Failproof Home Automation System Using Arduino

Praveen B.C.
Computer Science and Engineering
Lourdes Matha College of Science and Technology
Thiruvananthapuram, India

Anjana Thampy S.
Computer Science and Engineering
Lourdes Matha College of Science and Technology
Thiruvananthapuram, India

Abstract—**This paper presents a home automation system with manual backup, with the help of Arduino Uno, Bluetooth, Infrared Remote, Smartphone which uses an android application and Manual switch boards. The advantage of this system is the manual switches which can be used even when the automation system fails. The stand out of the system is automatic and manual regulation of room temperature by controlling fan speed with the help of temperature sensor, the switching on and off of gate lights by Light dependable resister and also by manual ways. Up to 15 devices can be connected in this system. The software and hardware architecture along with the scope for further development is explained in this paper. The contents of this paper is tested and expected results were produced.**

Keywords— Arduino Uno; Bluetooth; Infrared;

I. INTRODUCTION

Technology has moved leaps and bounds forward. In this busy life where time conservation is very important automation has become a necessity. People depends upon on technology for everything including domestic house hold equipments such as fan light etc. For example people may forget small yet important chores such as turning on a gate lamp or turning it off and this can be overcome by an automation system. This help to reduce power consumption and overcome human errors. Lot of home automation systems are available in the market which uses WiFi, GSM, LAN etc. Currently available home automation systems doesn't provide a manual backup solution. The major drawback of contemporary systems are if the automation system doesn't work the entire house hold equipments which are connected to this systems stops working. This problem has been overcome in this system by addition of manual switch boards. The Fig. 1. shows the typical architecture of home automation system.
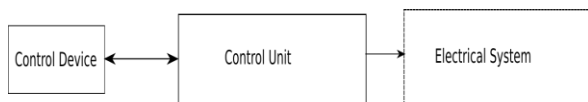

Fig. 1. Typical architecture of home automation system.

Every home automation system mostly will have three major components, which are control device, control unit, electrical system. The control device acts as interface between user and system. The control device can be smartphone, Infrared remote, Tablet, Touch screen etc. The control unit takes up information from control device and sensors and process it then it controls the electrical system. The electrical system may consists of fan, TV, lights and other home equipments.

II. PROPOSED SYSTEM

The proposed system consists of two parts, hardware and software. The components of hardware are Arduino Uno, Smartphone, Infrared remote, Bluetooth module etc. The components of software parts are Android application, Arduino IDE and Android studio IDE. The Fig. 2. shows the architecture of proposed system and Fig. 3. shows the flow chat of the proposed system.
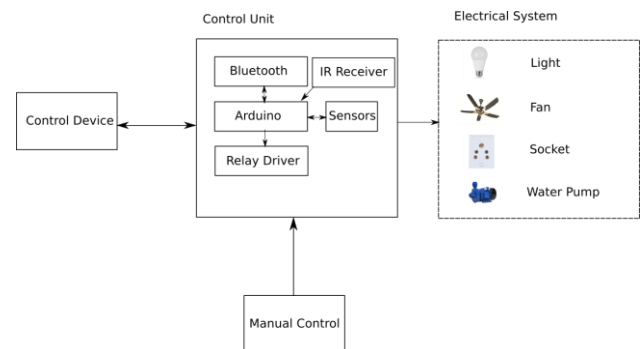

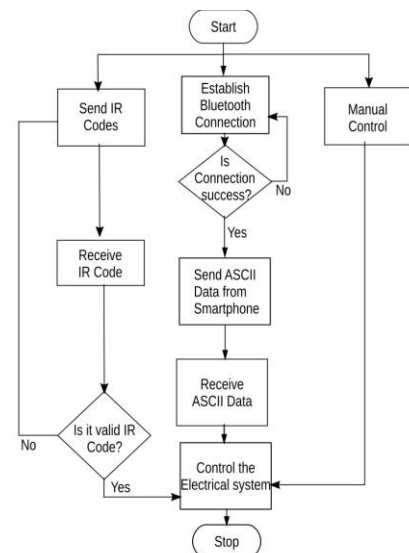Fig. 2. Architecture of proposed system.

Fig. 3. Flow chart of proposed system.

III. HARDWARE ARCHITECTURE

A. Arduino Uno

Arduino is an open source electronic platform consists of hardware and software. Arduino Uno is based on ATmega328P Processor. It operates in 16 MHz quartz crystal frequency. It has 14 digital input/output and 6 analog input pins and operates at 5 volts. It has 32 KB flash memory, 2 Kb SRAM and 1 KB EEPROM. The Fig. 4. shows the arduino uno board.
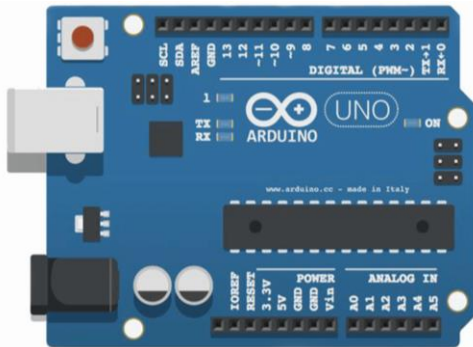

Fig. 4. Arduino Uno.

B. Bluetooth Module HC-06

The HC-06 is a class 2 slave Bluetooth module. The communication between the Arduino and smartphone is made possible by this module. It operates with in supply voltage of 3.6VDC to 6VDC. It consists of 4 pins: RXD, TXD, GND and VCC. The VCC and GND pins are connected to positive and ground pole of the power source respectively. The RXD and TXD pins are connected to TX and RX of Arduino Uno respectively. Connection diagram of Adriano Uno and Bluetooth module is illustrated in Fig. 5.
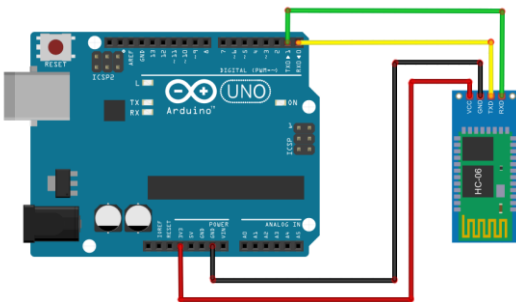

Fig. 5. Bluetooth Module HC-06.

C. DHT11

The DHT11 Temperature and Humidity Sensor. A high performance 8-bit microcontroller is integrated with it. This technology promises that high readability and excellent long-term stability. This includes a resistive-type humidity measurement component and an NTC temperature measurement component. It's cost effective. It operates with in 3 to 5.5V, temperature range is between 0-50°C with accuracy of ±2^{0}C and humidity range is between 20-90%RH with accuracy of ±5%RH. DHT11 Humidity Sensor consists of 4 pins: VCC, Data Out, Not Connected (NC) and GND. Arduino uses this sensor to sense the temperature and on basis of the collected data it cotrols the fan speed. The Fig. 6. shows the DHT 11 temperature sensor.
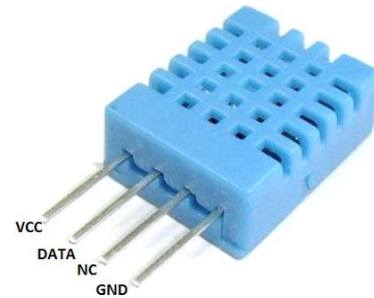

Fig. 6. DHT11 Temperature and Humidity Sensor.

D. LDR sensor

LDR sensor module is used to detect the intensity of light. It has both analog and digital output pins labelled as A0 and D0 respectively. It works depending upon the light when the light intensity gets reduced the resistance increases and vice versa. It has 4 pins VCC,GND,A0and D0. LDR sensor picks up the intensity of light and on basis of this, Arduino controls gate light automatically. The Fig. 7. shows the LDR sensor module.

Fig. 7. LDR Sensor module

E. Control Devices

The control devices are mainly used for giving input for home automation system, based on these inputs the home automation system will work.

i. IR remote control

An IR remote control is used for wireless communication between smartphones and Arduino board. The IR remote will send HEX data from IR remote to Arduino board, an IR receiver connected to Arduino board will receive the data. The Fig. 8. shows IR remote.

Fig. 8. R Remote Control.

iv. Smartphone

A smartphone application named Smart Home is used for wireless communication between smartphones and Arduino board. It has ability to transmit ASCII data serially from smartphone to Arduino board using Bluetooth module. The Fig. 9. shows smartphone with android application.
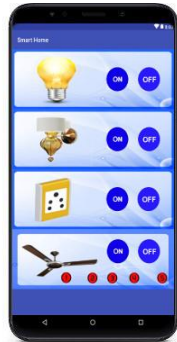

Fig. 9. Smartphone with Android Application.

v. Manual Switch Board

If home automation system fails we can operate the electrical system with the help of the manual switch board. The Fig. 10. shows manual controlled switch board.

Fig. 10. Manual Switch Board.

IV. SOFTWARE ARCHITECTURE

A. Arduino IDE

The Arduino Integrated Development Environment or Arduino Software (IDE) is used to write codes and upload to Arduino. The programs written using Arduino IDE are known as sketches. The Fig. 11. shows the Arduino IDE.

Fig. 11. Arduino IDE

B. Android Studio

Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA. It is available for Windows macOS and Linux based operating systems. The Fig. 12. shows the Android studio IDE.
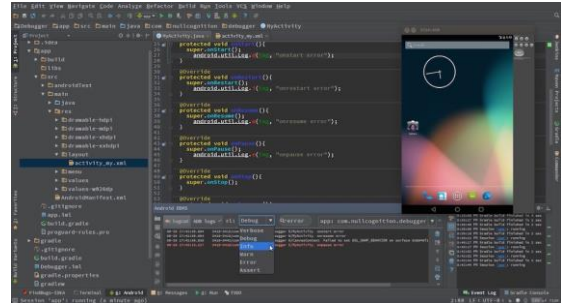

Fig. 12. Android Studio IDE.

C. Android Application

A smartphone application named Smart Home is used for wireless communication between smartphones and Arduino board. It has the ability to transmit ASCII data serially from smartphone to Arduino board using Bluetooth module. Sample ASCII data and their equated operation are given in Table. I. The Fig. 13. shows the Android Application.
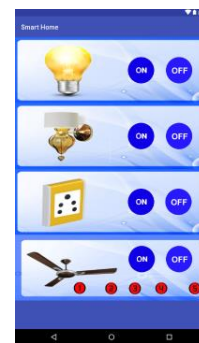

Fig. 13. Android Application.

Table I. ASCII data with its equated operations.

Device	ASCII Data	
	ON	OFF
Light 1	0	1
Light 2	2	3
Socket	4	5

VI. CONCLUSION

This paper put forth an ideal home automation system the inclusion of common manual switches which are usually present in a home gives this system an upper cut above the rest. If the automation system fails the entire equipments which are connected to the system also fails. But the proposed system has an option of controlling this equipments with manual switch thus it make sure that the equipments never fails. This system can be implemented at a very low cost. A user friendly mobile application is a boon of this automation system

For the time being this system can only be controlled from short range and can be improvised by using Internet of Things to connect and to control from anywhere around the world. The number of connected devices can be increased by using Arduino Mega, Raspberry Pi etc.

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