Smart Home Automation and Security System using GSM and ARM7

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***Abstract*— This project investigates the potential of Home Control and security which is the aim of the Home Automation Systems in near future. The analysis and implementation of the home automation technology using Global System for Mobile Communication (GSM) modem to control home appliances such as light, conditional system, and security system via Short Message Service (SMS) text messages is presented in this Project. Security in the form of LPG gas leakage alert, entrance of people without permission alert is added for enhancement of security in house. The proposed project is focused on functionality of the GSM protocol, which allows the user to control the target system away from residential using the frequency bandwidths. The concept of serial communication and AT-commands has been applied towards development of the smart GSM-based home automation system. Home owners will be able to receive alert messages of any home security issue in the home remotely from their mobile phones. Arm 7 LPC2148 microcontroller with the integration of GSM provides the smart automated house system with the desired baud rate of 9600 bps. The proposed prototype of GSM based home automation system was implemented and tested. Additional feature for old people at home is also added when an old person in home presses a button a message is send Needing Help.**

The security issues were also tested and verified. For the SMS alerts of LPG leakage, invader intimation, and help alert was tested and verified.

Keywords—Component; formatting; style; styling; insert (key words)

I. INTRODUCTION

The concept of home automation has been around since the late 1970s. But with the advancement of technology and services, people's expectations of what a home should do or how the services should be provided and accessed at home has changed a lot during the course of time, and so has the idea of home automation systems.

Security is a big challenge everywhere because thefts are increasing day by day owing to the unsafe and insecure security systems in homes, commercial complexes and industries. Several conventional technologies are available to keep home properties safe from intruders, but most common smart home security systems work on wireless GSM communication. Such systems provide security from natural, incidental, intended, unintended, accidental and human made problems by continuously monitoring homes with different sensory systems like motion, smoke, gas, temperature, glass break or door break detectors and fire alarm systems.

Fig.1 Home Automation And Security System

Security is one thing that is very influential in today life; everyone needs security guarantees when they work. Like health, security is an important aspect in life. Hence, various kinds of development in the technology field is designed to provide security at all times to protect they assets and privacy. In addition to the course with the application of security system, it can reduce the crime rate in the society especially the crime of theft at home. Due to the increasingly rapid movement of people, making them requires a security technology that has the characteristics of mobile technology in terms of getting information easily and quickly.

This paper mainly focuses on providing security when the user is away from home. SMS (Short Message Service) is a GSM mobile technology that can perform remote communication wherever they are. Through this facility messages can send quickly, accurately and at a low cost. Mobile phone with SMS facility will be very useful when applied to integrated security systems, where the information sends by a security system and the information received by the user mobile phone in the form of SMS.

II. LITERATURE SURVEY

In this section, discussed different Home Automation System with their technology with features, benefit and limitations they have. "The Figure 2" shows Basic Architecture of Remote Home Automation.

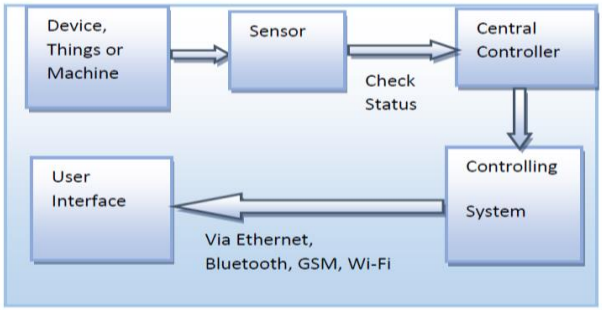

Figure 2: Basic Block Diagram of Home Automation

The Home automation system that uses Wi-Fi technology [1]. System consists of three main components; web server, which presents system core that controls, and monitors users' home and hardware interface module(Arduino PCB (ready-made), Wi-Fi shield PCB, 3 input alarms PCB, and 3 output actuators PCB.), which provides appropriate interface to sensors and actuator of home automation system. The System is better from the scalability and flexibility point of view than the commercially available home automation systems. The User may use the same technology to login to the server web based application. .If server is connected to the internet, so remote users can access server web based application through the internet using compatible web browser.

The application has been developed based on the android system [2]. An interface card has been developed to assure communication between the remote user, server, raspberry pi card and the home Appliances. The application has been installed on an android Smartphone, a web server, and a raspberry pi card to control the shutter of windows. Android application on a Smartphone issue command to raspberry pi card. An interface card has been realized to update signals between the actuator sensors and the raspberry pi card.

Cloud-based home appliance monitoring and controlling System. Design and implement a home gateway to collect metadata from home appliances and send to the cloud-based data server to store on HDFS (Hadoop Distributed File System), process them using Map Reduce and use to provide a monitoring function to Remote user [3].

It has been implemented with Raspberry Pi through reading the subject of E-mail and the algorithm. Raspberry Pi proves to be a powerful, economic and efficient platform for implementing the smart home automation [4].Raspberry pi based home automation is better than other home automation methods is several ways. For example, in home automation through DTMF (dual tone multi-frequency) [11], the call tariffis a huge disadvantage, which is not the case in their proposed method. Also, in Web server based home automation, the design of web server and the memory space required is ejected by this method, because it simply uses the already existing web server service provided by G-mail. LEDs were used to indicate the switching action. System is interactive, efficient and flexible.

Shih-Pang Tseng et al. [5] proposed Smart House Monitor & Manager (SHMM), based on the ZigBee, all sensors and actuators are connected by a ZigBee wireless network. They designed a simple smart socket, which can remote control via ZigBee. PC host is used as a data collector and the motion sensing, all sensing data are transferred to the VM in the cloud. The user can use the PC or Android phone to monitor or control through the Internet to power-saving of the house.

Arduino microcontroller to receive user commands to execute through an Ethernet shield. Our house network used together both wireless ZigBee and wired X10 technologies [6]. This system followed smart task scheduling with a heuristic for the Resource-constrained-scheduling problem (RCPSP). The mobile device can be either wired to the central controller through USB cable or communicates with it wirelessly, within the scope of the home. Arduino contains the web server application that communicates through the HTTP protocol with Web-based Android application. The system is highly flexible and scalable and expandable.

The home network which monitors the appliances and sensors and transmits data to the cloud-based data server which manages the information and provides services for users by transmitting data and receiving user commands from mobile application [7]. The proposed system has good modularity and configurability characteristics with very low power consumption in cost efficient way.

Application developed using the Android platform controlled and monitored from a remote location using the smart home app and an Arduino Ethernet based micro web-server [8]. The sensors and actuators/relays are directly interfaced to the main controller. Proposed design offers are the control of energy management systems such as lightings, heating, air conditioning, security, fire detection and intrusion detection with siren and email notifications.

Embedded system Raspberry Pi to serve as a communication gateway between mobile devices and Konnex-Bus (KNX) home automation systems [9]. Store the information of all actors and sensors within a Smart Home, instead of using separate profiles. Ensures energy-consumption could be reduced, compared to a standard desktop computer.

III METHODOLOGY

The microcontroller amr7 is the hearth of the Project. It controls working of whole project. Its constantly senses information from the sensor and controls different home appliances through activators.

This project has 5 sensors

1) LPG sensor
2) Temperature Sensor
3) humidity sensor
4) IR sensor
5) LDR Sensor

This sensor has 5 relays to control different appliances. The appliances which are there in this projects are

1) Fan
2) Light
3) Cooler (Light used demo purpose)
4) Geyser (Light used demo purpose)
5) CCTV Camera

The project uses 16*2 LCD to display temperature, humidity and Darkness.

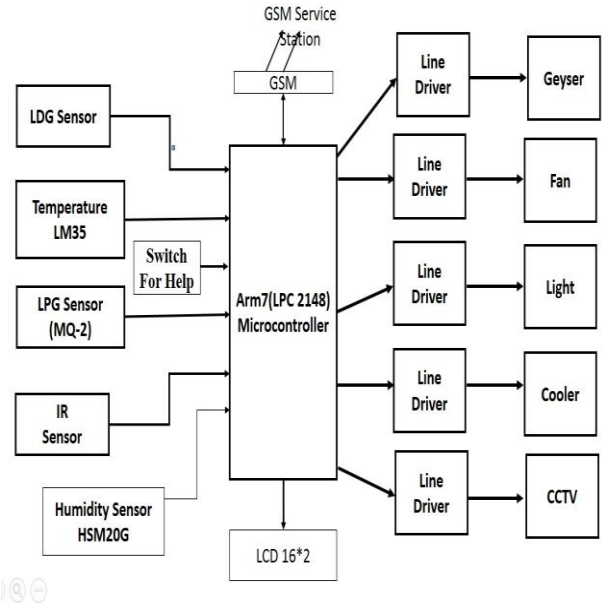

Fig. 4.1 Block Diagram of Smart Home And Security

The Communication Protocol used to communication with the user at far location is GSM. We are Neo_M660 GSM Modem which is used to send and receive commands from the user.
There is a toggle switch which is used to send information that a person is in help over a GSM modem when pressed.

The microcontroller keeps on checking the analog input pins data from temperature sensor, humidity sensor, and LDR Sensor. It displays the value on the lcd display.

The temperature reading are obtained from LM35 temperature sensor through ADC1 channel 4 of the arm 7 controller if the temperature of the room goes beyond the 40 degree Celsius. The fan is on through the relay driver circuit connected pin no P0.30.

The Humidity reading are obtained from HSM20g Humidity Sensor through ADC1 channel 3 of the arm 7 controller if the Humidity of the room goes beyond the 70 percent. The cooler is on through the relay driver circuit connected pin no P0.29. in our project we have used a light bulb instead.
The LDR sensor senses the light from the outside and is placed near the window if there is light from outside we switch off the bulb near the window. And if there is darkness we switch on the bulb near window. This save the electricity when there is already light from outside.

The microcontroller keeps on checking the digital input IR sensor and LPG Sensor through the Pins P0.17 and P0.18 respectively.

The IR sensor is placed near the door. If someone opens the door or enters in the ir sensor send digital one output to the microcontroller through the pin no 0.17 once this pin is detected, then microcontroller switches on the CCTV Camera Through pin no 0.31 and there is a SMS send to the mobile no which is stored in the mcrocontroller through the GSM Modem intimating that someone is detected.

The LPG Sensor is installed in kitchen in live project when it detects a leakage of gas the it sends a digital one output to microcontroller through the pin no 0.18 once this is detected microcontroller switches on the buzzer through the pin 0.23 of the controller and a SMS is send to the mobile no which is stored in the microcontroller through the GSM modem intimating that a gas leakage is found.

There might be an old person residing in home while all others are at work to ask for help there use to be an alarm. But it has a limit which is it can intimate to a person in house only. In our Project we have kept a switch if it is pressed there is SMS send through the GSM modem to a person whose mobile no which is stored in the microcontroller through the GSM Modem intimating that the old person is in help.

In our Project we can control the CCTV camera by SMS through GSM modem. If we send a SMS to a SIM installed inside the GSM modem of the project saying Cam On$. the SMS is received by the GSM modem and it transfers in to microcontroller. The microcontroller decodes the SMS and switches on the camera through relay connected to pin 0.31 of the microcontroller.

If we send a SMS to a SIM installed inside the GSM modem of the project saying Cam Off$. the SMS is received by the GSM modem and it transfers in to microcontroller. The microcontroller decodes the SMS and switches off the camera through relay connected to pin 0.31 of the microcontroller.
There might be no one in home but you want a to switch on the geyser so that you can freshen up as soon as you reach home for this purpose in our project we can control this through the GSM modem. If we send a SMS to a SIM installed inside the GSM modem of the project saying Geyser On$. the SMS is received by the GSM modem and it transfers in to microcontroller. The microcontroller decodes the SMS and switches on the Geyser through relay connected to pin 0.25 of the microcontroller.

If we send a SMS to a SIM installed inside the GSM modem of the project saying Geyser Off$. The SMS is received by the GSM modem and it transfers in to microcontroller. The microcontroller decodes the SMS and switches off the Geyser through relay connected to pin 0.25 of the microcontroller.

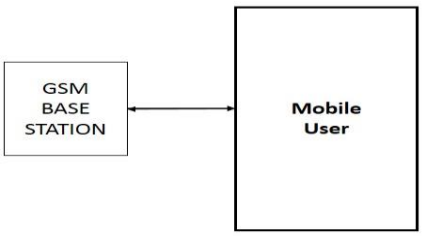

Fig. 4.2 Block Diagram at Mobile User

At the mobile user end we send 3 SMS from the project which are received this is the no which is fed into the microcontroller at the installed project in home. The SMS is send via a standard GSM format hence it can be read easily by the mobile as just another message. The 3 SMS received on the mobile of the user are

1) Person detected if an IR sensor detects some disturbance at the door
2) LPG Gas leakage if an LPG Gas sensor detects gas leakage at the door
3) Need Help If some help is needed by old person at home

We send four command in standard SMS format as just another SMS to the mobile no of the SIM installed in Home automation project the GSM are received by GSM modem at the project and decoded and appropriate camera and geyser is on and off respectively. The commands are

1) Cam on$ for switching on the camera
2) Cam off$ for switching off the camera
3) Geyser on$ for switching on the geyser
4) Geyser off$ for switching off the geyser

III. RESULTS

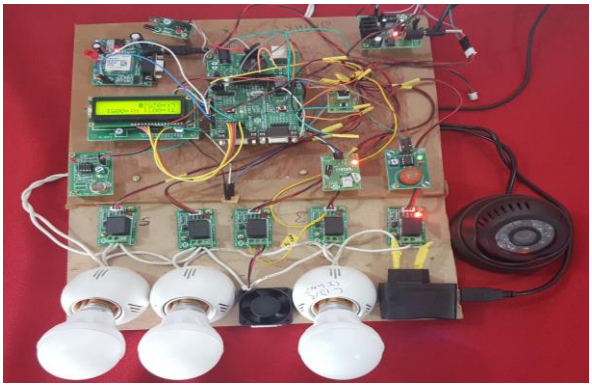

Fig 5.1 Implemented Model

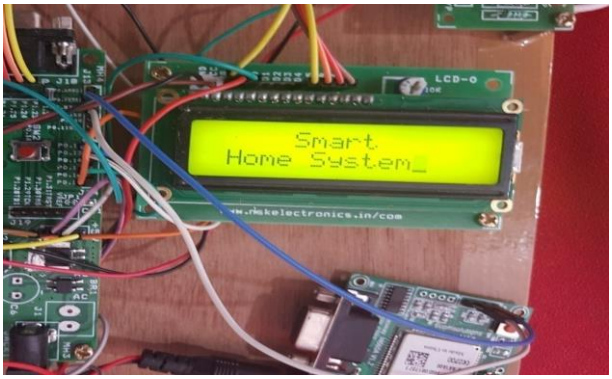

Fig 5.2 Turning On Home Automation System

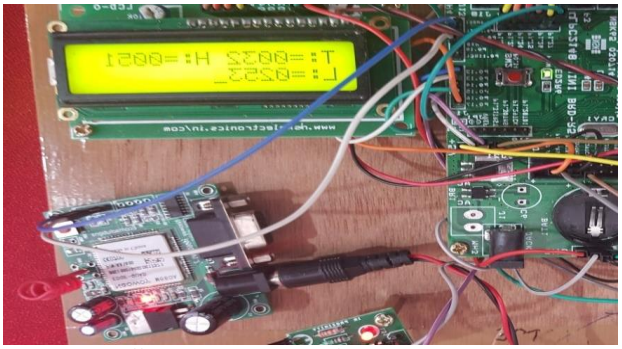

Fig5.3 Different average values of temperature (T), Light (L), and humidity (H).

Fig 5.4 Gas leakage indication via GSM

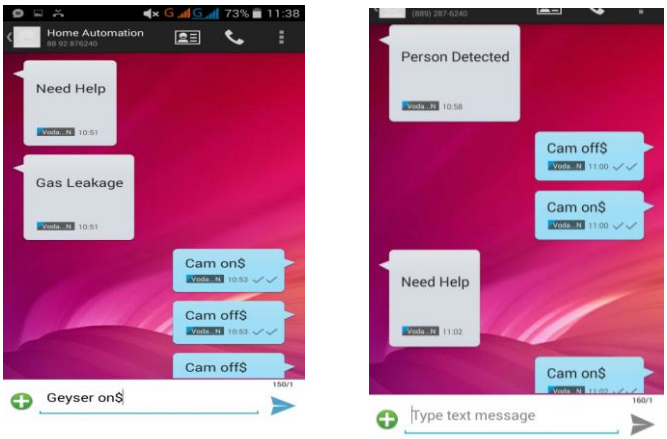

Fig 5.5 Sending and receiving of messages to control the home automation and security

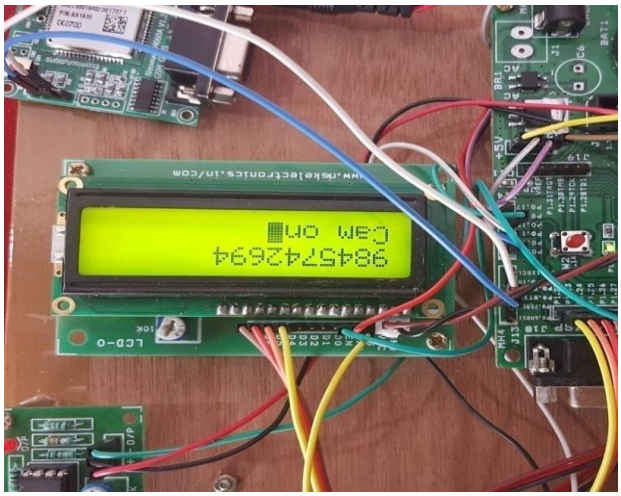

Fig 5.6 Turning On Camera through registered Mobile

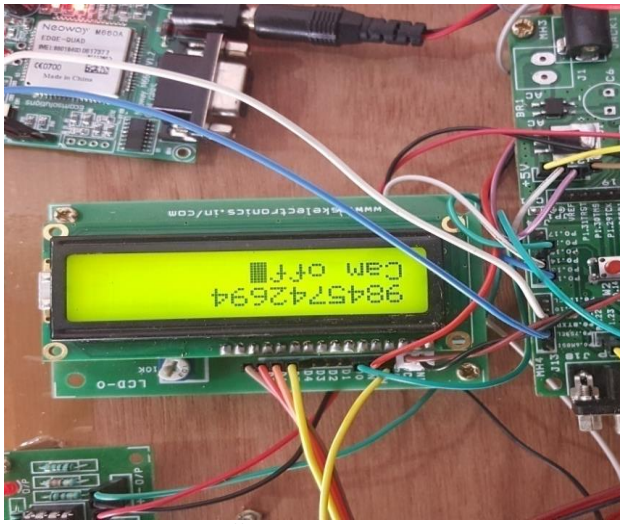

Fig5.7 Turning Off Camera through registered Mobile

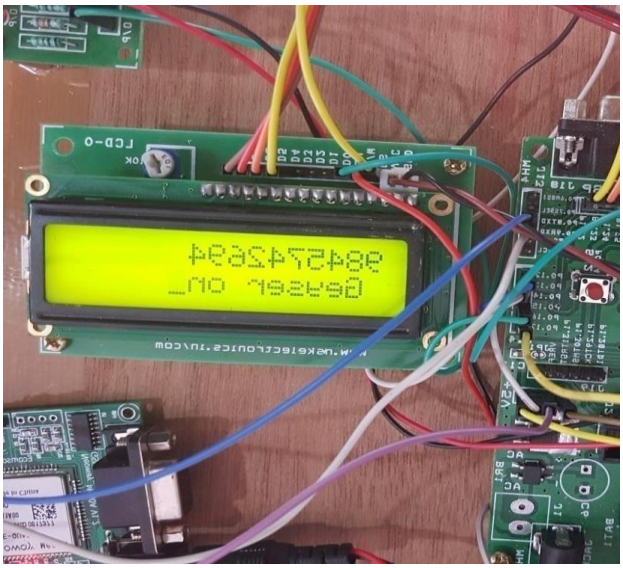
Fig 5.8 Turning On Geaser through registered Mobile

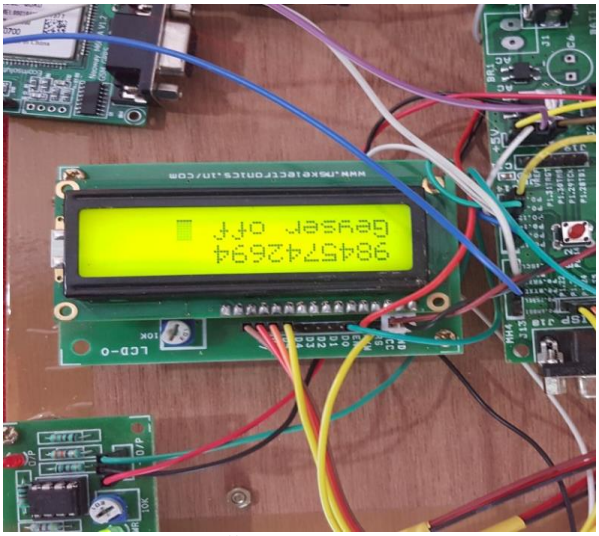

Fig 5.9 Turning Off Geaser through registered Mobile


Fig 5.10 Turning On camera when person detected

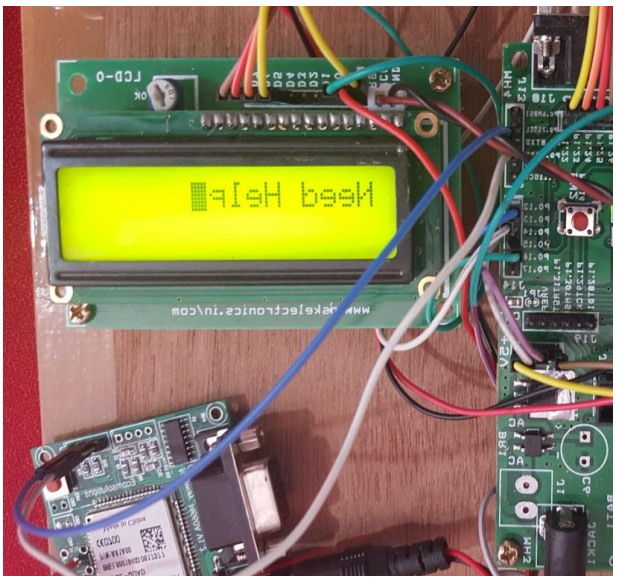

Fig 5.11 Need help message will be transferred to registered Mobile

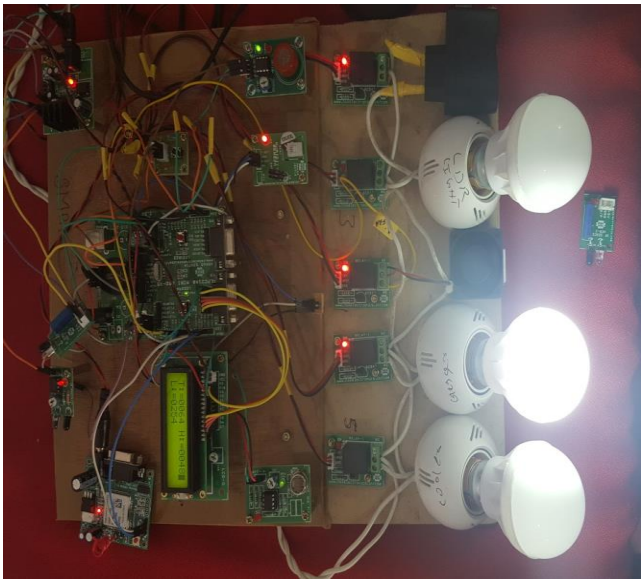
Fig 5.12 Turning ON/OFF of cooler, fan and Light using different Sensor

CONCLUSIONS

We have combined home security and automation in single project and added a help button for an old age person in our project. This is will provide optimum energy usage and provide security to system if a person enters without permission or gas is leaked a message is sent through GSM modem. Energy saving is done through controlling home appliances depending on the preferred conditions automatically.

In future the along GSM modem we can include GPRS modem or Wi-Fi module to connect to internet and optimize our project in terms of IOT. Akk the sensor could be connected to IOT cloud server and the video captured can also be sent to the IOT cloud server over an internet protocol.

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