DOMOTICS USING IOT

Apoorva Desai[1*], Shusnata Chowdhury[2], Siddesh G K[3] and Savitha A C[4]
[1]Department of Electronics and Communication, JSSATE, Bangalore, India
[2]Department of Electronics and Communication, JSSATE, Bangalore, India
[3]Department of Electronics and Communication, JSSATE, Bangalore, India
[4]Department of Electronics and Communication, JSSATE, Bangalore, India
xapoorvax@gmail.com, shusnata.c@gmail.com, siddeshgundagatti@gmail.com savithalm@gmail.com

***Abstract*— A smart home is designed centered around an ARM controller and based on the concepts of IOT. The version of ARM used in our model was ARM LPC2148. The home includes sensors to detect movement and to provide security, facial recognition to differentiate strangers at the door, live video footage of the house, temperature and gas sensors to detect harmful gases and fires and initiate protective measures. All of the information is interfaced to the user's smart phone using an Android app which allows the user to monitor and control all aspects of the house remotely. This also includes ergonomic features like turning the fan and lights on or off. The user also gets regular measurements of temperature and gas levels on their phone and alarms in the case an event of concern occurs, for example- fire, gas leakage, intrusion etc. Although the description here is for a home, this design can also be implemented in an office or industrial environment.**

Keywords— Domotics, home automation, smart home, ARM, ARM LPC2148, home security, GSM, Android platform

I. INTRODUCTION

Domotics is a contraction of "Domus" which in Latin stands for home and the words, telematics, informatics and robotics. So in essence, Domotics is another word for home automation. Manual systems are being taken over by automated systems in all aspects of human life. Automation is the use of information technologies and control systems to reduce human effort. The need or development of Domotics rose from a simple question; when every Wi-Fi enabled device in a home is already connected, how much harder is it to connect other things in the house? This project aims at integrating the physical objects to the digital world and through this project we have tried to show that by using the concepts of Internet of Things, we can design a smart house as a result of which power and manual labor can be saved to a large extent. Home automation can be useful to those who need to access home appliances while away from their home and can greatly improve the lives of the disabled. This application has been researched and developed since the days of the landline phone.[1] The internet of things (IoT) is essentially physical objects-devices, buildings, vehicles and other items- forming a network, embedded with- software, electronics and sensors. The network connectivity enables these objects to collect and exchange data. It began with the internet of computers- individuals with computers connected to the internet could send and receive files across the world. Then with the advent of social media, there was an explosion of the population of people on the internet. Thus began the era of the Internet of People. So now that every computer and every individual is already interconnected, the only logical next step was to add things on the internet. This led to the Internet of Things.

II. SYSTEM DESIGN

A. Block Diagram

In our project, the home is controlled through an android application on the user's smart phone [2]. The applications are developed such that the entire home 3D view is displayed on the mobile. The user can control the home by using that mobile. The smart phone is connected to the server through Wi-Fi and internet. The server is then connected to a controller. The relay drivers are used to control electronic devices such as lights, TV, fan and others. The sensors are used to monitor the integrated devices. Cameras are used to capture live videos to provide security. GSM technology has been used for communication between the system and the user. The design of our system is represented as a block diagram in Figure.1.

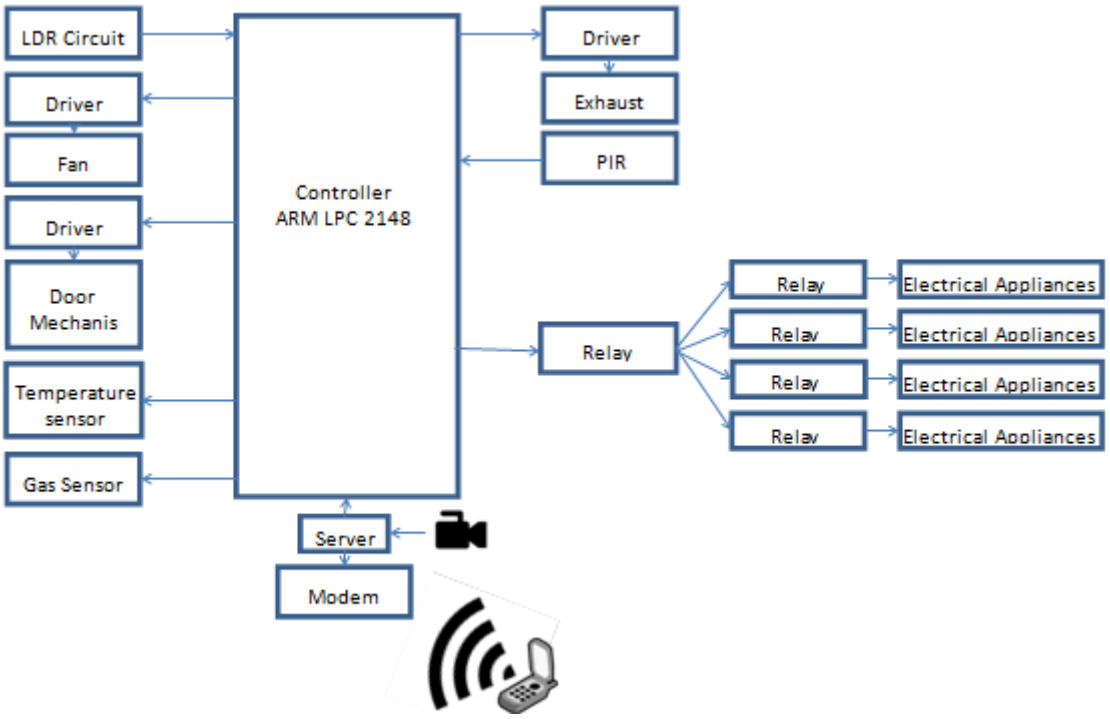

Figure 1 Block diagram of the system

The user can control the operation of the devices connected to the product from remote places. This is possible by sending a text message in the predefined format to the SM modem using SIM card. Whenever the owner sends a valid SMS to the GSM modem, the message is read; the password and the command are verified and validated. Once the command and the password have been authenticated, then an appropriate action will be taken by the ARM controller based on the request made. Similarly whenever a security problem occurs, to the owner of the product will be informed by sending an SMS to the user mobile.[3] The GSM modem is controlled by a standard set of AT (Attention) commands. These commands have been used to control the majority of functions of the GSM modem. The GSM will then be used to send the message to nearest police station in case of an emergency.

B. Hardware Description

The home automation model includes the following components:

1) ARM7Controller (LPC2148)

The ARM7 Controller constitutes the main part of the embedded system. Advanced RISC Machines (ARM) is categorized under the Reduced Instruction Set Computer (RISC) architecture. The controller model used in the project is the LPC2148 model. It is characterized by real time emulation and embedded trace support with an embedded high speed flash memory. The controller is a low power consumption unit and has the ability to operate in two different modes (16 and 32 bits) [4]. Due to their tiny size, they are applicable where miniaturization is a key factor such as access control. The controller processes the incoming data from the sensors and displays the necessary information on the LCD display.

2) Temperature Sensor

It is typically a thermocouple that measures temperature through an electrical signal. The sensor detects changes in the ambient temperature which is proportional to the analog voltage outputted to the controller in terms of potential difference. The temperature sensor model used in the project is the LM35 model. If the temperature is above 45 degrees, the controller sends the signal to the relay. The relay in turn switches the buzzer on.

3) PIR Sensor

Passive Infrared Sensor is a pyro electric device that detects motion by observing changes in the infrared radiation levels emitted by the surrounding objects. The entry of a person room, the sensor detects the change in IR radiation emitted and triggers the lighting system. Hence it monitors the presence of a person in the room [5].

4) LDR (Light Dependent Resistor)

A photo resistor or photocell is a light controlled variable resistor. More the light incident on the photo resistor, the resistance decreases. In other words, it exhibits photoconductivity. In the home automation project, it is used to monitor light intensity of the room.

5) Gas Sensor

It is a device that detects the gases emitted due to leakage. This leakage is interpreted as a signal and interfaced with the control system so that the process is automatically shut down. The model used is the MQ-5 which detects the concentration limit from 20ppm-1000ppm. Resistance value of MQ-5 varies for different gases. So when using the sensor, sensitivity adjustment is necessary.

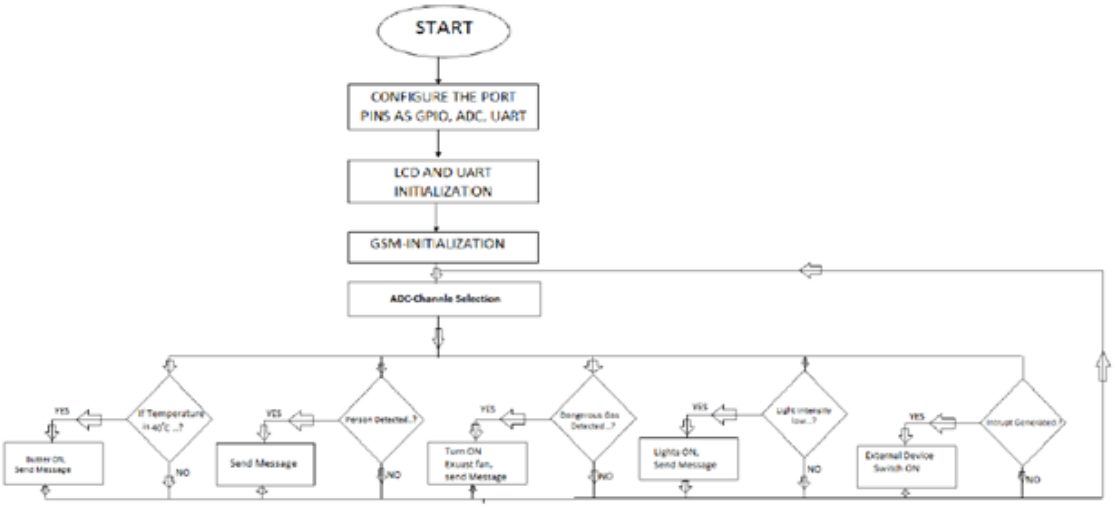

Figure 2 Flowchart for Software Description

6) Exhaust Fan

It is a wiring mechanism used for the circulation of air. It works on the principles of a DC motor. Any leakage of gases is drawn out by the fan to the outside.

7) Relays

The relay is a switch operated with electricity. The project uses the relay model ULN2003/2803.Relay circuits are controlled by a low power signal. It uses an electromagnet to operate mechanically. In some cases it operates on principles of solid state relay.

8) LCD (Liquid Crystal Display)

An electronics display module which has a variety of applications. A 20X4 LCD module is used in the project which is used to display room temperature, light intensity, concentration of gases and presence of a person in the room. The 8 bit data lines send the information to the LCD.

9) GSM

The GSM net is used by a cell phone to provide wireless communications that need connectivity rather than high data rates.

GSM modem can be controlled by a standard set of AT(Attention) commands. In this project GSM modem is used for communicating with the user and controller. It sends a message to the user whenever the sensor value is high.

C. Software Description

Looking at Figure 2:

- The port pins have been configured as GPIO, ADC, and UART.
- LCD and UART is initialised
- The ADC channel is configured and the sensor is monitored continuously.
- When the temperature is sensed to be above 40 degree Celsius, controller sends a message to the user and it is displayed on the LCD.
- When the PIR sensor detects movement then it sends a message to the user through GSM system.
- When light intensity is very low then the lights in the room will be turned ON and if intensity is comparatively higher the lights are turned off.
- When gas leakage is detected in a room, the exhaust fan is turned ON and a message is sent to the user through the GSM system.
- When an interrupt is generated by the software then the other electronic devices are switched on.

D. Android Platform

An Android based app is used to provide a suitable interface between the user and the home automation system. Bluetooth based Android smart phones have been used with IP connectivity for accessing and controlling devices from remote places [6]. The screenshot in Figure 3 depicts the login page as seen on the user's phone. Only after authentication is an individual allowed access to the controls of the house. The screenshot shown in Figure 4 is the home screen that is displayed once login is successful. This contains the icons for different parts of the house upon clicking which, a live stream is displayed. An example of this is shown in Figure 5. This design can also be extended so it applies for industries as shown in Figure 6 and Figure 7.

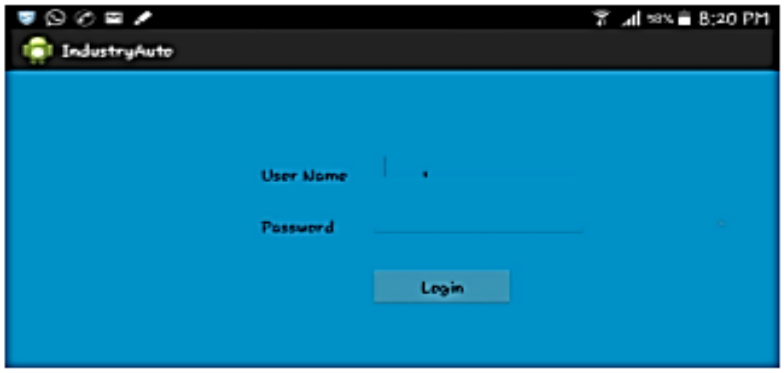

Figure 3 Login screen of the Android App

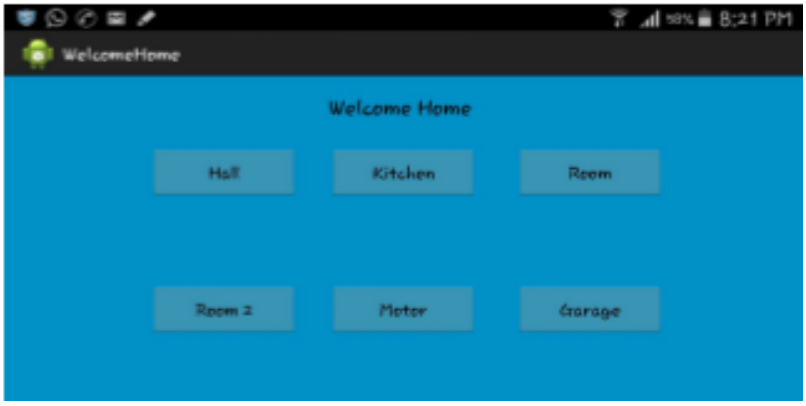

Figure 4 Home page

Figure 5 Live stream of the living room

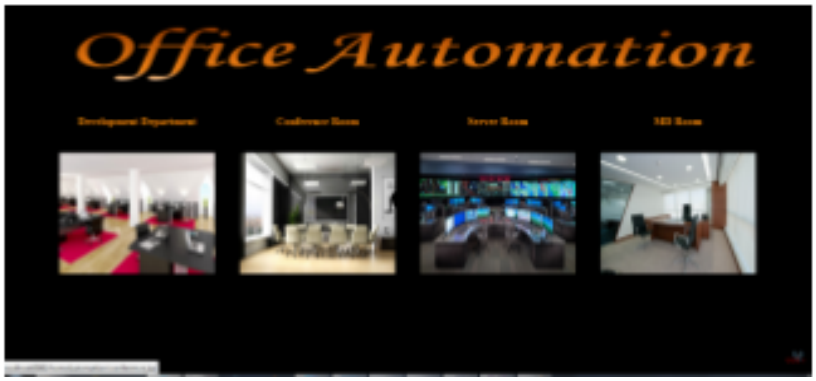

Figure 6 Office automation homescreen

Figure 7 Live stream of conference room

III. RESULTS

- When the temperature is above 45 degrees, the controller sends a message to the user by displaying the result on the LCD.
- When PIR sensor detects movement of a person in the room, a message is sent to the user by using GSM. The absence of a person in the room will cause the lights to be switched off.
- When the light intensity is low then the room lights will be turned ON using GSM.
- Presence of gases will be removed by the exhaust fan and its concentration is indicated on the LCD.A message is sent to the user's registered smartphone.

IV. SCOPE FOR FUTURE ENCHANCEMENTS

This project has tremendous scope in the future. It can be developed and made more user friendly with additional features such as:

- 3-D projector can be implemented with smart phones.
- It can be implemented for military applications.
- It can be used to run manufacturing lines in industries.
- Hologram system can be implemented to create an augmented reality [7].

V. CONCLUSION

Domotics has been implemented successfully. We have successfully integrated the house and its appliances to the digital world. The project is cost effective and can be easily implemented for other real time applications. It can be realised with the usage of less power. This project is secure and user friendly and can be employed by the government in large scale to help industries too. This technique helps to control the unauthorized access of data and devices. By automating a house, a stress free living environment can be created with the available advanced mechanism and the entire system integrated into one network. The home is substantially safe from fire accidents, break-in attempts and gas leakage.

ACKNOWLEDGMENT

We would also to thank the Head of Department Dr H S Aravind for his support. We would also like to thank our principal Dr Mrityunjaya Latte and our college for providing us with the resources and the encouragement to ensure the successful completion of this paper. We also want to extend our gratitude to our coordinator, Mr Siddesh G for proof-reading our paper, finding various platforms and encouraging us to publish it.

REFERENCES

[1] Kaur, I., "Microcontroller based Home Automation System with Security," International Journal of Advanced Computer Science and Applications, vol. 1, no. 6, pp. 60-65, 2010. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[2] Periyar Dasan, Agan Prabhu,Shanmuga Sundaram, Senthil Rajan,Kesavan, "A Ubiquitous Home Control and Monitoring System using Android Based Smart Phone", International Journal Of Computer Science And Mobile Computing.vol.2,no.12,pp.188197,December 2013.

[3] Rupam K.S.,Ayub M.,Himaraka K. and Dhiraj K, "Android Interface based GSM Home Security System", proc. of IEEE International conference on Isssues and Challenges in Intelligent Computing Techniques, 2014.pp.196-201.

[4] "ARM7DI Data Sheet"; Document Number ARM DDI 0027D; Issued: Dec 1994.

[5] M. Kretschmar and S. Welsby (2005), Capacitive and Inductive Displacement Sensors, in Sensor.

[6] Piyare, R., Tazil, M., "Bluetooth based Home Automation System using Cell Phone," IEEE ISCE, pp. 192-195, 2011

[7] MGraham, M., Zook, M., and Boulton, A. "Augmented reality in urban places: contested content and the duplicity of code." Transactions of the Institute of British Geographers, DOI: 10.1111/j.1475-5661.2012.00539.x 2012.

AUTHORS PROFILE

ApoorvaDesai Has a bachelor's degree in Electronics and Communication engineering from JSS Academy of Technical Education, Bangalore, Visvesvaraya Technological Universty, Belgavi. She is currently applying to pursue a Masters degree in the same field. She is ambitious, dedicated and high achieving. She is a hard worker and works well in a team. She completed her secondary education from United Kingdom and has a paper published in an international journal while there. She has also completed a project with the RDA Department, ISRO, Bangalore. Her main areas of interest include Automation, Programming, Digital Circuits, Image processing, IOT and VLSI.

Shusnata Chowdhury She has completed her Bachelor's degree in Electronics and Communication from JSS Academy of Technical Education, Bangalore under Visvesvaraya Technological University. She has interned with the Radar Development Authority of ISRO to design a Ka band-pass filter of a Cloud Radar. She is keen on pursuing her masters in the communication field. She is focused and highly motivated to achieve her set goals. She has given a seminar on "Artificial Neural Networks" in the ECE department of JSSATE, Bangalore. Her main areas of interest include Signals and Systems, Digital signal processing, Analog Communication and applied mathematics.