IoT Based Smart Appliances Monitoring and Fault Detection

[1]Shivani.S.Soma, [2]Radha.B.K,

[1]M.Tech Student, [2]Assistant Professor

[1]Compter Science and Engineering

[1]Poojya Doddappa Appa College of Engineering, Kalaburgi, Karnataka, India

Abstract: Now a day's as population is increasing day by day the mobile phone applications are also increasing. The popularity and functionality the demand for mobile application which is widely been increasing in our daily lives. This paper proposes to develop a module for home automation and fault detection system mainly in a Home and Industry and transfer the related sensed data. Home automation machines uses of portable devices as a user interface. They can communicate with home automation network through an Internet gateway is the IoT Gateway which is bridging between the sensor network and the internet using the latest GSM Technology. A home owner maintains an guardian application to monitor and to detect the home appliances via Smartphone, home appliances are monitored by switching On/Off of the bulb, fan and photo is captured when intruder found, complaint text message is sent to officer these are remotely controlled through mobile. The proposed work also includes the fault detection of Gas, Fire, water level, and intruder associates an alerting voice notification as a text message to the home owner. The server can be interfaced with relay hardware circuits that manipulate the appliances running at home. The Microcontroller SST89E516RD2 is utilized to get and send codes through GSM and for controlling the external devices according to the codes received through the GSM. To achieve this, four sensors - Gas sensor, Float sensor, Fire sensor and IR sensor are utilized.

***Index Terms* – IoT, Android Phone, Home Automation, Embedded System.**

I. INTRODUCTION

As per the survey carried out the home automation refers to the auxiliary control of systems (electronic and electrical) at base station such as home. The control can extend to a system that constantly monitors and detects the fault to its immediate environment, besides accepting commands from the user. Therefore home automation in itself would be a completely independent unit capable of maintaining the critical functions of the base station or home and reacting to emergency situations that may arise in the absence of human supervision. Home automation can vary in complexity from simple devices that provide and manipulate over each components to individual home subsystems. The proposed system is developed by using an guardian application by entering a mobile number which can be monitored and detected by switching bulb and Fan ON or OFF the devices connected to it or can control the various parameters related to the appliance. And photo is captured when intruder found, complaint text message is sent to the officer, these are remotely controlled through mobile. The proposed work also includes detecting Gas, Fire, water level intruder associates an alerting voice notification as a text message to the home owner. The microcontroller SST89E516RD2 is utilized to receive and send codes. An integrated house system would unify all such devices and subsystems within the home with a central control system, which is called the base static controller. Home automation encompasses lighting, security, telecommunications, access and safety, fault detection information and entertainment systems and thermal comfort systems. Besides self monitoring and regulation the home automation system may also deliver the auxiliary control to the person to enable him/her to control any application from a remote place. The guardian application is used by the home owner where in the voice notification text message which is received should not be ignored in any situation which has been proposed. Such a facility would require a device that extends get right of entry to home automation base station controller from his/her premises to anywhere the user might be. This is accomplished through a cell tool making this system truly global. Commands are dispatched to home automation system through user's cell as data through SMS (Short Service Messages). The coded SMS is sent to the home automation base station controller that receives as a voice Notification as a text messages. In the complete form home automation system comprises of three parts the user end, home automation system, officer end. The user would communicate with home automation system using the mobile device which sends and receives SMS text messages to and from the home automation system.

II. LITERATURE SURVEY

[1] Somak R. Das has proposed the Home automation and security for mobile devices. Wherever Overseeing Mobile phone have become pervasive in our society, a home automation and security system for mobile devices that leverages mobile technology to provide essential security to our home and associated control operations, with the help of Mobile devices the home appliances are controlled such as turning ON/OFF a television, Light and so on. The device used is Apple's ios device, the ios application support the x10 standard and video cameras with limitations x10 commander controls x10-compatible light and the appliances, it does not support any cameras or motion detectors the cameras automatically initiate recording and the ios device alerts the home owner immediately. Home automation and security capability into mobile devices. The application is also available through web browser. [2] Jorge C has proposed a IoT based intelligent system for fault detection and Diagnosis in Domestic Appliances. The system is able to analyze the collected data, detect possible faults, and report the situation to the user, interface make use of digital TV, mobile device or conventional computers to warn householders about necessary interventions.

The fault diagnosis can determine the type, location, magnitude, timestamps, and behavior of the variable with time, for every type of fault the intelligent system stores its residual values in a database. The fault is diagnosed through the classifier and the FDDs decision maker, which will identify the degree of relevance of the fault by comparing manufactures information stored in the database and the fault data history database. [3] Ranjith Balakrishnan has proposed the IoT based Monitoring and control system for Home Automation**.** Home Appliances are controlled via smart phone using Wi-Fi as communication protocol and raspberry pi as server system, where as home appliances like light, fan and door lock are remotely controlled through the website. The protection from the fire place associates an alerting message and an image is sent to the smart phone, the server will be interfaced with relay hardware circuits the control appliances running at home. [4] Hiroshi Ignacio has proposed the Mashing up Multiple Logs in Home Network System for Promoting Energy-Saving Behavior. By mashing up the appliance control the environment logs with energy consumption data, user which finds and evaluate the relationships, appliances control logs and environment logs which is collected via the home network system. In the log, date, a user name, an appliance name, an appliance function are recorded when the appliance function is used, the appliance control logs and the environmental sensor logs, users can identify past energy inefficient behaviors about appliances control. [5] Matthias Kovatsch has proposed the Embedding Internet Technology for Home Automation. Home Automation system over all covers the heating, lighting, shading and door/window control. Main objective is taking care of energy efficiency, the ipv6 provides the auto configuration mechanism that generates interface addresses from link-layer addresses and router advertisements, security system provides like firewalls, VPN, IPSec and SSL/TLS these are the backbone network of the homes and manage as remotely. Meter which is supplying and monitoring appliances in the home, a gateway that manages and provides access to the data obtained by the smart meter, mobile device that allows real time feedback on the energy consumption.

III. HARDWARE COMPONENTS DESCRIPTION

A. Development board

The development board is designed to program the SST89E516RD2 Microcontroller. It is a 8-bit 8051 compatible microcontroller with embedded super flash memory. SST operates at 0 to 40 MHz at 5V Maintaining the Integrity of the Specifications.
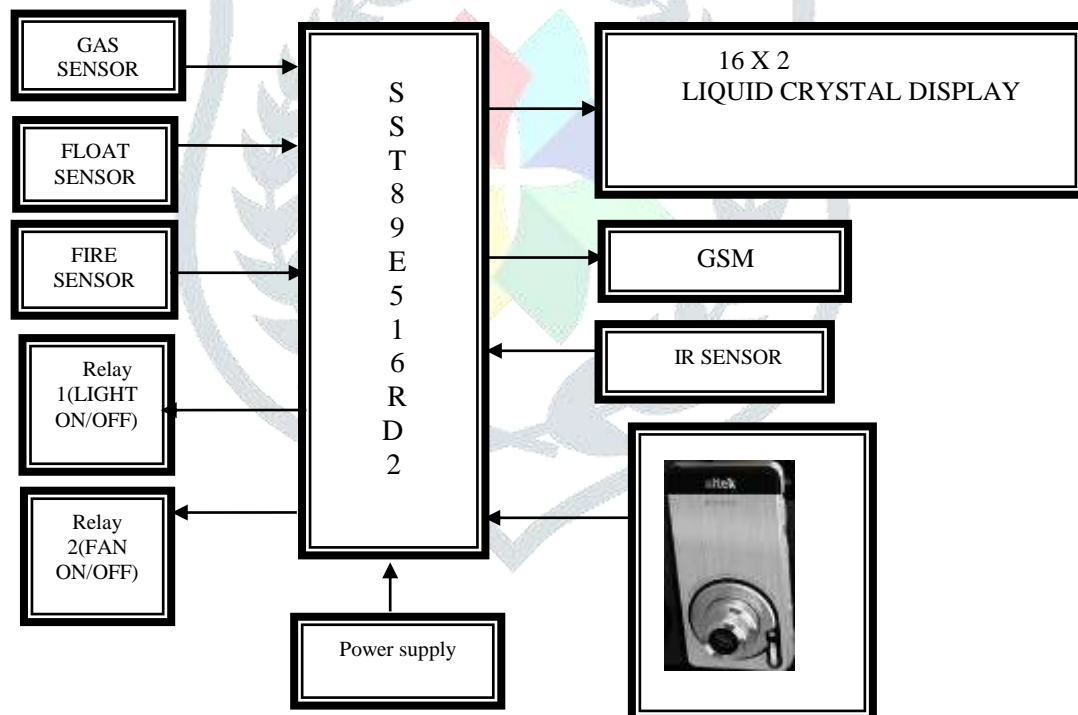

Figure 1. Block diagram of proposed system.

B. Fire Sensor

The Fire sensor is a device which is utilized to recognize fire blazes. The fire sensor is used to gather all of the techniques and processes that contribute to early detection of a fire. In this system fire sensor is used to detect the fire in the home in order to minimize biological loss of environment..

Figure 2. Fire Sensor.

C. Gas Sensor

Gas sensor is a device which sense the gas, which is used in gas leakage detecting equipments in a home and industry, are suitable for detecting of LPG, natural gas, town gas, avoid the noise of alcohol and cooking fumes and cigarette smoke.

Figure 3. Gas Sensor.

C. Float Sensor

A float sensor is a device utilized to detect the level of water within a tank. The switch is used in a pump, an indicator, and water overflow it helps to sense the level of water present in the overhead tank.
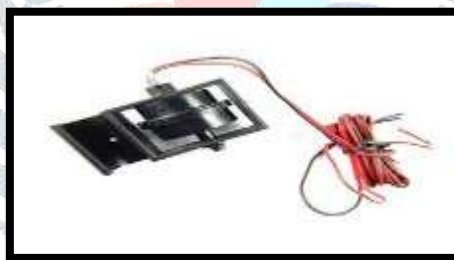

Figure 4. Water Float Sensor

D. IR Sensor

IR Sensor which is also called as infrared Sensor. IR Sensors is a device which senses the object work by using a specific light sensor when an object is close to the sensor, the light from the LED bounces off the object. As shown in the Figure 5. IR sensor which sense the object and pass the voice notification text message to home owner saying that intruder detected, immediately home owner clicks on the button photo the image is captured and sent to users Gmail account.

Figure 5. IR Sensor

IV. SOFTWARE IMPLEMENTATION

A. Software KEIL

Software is for coding embedded c and assembly language, U-Vision 2 is the new IDE for keil. Software combines task control, supply code editing and software debugging is powerful. Keil require Flash magic to dump the code into microcontroller an UART port is required as a USB device to connect to computer and microcontroller.

B. Android studio

Android studio is software for developing the mobile application we implemented the Guardian Application using this software where the coding is done using java and the UI coding is done using html. The application helps in having a smart usage .for home appliances monitoring and fault detection.

V. DESIGN DESCRIPTION

A. Guardian Application

The Application is using the Android Studio where the application is provided to the home owner. This application helps to monitor the switching the Bulb and Fan on/off, or any appliances like mobile charger, laptop charger any appliances can be utilized to connect within the switch provided consisting of 230 v. When intruder is found the image is captured immediately by clicking photo by home owner in this application the image which is received in home owners Gmail account immediately the complaint will be registered to the officer by clicking on the button complaint with default address and action is taken place.

B. Data flow Diagram Details

Data Flow Diagram (DFD): In Figure 6 we explain flow of our system.
Initially when power supply is given to the microcontroller it will reset and display the welcome message on the liquid crystal display. As shown in the Figure 6. First of all we collect the vales of the entire four sensors Fire, IR, Gas, Float as an input and also the values of relay of two relays. If any of the four sensors (Fire, IR, Float, Gas) sense in home automation system, the fault is detected by any of the four sensor or relay of two relays it displays on the liquid crystal display (LCD). The collected values of four sensors and relay of two relays are sent to the SST microcontroller which displays on the liquid crystal display (LCD) using GSM module the voice notification and /or text message will be sent to the home owner.
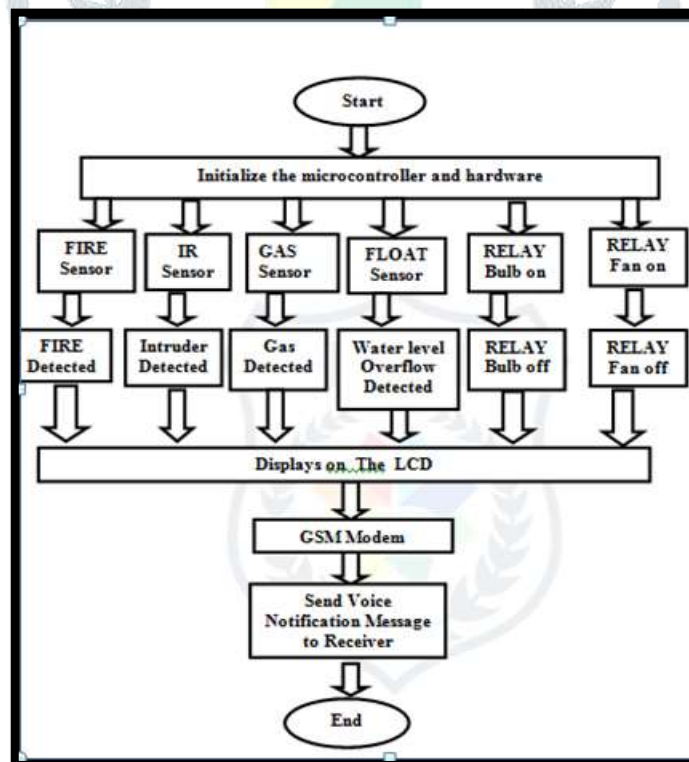

Figure 6. Flow diagram of home automation

VI. EXPERIMENTAL RESULT AND DISCUSSION

A proposed system is developed as a prototype using GSM technology to send and receive messages through it. The hardware setup is made as shown in figure 7. The microcontroller contains the IC where the code for operating this hardware is dumped. The code is implemented in keil software, it is compiled and dumped into the IC using flash magic tool. Once the setup is done the coding in the keil software is complied and run by making the microcontroller to operate in a 5V power supply. An application is built for the purpose to monitor the home appliances.
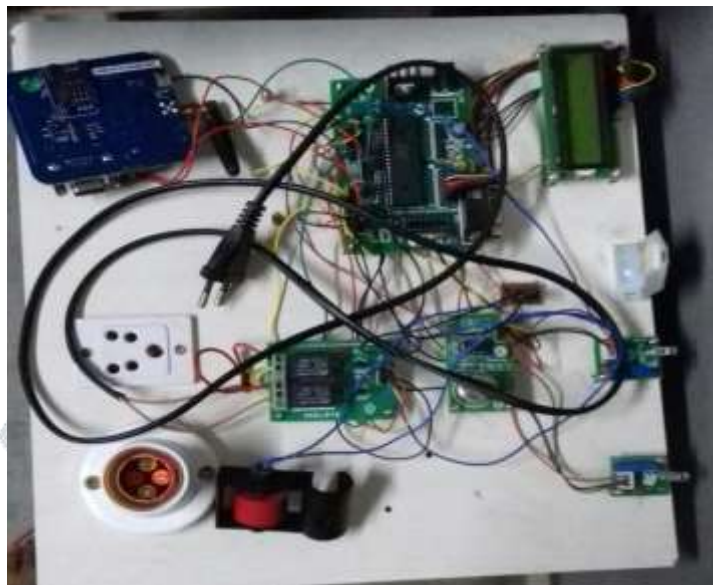

Figure 7. Prototype setup of automated system

The Guardian application is developed using android studio this application is given to the home owner of the home for having smart home monitoring system and fault detection it consist of Enter mobile number field and six textview buttons provided are bulb on, bulb off, fan on, fan off, photo, complaint as shown in figure. 8.

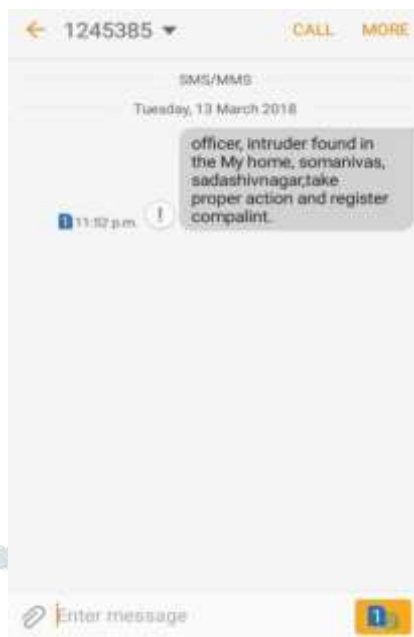Figure 8. Cell Phone GUI for controlling the home appliance

Figure 9. Sample Complaint message display.

As shown in the Figure 8 First officer mobile number is entered in a field next by taping on a complaint button in the guardian application the message is sent to the officer mobile number with a address as shown in the Figure 9 which is an real-time system.
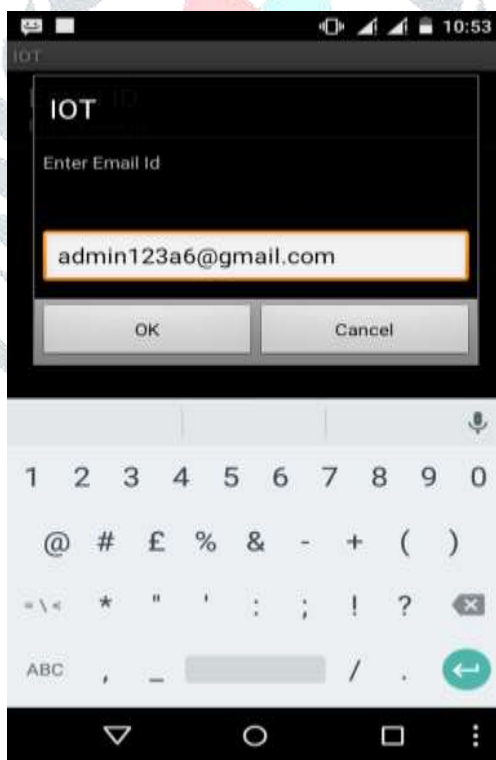

Figure 10. Sample Enter Email id Field.

We have defined Email id for the sender and receiver side of the Email through an Internet. The proposed work which handles to receive the photo of the intruder found by Entering home owner sample Email id field as shown in the Figure 10, hence it acts as a server side.
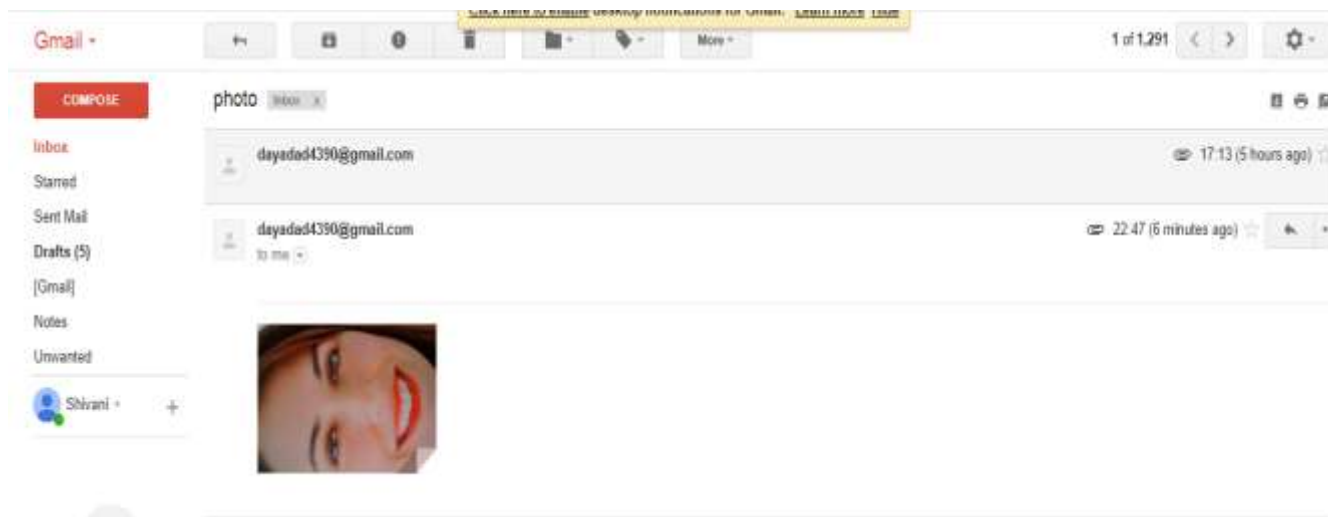
Figure 11. Sample Intruder image received in Gmail account

When intruder is found the voice notification text message is received to the home owner, home owner is tapped on the button photo through an guardian application automatically image is captured through a phone, home owner can view the sample picture as shown in the figure 11 as sample intruder image received in Gmail account.

VII. CONCLUSION

In this paper, the automated home appliances monitoring system and fault detection system is implemented using SST89E516RD2 microcontroller. In this approach the home owner is able to monitor through a guardian application an easy android phone through GSM. As this automated system which register the complaint, to the officer with address proof.   The benefits of implementing this project are the automated system, used by saving time, Energy, money, Easy setup. Further it can be implemented to make our application context- or location-aware system and application which can run on all operating system by using xamarian platform.

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