

Android Controlled Home Automation System Based Arduino Board

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Abstract: In recent years automation has played an important role in developing human life and enhancing safety and security protocol. Smartphones are common among all people. Day-to-day household work like switching ON/OFF the fan or lights, decrement or increment in air conditioner temperature can be easily done using a smartphone. Today home automation system (HAS) has been a major part of research in recent times. Home automation using the android platform reduces the process of individual involvement and enhances easier and faster daily household needs for everyone. The home automation system (HAS) designed and implemented on the android platform has been interfaced with an 8-bit microcontroller i.e. Arduino to control the home appliances using the relay. Bluetooth has been used as the most reliable and efficient technology for small-range communication. Different type of sensor has been used which are illustrated in detail below. This paper provided a novel approach to enhancing automation in household services and eliminating the traditional method of switching.

I. Introduction

Today most home uses electronic appliances such as fans, lights, air conditioner, etc. As smartphones are very common to all people nowadays using mobile as the mode for controlling home appliances will enhance the affordability and simplicity of the HAS. Smartphones with the android-based operating system have the capability of connecting to most electronics' equipment. The mobile application needed for the operation of HAS is designed in the Android platform. To increase the android application's security feature, such as password protection, has been provided. In this application, Arduino is used as a microcontroller. Bluetooth has been used for the short-range efficient connections and Sensors like MQ5 the LPG sensor and LM35 the temperature sensor and DHT11 the humidity sensor has also been interfaced with Arduino to enhance the safety feature of the HAS [1]. The MQ5 is the most reliable gas sensor it can detect the leakage of LPG gas and a buzzer has also been implemented to alarm the user in case of gas leakage. In case of firing the temperature will increase. LM35 detects the temperature and alarms the user so that possible measures could be taken to withstand a vital disaster.

II. Project Objectives:

Android controlled Smart Home Automation should be able to control the home appliances wirelessly effectively and efficiently.

Controlling Home Appliances via Application (Switch and Voice Mode)

To develop an application that includes the features of switches and voice mode applications. Switch Mode or Voice Mode can be used to control the switches of home appliances.

Real-Time Video Streaming from IP camera

To receive the quality video from the camera to the android application.

Secure Connection Channels between Application and Raspberry pi

Use of secure protocols over Wi-Fi so that other devices cannot control the appliances. Options for a secure connection is SSL over TCP, SSH.

Controlled by any device capable of Wi-Fi (Android, iOS, PC)

To make the home appliances flexible in control, any device capable of Wi-Fi connectivity will be able to control the home appliances from a remote location.

The extensible platform for future enhancement

The application is to be highly extensible, with the possibility of adding features in the future as needed.

Scopes

The project aims at designing a prototype for controlling the home appliances that can be controlled wirelessly via an application that provides the features of speech recognition, video streaming and switch mode. An application is run on an android device. The system can be used in a wide range of areas.

The system integrated with different features can be applied in the following fields.

- The system can be used in the home, from small offices to the big malls
- The system can be used from home to offices to control the electrical appliances.
- For remote access of appliances in internet or intranet.
- The home/office appliances can be controlled intra-network or can be accessed via the internet.
- For the development of a technology-friendly environment
- The system incorporates the use of technology and makes smart home automation. By the use of day-to-day gadgets, we can utilize them from a different perspective.

Hardware Platform

The hardware platform comprises an Arduino UNO, digital computer, temperature sensor (LM35), gas sensor (MQ2), temperature and humidity sensor (DHT11), and a buzzer which are discussed below with their function in the home automation system.

Arduino UNO Arduino UNO [2-3] is an 8-bit microcontroller board that is based on ATmega328P. It comprises 14 digital input and output pins, a 16 MHz quartz crystal, a USB connection for easy computer connectivity, and a reset button to eliminate and restart in case of malfunction. It has an operating voltage of 5V, a flash memory of 32KB, and a clock speed of 16 MHz for faster data processing.

Temperature Sensor (LM35) LM35 are integrated-circuit temperature [4-5] devices that generates an output voltage linearly proportional [6] to centigrade temperature. It requires no calibration or trimming to achieve the most precise output. Lower cost if the device makes it more affordable. It operates on the input voltage of a minimum of -0.2 V and a maximum of 35 V. It works on an output voltage of a maximum of 6V and a minimum of -1V.

LPG Sensor (MQ5) The MQ5 gas sensor [9-10] is the best choice for LPG leakage detection as it provides a wide range of accurate LPG detection range from 200ppm to 10000 [12]ppm it works on AC or DC in $5V \pm 0.1$ [11]. It is a better choice rather than MQ2 [7-8] as it has a shorter detection range from 5000ppm to 10000ppm [12].

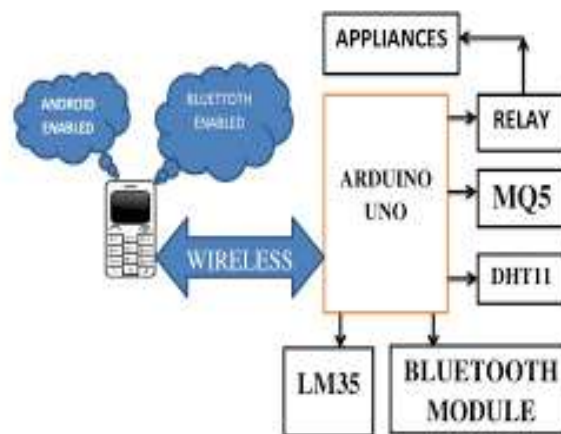
Humidity Sensor (DHT11) DHT11 is a humidity sensor [13] that utilizes a capacitive humidity sensor along with a thermistor to analyze the surrounding air to provide a digital output to the data pin connected. It provides almost accurate data in real-time for every 2 seconds. Because of its low cost and high accuracy rate, it makes it more popular in weather sensing and analyzing the industry.

Bluetooth Module Bluetooth module HC-05 provides radio communication between almost all communications-enabled devices enabling the user with efficient wireless communication on an unlicensed radio spectrum [14]. It typically operates on a frequency of 2.4GHz and has a range of up to 20m to communicate with other devices.

System Architecture

In the home automation system, the user interfaced android application has been implemented in the android platform enabling easy access for the user and Arduino has been used as a microcontroller with a relay circuit and Bluetooth module for wireless access.

Interfacing of instruments, A Bluetooth-based mobile with android OS has been interfaced with the Bluetooth module and the Bluetooth module has been interfaced with Arduino UNO. The relay circuit has been interfaced with the appliances and the relay circuit has been connected to Arduino. LM35 MQ5 and DHT11 have also been interfaced with the Arduino. A detailed description has been illustrated in the Block diagram below.



Block Diagram

Bluetooth Application Controller for Arduino Bluetooth application controller for Arduino [15] is available in the GOOGLE play store it serves as a six-controlling device which is touch operated android application. It makes the home automation system more easily accessible enhances easy operation and eliminates the traditional method of switching. It has been linked via the Bluetooth module HC-05. The control action has been done by relay.

Appliances Implementation

Various daily household required devices in day-to-day life are used for implementation. The following devices used are given below: -

- Bulb
- Television
- Fan
- Refrigerator
- Music player
- Air conditioner

The appliances are simulated using a relay and the dc motor drives the appliances when the command is given using the application.

Output

Application Consists of Graphical User Interfaces. It consists of the following different activities.

- 1.Start Mode Activity
- 2.Option Mode Activity
- 3.Voice Mode Activity
- 4.Switch Mode Activity
- 5.Video Mode Activity

Start Mode Activity:

In this mode, all the rooms of the home are displayed. The user can select the necessary room from the option to control the appliances connected to the specified room.

Option Mode Activity:

This mode provides the user with the option to control. The user can select either switch mode or voice mode to control the appliances.

Voice Mode Activity:

This mode provides the user to give speech feedback to the application. The speech data are processed and required appliances are controlled.

Switch Mode Activity:

This mode provides the user with on/off buttons to control the required home appliances.

Video Mode Activity:

This mode displays the video of the IP cameras connected to the rooms of the home.

III. Conclusion

The home automation system using the android application has been tested and successfully implemented and is highly reliable and efficient for the aged people and paralyzed people on a wheelchair who cannot reach the switch for the switching of ON/OFF the device and are dependent on other. This system has a wide scope of development and modification. The voice control system can be implemented with accuracy in voice recognition and better pitching analysis. More devices can be simulated and a timer could be set for automatic operation.

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