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RESEARCH ARTICLE

Android Phone Enabled Home Automation

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Abstract

Automation of the devices, appliances at home and office is having wide scope of research with the advancement of technology in communication era. Misuse of power energy can be curtailed by automating the devices and appliances. Mobile communication is playing a vital role in the domain of automation. Android phones are powered with application programs to automate the required devices. This study focused to automate the home appliances using the Bluetooth short range communication. The status of the devices is linked to the local internet to enable the graphical user interface (GUI) for device monitoring. Sending the command signals using Android Bluetooth and monitoring the device status using IEEE 802.15.4 wireless communication device interfaced to the internet are the main two steps considered in this study. Internet is used to analyze the performance of the devices and appliances with the support of python software. Each device graph is plotted to know the state of the devices using internet server.

Keywords: Automation, mobile communication, graphical user interface, android Bluetooth, python software.

Introduction

Safety mechanism of the home appliances and office rooms are having significant importance in modern technology. Automation of the house or office is to be required with electronics and communication advancement. Fire incidents need to be suppressed before it starts destruction of the house or office. Gas leakage is the serious issue to be considered to save the human life from explosions. Several witnesses forced to propose an innovative methodology to protect from unexpected situations. A sensor eye is to be kept enable to recognize the fire and gas related explosions. A control unit is developed to receive the state of the security of the house and to disable the devices by receiving the commands from the transmitter unit. Safety status of the house linked to the Web will enable the secured safety monitoring system. Panth and Jivani (2011) proposed a home automation system using android phone. Bluetooth communication is used to control the appliances. Anwaarulla and Altaf (2013) used open source RTOs augmenting with scm RTOS. Pattern based password protection is proposed to control the appliances. Voice recognition feature was used to enable and disable the devices using voice commands. Kallakunta *et al*. (2014) proposed a home automation system using android smart phone. At mega32 microcontrollers is used to control the devices. Jivani (2014) proposed GSM based secured device control system using android mobile phone. An app inverter is used to simplify the programming task. Khadke (2014) proposed Graphical user interface (GUI) and designed on android smart phone to control the home appliances remotely. AVR Atmega processor was used to enable the drivers of the appliances. Kumar and Lee (2014) proposed a smart living system for control of home appliances. Android phone is used for application program to transmit the commands using Bluetooth or internet connection.

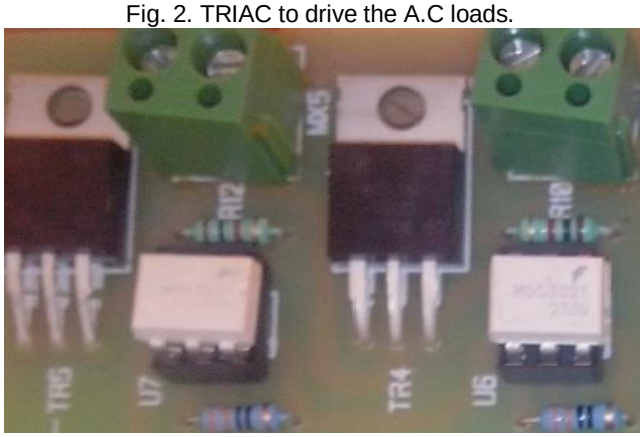
Materials and methods

Gas sensor: A MQ-5 Methane LPG liquid propane gas sensor is used to sense ammonia produced by methane (Fig. 1). The sensing element adsorbs it after ionized into its constituents. The resistance of the sensing element cause to change. This resistance change causes to change the potential difference in the form of current (heating current) develops across the output line of the sensor. The gas sensor draws an output signal 4.6 V when it detects the ammonia gas. The analog output of the sensor is fed as input signal to the microcontroller for serial data output.

Fig. 1. Gas sensor.

Fire sensor: Hydrocarbons will burn quickly than ordinary combustibles with flame temperatures. Hence, damage is more with hydrocarbon fire. The fire detection sensor is having its own significance to consider. Ionization type smoke sensor is used to detect the fire. The radioactive element causes to ionize the air in a chamber. The free flow of electrons between the adjacent electrodes is equal. The normal flow of electrons is interrupted when the smoke particles enter into the chamber. This develops a voltage drop at the output pins of the sensor. The sensor is interfaced to the microcontroller port to enable the serial data transmission. The serial data is uploaded directly to the Internet server for remote monitoring.

Fig. 2. TRIAC to drive the A.C loads.



TRIAC BT136: Five devices are considered to monitor their status. To drive these devices to switch ON and OFF five number of Triac BT 136 are used (Fig. 2). A triggering pulse is given to the gate to enable the flow of current in both directions. The TRIAC is 'off 'when the gate current is removed. To keep the TRIAC conducting minimum voltage is maintained at the gate.

Communication

Transmitter: Application software is developed for the android phone to drive the AC loads at home and at office. This application has a list view as shown in Fig. 3. The Bluetooth communication has been established between the device controlling unit and the transmitter. Android Bluetooth application framework provides access to the Bluetooth functionality. ASCII characters will transmit serially through Bluetooth. SBUF register will read this ASCII characters as equivalent HEX value at the receiving side.

Receiver control: HC 05 Bluetooth module is used at the receiver to receive the ASCII codes transmitted by the android mobile Application software (Fig. 4). The microcontroller AT 89S52 is used to enable the TRIAC. The microcontroller receives equivalent Hex values through Serial buffer (SBUF) register. An ASCII character "A" outputted by the transmitter will receive its equivalent hex code "0X 41" at the microcontroller using Bluetooth serial module HC05.

Fig. 3. List view of the android app.

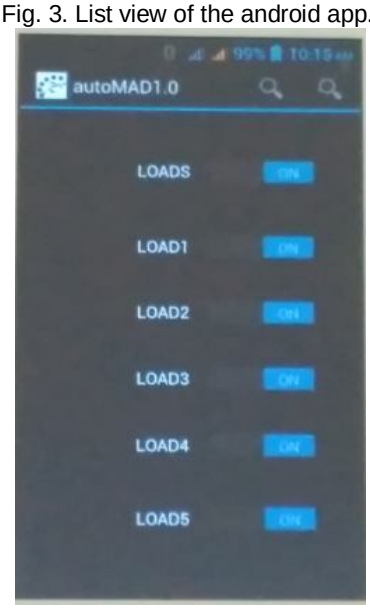


Fig. 4. Simulated receiver circuit.

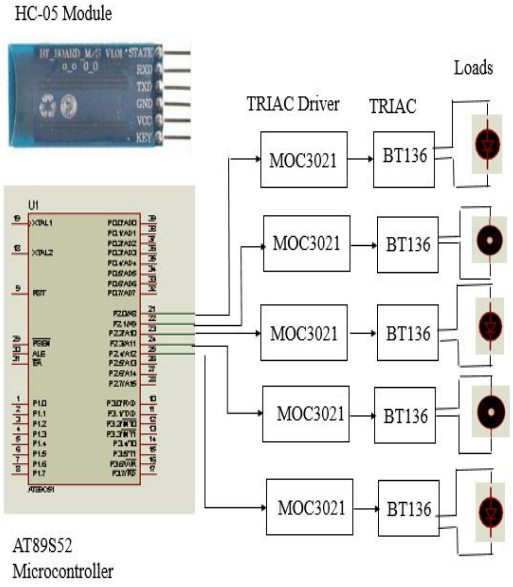
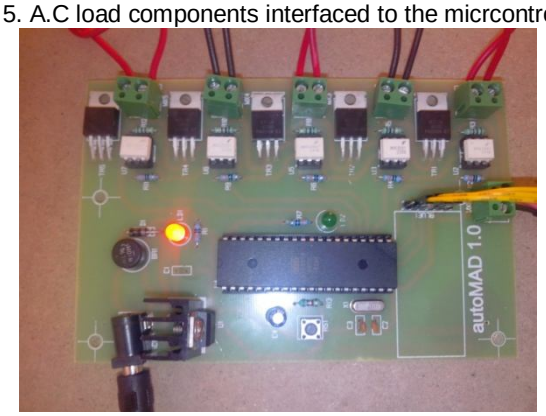


Fig. 5. A.C load components interfaced to the micrcontroller.



The load '1' will be switched OFF. The ASCII Characters "B", "C", "D" are used to turn off the A.C Load device 2, device 3, and device 4 respectively (Fig. 5). The status of the device is transferred to the local internet using IEEE 802.15.4 receiver. Python software is used to plot the response of the devices for monitoring at any location.

Algorithm

Step 1: Equate Fire station = 9705077527
Equate concerned person = 9848960527
Step 2: Equate port 2_0 with device 1(D1)
Equate port 2_1 with device 2(D2)
Equate port 2_2 with device 3(D3)
Equate port 2_3 with device 4(D4)
Equate port 2_5 with Alarm
Equate port 2_6 with Emergency door
Step 3: Equate Port 0 _1 with smoke sensor
Equate Port 0_2 with Gas Sensor
Equate port 0_3 with Bluetooth receiver
Step 4: Read port0_1
If
The sensor output is Logic high
Then
Enable the alarm
Insert step '1'
Send Message "Fire enabled, House N0:---'Street name"
Else If
Read port 0_2
If
The sensor output is logic high
Then
Enable the alarm
Out logic '1' on port 2_6 to open the emergency door
Insert step'1'
Send message "Gas discharging abruptly"
Else if
Go to Next step
Step 5: Read the device status buffer register (SBR)
SBR Logical AND with 00111111 B
If
D0 = '1'
Then
Go to Next step
Step 6: Handshake with two Bluetooth devices
Enable the android application
Step 7: Send an ASCII code 'A' to turn off the device '1'
Step 8: Read the SBR
If D0 = 1
Then go to step '6'
Else
Go to next step
Step 9: Send buffer data to the internet server
Read the device status buffer
Step 10: If
D1 = '1'
Then send an ASCII code 'B'
To turn off the device '1'
Else
Go to Next step
Step 11: Insert step '9'
If D2 ='1'
Then
Send an ASCII code 'C'
To turn off the device 2
Else
go to next step
Step12: Insert Step 9
If
D3 ='1'
Then
Send an ASCII code 'C'
To turn off the device
Else go to next step
Step13: Insert step 9
If
D4 =1
Then
Send an ASCII code 'D'
To turn off the device '4'
Else
Go to next step
Step14: Insert step 9
SBR is AND with 00111111
If
SBR ≠ 0
Then
Go to step '6'
Else
Go to step '4'

Results and discussion

Figure 6 represents the enable state of the load 1. The microcontroller at the receiver section will receive input data from HC 05 Bluetooth receiver. Figure 7 represents the android app used to transmit the command signal to enable the AC load devices. All the devices 'ON' command are transmitted. The Bluetooth receiver receives this signal cause to convert its equivalent Hex codes as input signals to microcontroller. Figure 8 represents the energized state of all the devices with respect to the command transmitted as shown in Fig. 7.

Fig. 6. Load 1 is On.

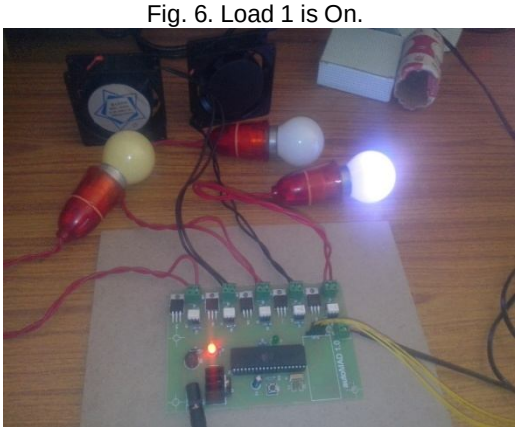


Fig. 7. All devices enabled using using android app.

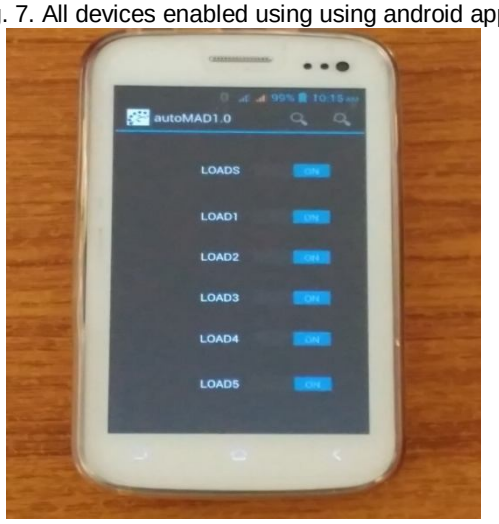
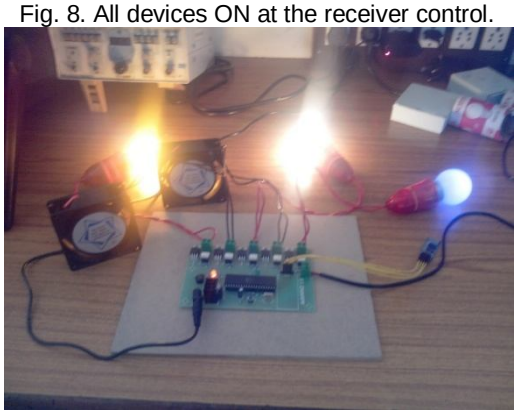


Fig. 8. All devices ON at the receiver control.



Conclusion

The proposed methodology can be implemented at any location to automate the devices. The house or office is safeguarded from the fire accidents and gas leakage situations. This mechanism will keep the entire house or office in monitoring state. The status information is to be updated to the WEB server. This will enable to verify the safety record of the house or office at any location. The results encouraged to implement in real time operations in near future. Further this study is proposed to extend with visual supervision by incorporating the image classification and data presentation methods.

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