automatic mode. When intrusion occurs, it can alert the user by sending an E-mail and Android App notification. Finally, we implement the Android based multipurpose intelligent robot using android phone which has been tested with real data and it performs with 90% efficiency in minimal cost. In future, we are going to include more functions like voice, image recognition and heartbeat reading.

REFERENCES

[1].Rupam Kumar Sharma,Ayub Mohammad, HimankaKalita, DhirajKalita,"ANDROID INTERFACE BASED GSM HOME SECURITY SYSTEM", IEEE Conference Publication 2014.

[2]. Ren C. Luo, KuoL.Su,"THE DEVELOPMENT OF INTELLIGENTHOME SECURITY ROBOT", IEEE Conference July-2005 .

[3].Ch.ManoharRaju and N.Sushma Rani, "AN ANDROID BASED AUTOMATIC GAS DETECTION AND INDICATION ROBOT", International Journal of Computer Engineering and Applications, Volume VIII, Issue I, Oct 2014, ISSN 2321-3469.

[4].ZakiUd Din, Wee-Gin (David) Lim, "HOME AUTOMATION WITH SMART ROBOT FEATURING LIVE VIDEO FEED AND REMOTELY CONTROLLED SWITCHES", IEEE Conference Publication 2013.

[5].Dr.Shantanu K. Dixit, Mr. S. B. Dhayagonde, "DESIGN AND IMPLEMENTATION OF ESURVEILLANCE ROBOT FOR VIDEO MONITORING AND LIVING BODY DETECTION", International Journal of Computer Engineering and Applications, Volume 4, Issue 4, April 2014 ISSN 2250-3153.

[6].Mr.Vishnoo.S.K, Mrs.Aarthy.S.T, "ROBOT FOR SURVEILLANCE, COMBATING TERRORISM AND RESCUE OPERATIONS", International Journal Of Engineering Development And Research, Volume 3, Issue 2 ISSN: 2321-9939.

[7].Wen-Chung Chang, Ping-Rung Chu, Taiwan, "AN INTELLIGENT SPACE FOR MOBILE ROBOT NAVIGATION WITH ON-LINE CALIBRATED VISION SENSORS", IEEE Conference Publication 2010.

[8].https://www.arduino.cc/en/Main/ArduinoBoardMega2560

[9].https://www.arduino.cc/en/Main/arduinoBoardMega

[10].https://www.parallax.com/sites/default/files/downloads/28015-PING-Sensor-Product-Guide-v2.0

[16].https://www.quora.com/At-what-temperature willcotton- ignite

[17].Professional Android Application Development, Reto Meier, WROX publication, May 2012.

[18].Head First Android Development, Dawn Griffiths & David Griffiths, O`Reilly Media, June 2015.

[19].http://www.idc.com/prodserv/smartphone-os marketshare. Jsp

[11].http://www.elecfreaks.com/store/download/product/Sensor/HC-SR04/HCSR04_ Ultrasonic_Module_User_Guide

[12].https://www.facstaff.bucknell.edu/mastascu/eLessons HTML/Sensors/LM35

[13].http://www.engineersgarage.com/electroniccomponents/lm35-sensor-datasheet

[14].http://www.cisco.com/c/en/us/products/collateral/physical-security/video-surveillance-6000-series-ipcameras/

datasheet-c78-728703.html

[15].https://www.adafruit.com/images/productfiles/
2471/0A-ESP8266__Datasheet__EN_v4.3