ISSN: 2456 - 3935

International Journal of Advances in Computer and Electronics Engineering
Volume 2, Issue 12, December 2017, pp.1–7

Design and Implementation of an Automated Home Security Robot

Md Fahad Jahan
Department of Electronics and Telecommunication Engineering
Daffodil International University, Bangladesh
Email: jupiter@diu.edu.bd

Md Taslim Arefin
Department of Electronics and Telecommunication Engineering
Daffodil International University, Bangladesh
Email: arefin@diu.edu.bd

Abstract: *This paper has aimed to implement and design a security prototype Automation robotic vehicle which will be able to sense humidity level, temperature level, detect smoking, detect harmful gas presences, and detect extreme sound values. Implemented IP camera has been implemented for live footage support to detect any movable object by motion sensor and record automatically. In this project, PIR sensor is used for detecting any moving object. A0020GSM module has been implemented for informing sensing value and detecting moving object ability to anywhere through anywhere. DTMF controlling system is used for controlling the robot activities from anywhere in the world via Cellular Network. An overall performance study has been outlined to monitor overall quality.*

Keyword: *Home security robot; DTMF; Motion sensor; PIR; LDR*

1. INTRODUCTION

Robot turns out to be broadly utilized as a part of modern because of their qualities. Robot ready to work in 24 hours ceaselessly without feeling tired not at all like human that keep to certain time. The cost to setup the robot these days turns out to be more reasonable and their long haul prospect is splendid judging from their ability to perform [1]. Be that as it may, in all actuality, there is no robot ready to capacities impeccably and as yet making blunder.

A superior controller required here, to permit the robot performs proficiently and make less mistake. Utilizing computerization home security robot doing particular errand, is more affordable, more solid and it can achieve similar points of one robots [2]. The nature of work environments requires the robotic systems be fully autonomously in achieving human supplied goals. The automation home security robot using PIR sensor controlling system for detection moving object. Used Motion detective IP camera for capture moving object footage immediately. IR sensor used for obstacle reduction and moving robot smoothly. Humidity sensor sensing humidity level, temperature sensor sensing value of temperature, sound detector sensor detecting extreme sound sensitivity, smoke detecting sensor sensing smoke presence, harmful gas detector sensing harmful gas presence. Required information transmit via SMS to anywhere.

An automation home security robot divided into two main parts, namely the software and Hardware. Software of microcontroller is program code platform known as open source microcontroller platform and PICKit2 programmer used for system controller for this robot. While on the hardware side, a circuit will be built in 4 circuit, number one front circuit, number two main circuit, number tree back side motor drive circuit and number four GSM module circuit.

We have Used DTMF controlling system for controlling robot activities from anywhere in the world via Cellular Network. Generally this robot can go anywhere automatically or can be controlled with DTMF and Bluetooth controlling system of a smart phone.

2. DESIGN AND IMPLEMENTATION

Cite this paper:

Md Fahad Jahan, Md Taslim Arefin, "Design and Implementation of an Automated Home Security Robot", International Journal of Advances in Computer and Electronics Engineering, Vol. 2, No. 12, pp. 1-7, December 2017.

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All Section working as an individual work as their perception and complete fully operation of the Automation Home Security robot properly. Home security purpose automation robot working as a systematic way. Those Systems are described below. Figure 1 shows the flowchart of Home security robot architecture.

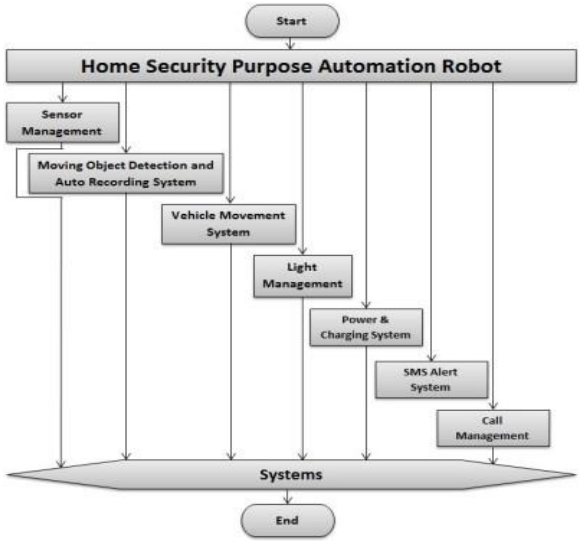

Figure 1: Automation Home Security Robot System Architecture.

2.1 Sensor Management

This Section Sensing value from the Object detection Sensor, Temperature detection, Harmful Gas detection, Humidity sensor, extreme sound detection, Smoke detection sensor etc. The full process is shown in figure 2. It Collects all Data and Synchronizes with system data value and then display it.

Humidity Sensor: Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity Sensor Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort [3].

Temperature Sensor: In general, a temperature sensor is a gadget which is planned particularly to quantify the hotness or coldness of an object. LM35 is an accuracy IC temperature sensor with its yield corresponding to the temperature (in °C) [4].

A gas indicator is a gadget that identifies the nearness of gasses in a zone, regularly as a component of a wellbeing framework. This sort of gear is utilized to recognize a gas spill or different emanations and would interface be able to with a control framework so a procedure can be consequently closed down. A gas identifier can sound a caution to administrators in the territory where the hole is happening, giving them the chance to take off. This kind of gadget is vital in light of the fact that there are numerous gasses that can be destructive to natural life, for example, people or creatures [5].

Extraordinary sound locator: The Sound Detector is a little board that joins an amplifier and some preparing hardware. It gives a sound yield, as well as a parallel sign of the nearness of sound, and a simple portrayal of its sufficiency [6].

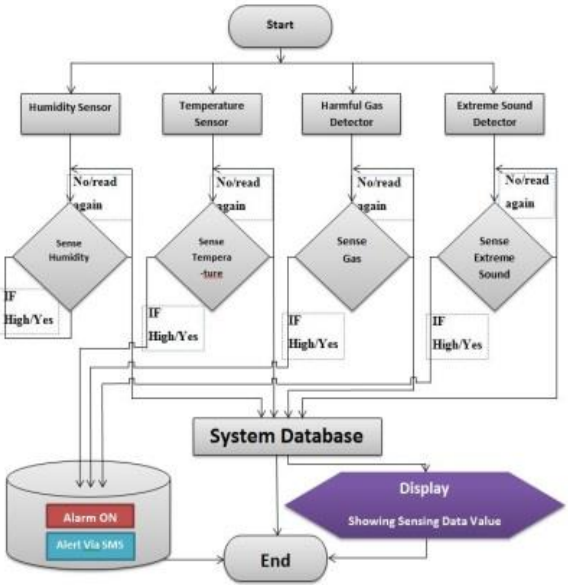

Figure 2: Sensor Management System.

2.2 Moving Object Detection System

In this Section detecting moving object via motion sensor and motion detection based IP camera. If Found any moving object then start Alarming, Call to the Owner and started auto recording to capture moving object. Its saves video Footage in SD Card also in Cloud Storage. We can get Live Video Footage from It. Figure 3 shows the full functionality in flowchart.

Motion Sensor: A movement locator is a gadget that identifies moving items, especially individuals. Such a gadget is regularly incorporated as a segment of a framework that naturally plays out an undertaking or

ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
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alarms a client of movement in a territory. They frame a crucial part of security, mechanized lighting control, home control, vitality effectiveness, and other valuable frameworks [7].

Smoke Detector: A smoke finder is a gadget that detects smoke, regularly as a marker of flame. Business security gadgets issue a flag to a fire alert control board as a feature of a fire caution framework, while family unit smoke finders, otherwise called smoke alerts, for the most part issue a nearby discernable or visual caution from the identifier itself[8].

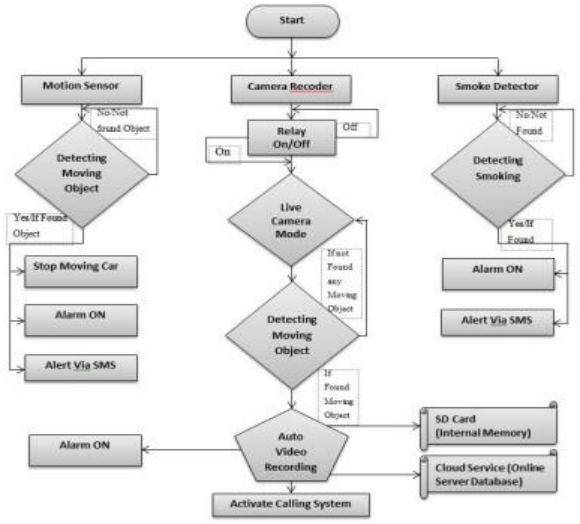

Figure 3: Moving Object Detection and Auto Recording System.

2.3 Vehicle Movement System

Vehicle Movement System use Controlling system via Bluetooth, DTMF (Dual tone Multi Frequency) mode and Automatic Mode.

Bluetooth: The Bluetooth Module Breakout is the most recent Bluetooth remote serial link! This rendition of the well-known Bluetooth utilizes the HC-05 module. These modems fill in as a serial (RX/TX) pipe. Any serial stream from 9600 to 115200bps can be passed flawlessly from your PC to your objective [9].

DTMF: Double tone multi-recurrence flagging (DTMF) is an in-band media transmission flagging framework utilizing the voice-recurrence band over phone lines between phone hardware and different specialized gadgets and exchanging focuses[10]. This robot can run automatically. If any obstacle is found, it rotates back to 45 degree starts moving again. Bluetooth & DTMF: Using cell phone DTMF system we can control the robot via keys manually. Figure 5 shows the Bluetooth and DTMF system.

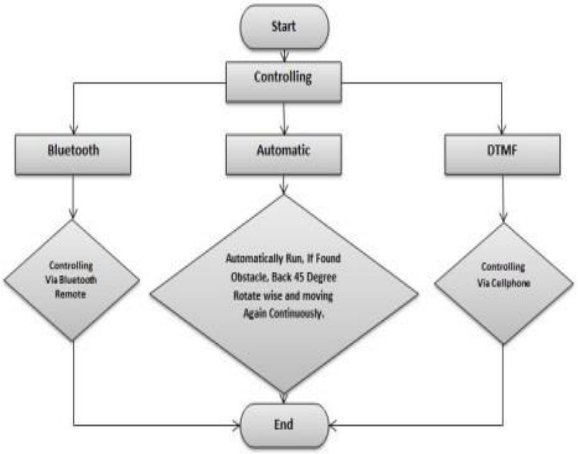

Figure 4: Vehicle Movement System.

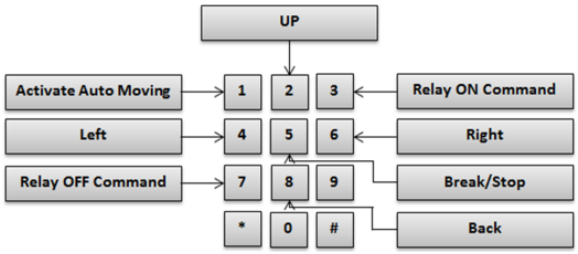

Figure 5: Bluetooth & DTMF Controlling System.

2.4 Light Management

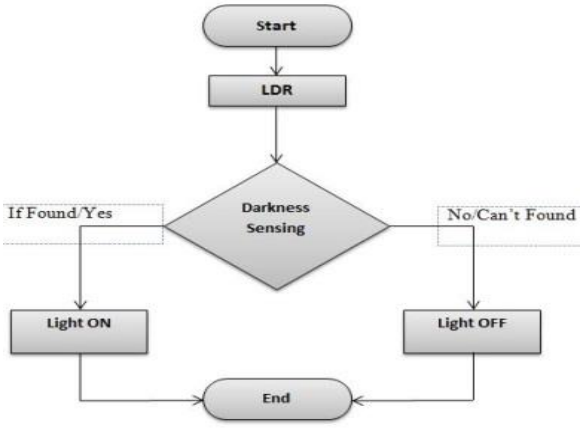

Figure 6: Light Management System.

Light management system controls Light Sensitivity with darkness. LDR Measures Darkness Sensitivity. If

ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
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it is dark then it will turn lights on and if not then turn off light.

2.5 Power & Charging System

Power circuit maintain charge receiving system from different zone. This robot contains charged Extra Battery Pack (Li-ion Battery) for backup. Wireless charging pad produce wireless charging system to power circuit. Inductive charging (otherwise called remote charging or cordless charging) utilizes an electromagnetic field to exchange vitality between two questions through electromagnetic enlistment [12]. An electric battery is a gadget comprising of at least one electrochemical cells with outside associations gave to control electrical gadgets, for example, spotlights, cell phones, and electric cars.[13] When a battery is providing electric power, its positive terminal is the cathode and its negative terminal is the anode.[14]

2.6 SMS Alert System

This Section Providing SMS to owner if found any high sense value measured from data list. GSM System module provides this SMS service successfully with those SMS format shown in figure 7.

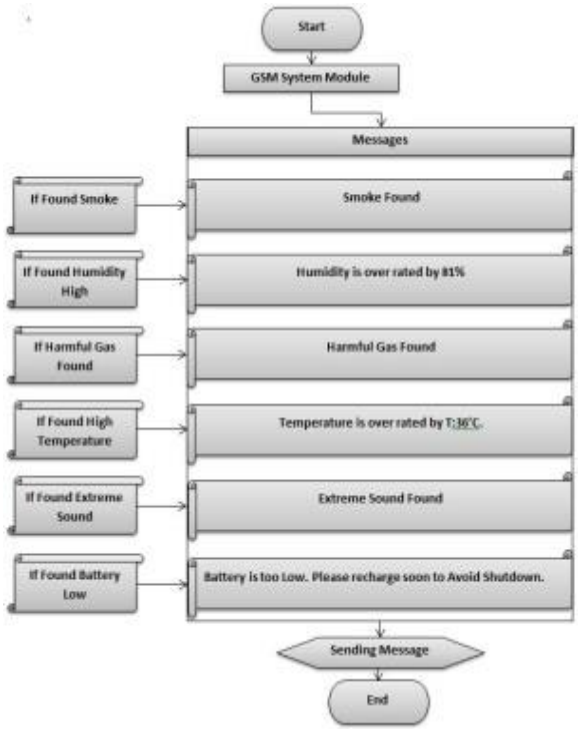


Figure 7: SMS Alert System.

Call Management: Actually call management system providing a calling system to owner if found any Moving object. Calling system will continue call process for two minutes for once any moving object is found.

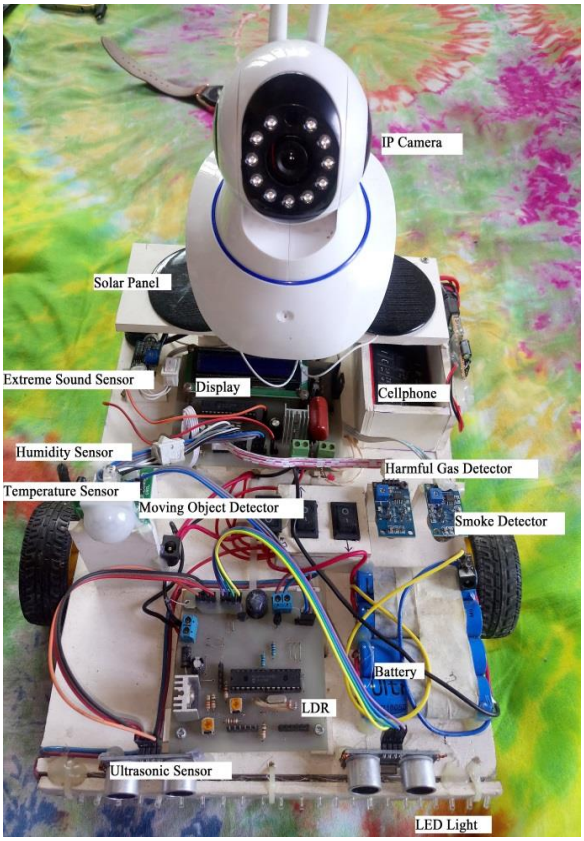
2.7 Software implementation

For programming purpose micro C programming language is used. We have used Pickit2 microcontroller programmer for Coding in Microcontroller IC. Coding process divided into 3 parts as follows:

a. Fixed obstacle and LDR section,
b. Sensor section and others and
c. Motor drive section.

2.8 Complete View

The complete view of automation home security robot is shown in figure 8 which ensure security with movable object detection IP camera. This can detect humidity, high sound, temperature, harmful gas, smoke and moving object. It can automatically send information via SMS and Calling system.



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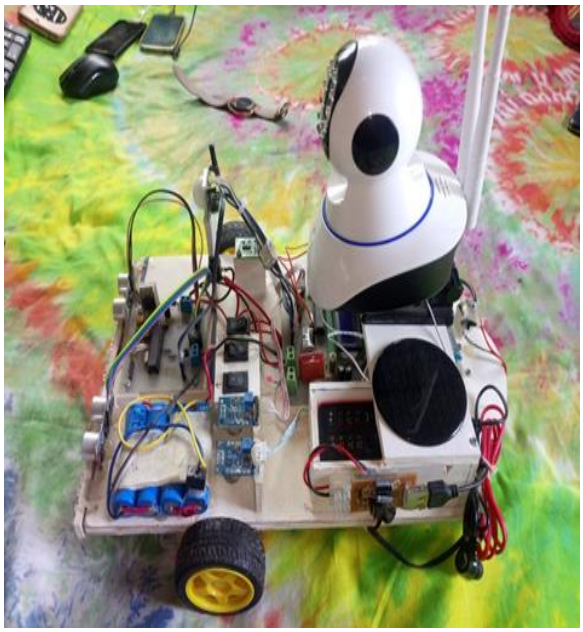

Figure 8: Home Security Automation Robot.

3. PERFORMANCE ANALYSIS

We have performed a Performance analysis based on SMS, Call and Sensor Part.

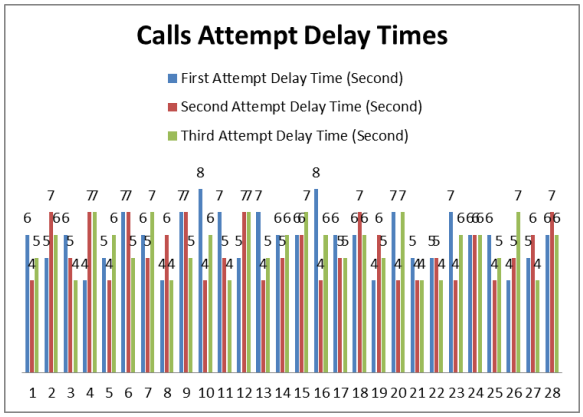

Figure 9: Call delay time

3.1 Average Call & SMS Delay Time

Call delay performance analysis is done with 28 calls for each attempts shown in figure 9. We have attempted 3 times here.

In Attempt number one average delay time is found 5.85 Seconds. In Attempt number two average delay time is 5.35 Seconds and 5.53 in attempt number three. Total average delay time of call performance analysis is 5.58 Seconds.

We have done the same procedure for calculating the SMS delay time. Figure 10 illustrates the SMS delay time graph.

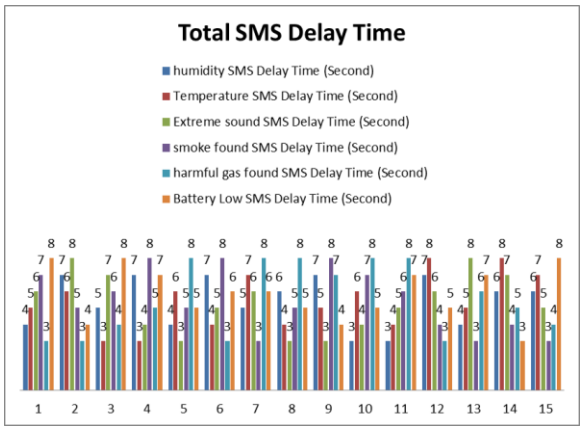

Figure 10: SMS delay time

In SMS delay section average value of humidity sensor 5.4 seconds, temperature sensor 5.4 seconds, extreme sound sensor 5.33 seconds, smoke sensor 5.47 seconds, harmful gas 5.53 seconds and battery low 5.87seconds. So, the total average delay time of SMS 5.50 seconds.

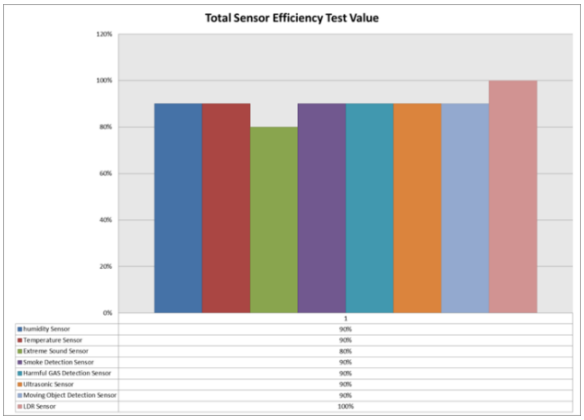

Figure 11: Sensor accuracy

Figure 11 has shown sensor accuracy. Every sensor was tested for 10 times and the outcomes are shown in the total sensor efficiency in the test value Figure.

3.2 Power Consumption Analysis

Every sensor and part needs power to runs or work. We calculated every sensor's power consumption and

ISSN: 2456 - 3935

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working time on power backup system which is as follows:

Consumption: 7.182*5V = 35.91 Watt.
Total Battery Capacity: Used Two types battery.
Lithium-Ion Battery 4.5Ah*4 piece =18Ah (8 Volt)
Normal Battery 2Ah*2 piece =4Ah (8 Volt)
So, (18+4) Ah=22Ah*8 Volt =176 Volt Ampere Hour or Watt. Hour.
Total Running Time: 176/35.91= 4.89 Hour.

4. CONCLUSION

This Paper has focused on the security aspect of the existing home automation system and points out its functionalities. It shows how the concept of security and meaning of the word "intruder" has changed in modern homes. The paper has pointed out the shortcomings of existing home automation systems in identifying and preventing sophisticated intruders in a home environment.

For future work in the field of home automation security, to encourage the researchers to consider a home automation system as a whole and develop behavior prediction and advanced sensing parameters that can help to identify and prevent skilled and sophisticated intruders. Security is vital for the proper implementation and development of the home automation systems. Moreover, it can provide a sense of security to a home's inhabitants and puts their minds at ease.

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Authors Biography

Md. Fahad Jahan is working as Engineer of Starlink Engineering Limited. He started his working career in 2017 as Engineer. Md. Fahad Jahan is currently a M. Sc. Student at Daffodil International University in the Department of Electronics & Tele-communication Engineering. Md. Fahad Jahan received his B. Sc. Degree in Electronics & Tele-communication Engineering from Daffodil International University in 2016 His research interests are robotics, cellular network planning and optimization etc.

Md. Taslim Arefin is working as Associate Professor in the Department of Electronics & Tele-communication engineering of Daffodil International University. He started his teaching career in 2006 as Lecturer. Md. Taslim Arefin is currently a PhD re-searcher at Jahangirnagar University,

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Bangladesh in the department of computer Science and Engineering. Mr. Arefin received his MSc. Degree in Electrical Engineering from Blekinge Institute of Technology, Sweden in 2008. He received his BSc. Degree in Computer Engineering from American International University- Bangladesh in 2005 His research interests are mobile computing, IoT, Wireless sensor networks, Wireless ad-hoc networks, cellular network planning and optimization.

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