Office Automation System Using Internet of Things

Sahana H S[1], Sandeep V S[1], Shwetha R[1], Sowmya J[1], Krupa K S[2]

[1](Department of Computer Science and Engineering, Global Academy of Technology, Karnataka, India)
[2] (Department of Information Science and Engineering, Global Academy of Technology, Karnataka, India)

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Abstract - *As the technology is advancing, we are witnessing automation in each and every field. A fully autonomous office is going to be the future. People often wish to have automatic control over various electrical appliances in office like fan, light, computer and microwave oven. This project presents a solution which helps in accomplishing the task successfully. A universal switch has been realized using Arduino Uno Atmel Microcontroller, Android application and GSM modem along with fire and human sensors the whole of which constitutes Office Automation System.*

The main objective is to design and implement an Office Automation System using IoT(Internet of Things) that is capable of controlling and automating most of the office appliances through an easily manageable android application.

*Key Words***: Android application, Arduino Uno ATMEL Microcontroller, Fire Sensor, GSM Modem, Human Sensor, Relays.**

1. INTRODUCTION

Present industry is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers and robots. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation. The "OFFICE AUTOMATION" is designed and developed to accomplish the various tasks in an adverse environment of an industry [1]. The intelligent uses PIC microcontroller, GSM Modem, Android application. This work is own to the technical advancement. This system can be applied effectively and efficiently in an expanded dimension to fit for the requirement of industrial, research and commercial applications. Microcontroller is the heart of the device which handles all the sub devices connected across it. It has flash type reprogrammable memory [2]. It has some peripheral devices to make this project perform. It also provides sufficient power to inbuilt peripheral devices. The peripheral devices also activates as low power operation mode.

2. LITERATURE SURVEY

Automation is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention.

There are various types of automation [3]. Based on the application they can be categorized as home automation, office automation, industrial automation, autonomous automation, building automation and others. This project is about Wireless Office Automation using IoT(Internet of Things).

Office Automation is the process of controlling various electrical appliances in office such as fan, light, computer, microwave oven automatically using remote control system techniques with safety system installed in them in the form of human and fire sensors.

There are various techniques to control electrical appliances in office such as IoT based office automation over cloud, Wifi through android applications from any smartphone, Arduino based Office Automation, Office Automation using digital control, RF based Office Automation and touch screen based Office Automation. Wireless Office Automation using IoT is an innovative application of Internet of Things developed to control office appliances remotely using android application [4].

3. PROPOSED METHODOLOGY

The proposed system design consists of Arduino Uno Atmel Microcontroller [5] that acts as the main controller. Android application, that helps in remote monitoring.

GSM modem that accepts a SIM card and operate over a subscription to a mobile operator. The above three are the main components for implementing the system. Fig-1 depicts the block diagram of system architecture.
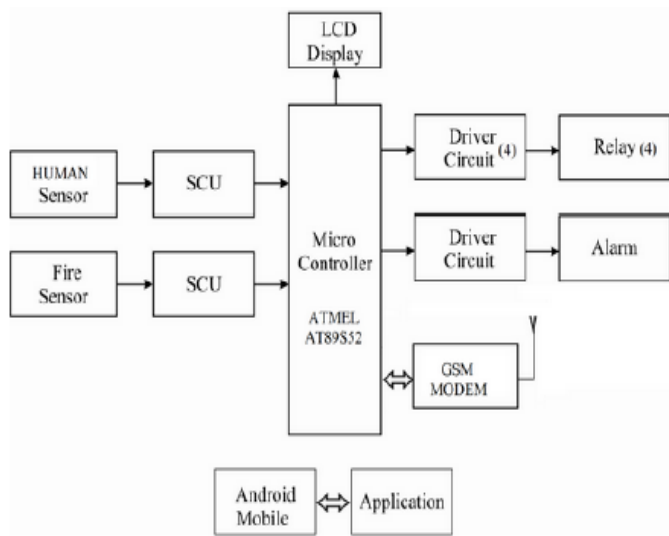
Fig 1: Block diagram of System Architecture

The functional requirements of the system architecture are as follows-

(i) Arduino Uno Atmel Microcontroller:- The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

(ii) Android application:- Android is a growing technology which has started to fulfill needs with lots of application to make things handy. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the android platform using the Java programming language.

(iii) GSM modem:- A modem is a device that modulates an analog carrier signal to encode digital information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. It has quite similar functionality of mobile and can be accessed from anywhere in the world which is a prime advantage. It can also be implemented for real-time applications.

(iv) RS232 Cable:- RS232 is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a DTE(Data Circuit-

terminating Equipment). It is commonly used in computer serial port.

(v) Relay Driver Circuits:- Driver circuits are a combination of transistors and resistors to drive relay.

(vi) Relay and Alarm:- A relay is an electrically operated switch. They are used in our project to control the circuit by a low-power signal. Alarm is used to alert.

(vii) Human and Fire Sensors:- Human and Fire sensors are some special types of transducers with the range of 5m which convert one form of physical quantity to electrical quantity.

(viii) SCU(Signal Conditioning Unit):- SCU accepts only digital signal if the input is some other signal or low digital signal, and converts it as either '1' or '0' depending upon input.

(ix) PCB (Printed Circuit Board):- PCB [6] is the board base for physically supporting and writing the surface-mounted and socketed components in most electronics.

(x) LCD:- LCD is a flat panel display that uses the light modulating properties of light crystals.

4. IMPLEMENTATION

The following steps are involved in the implementation of this project-

Step1: Insertion of SIM

1. Insert one SIM inside the android phone and another SIM inside the GSM modem. Observe the device initialization indicated by LED's.

Step2: Hardware Setup

1. Switch on the ATMEL microcontroller toolkit.
2. Observe the GSM initialization procedure and a display message saying "Office Automation".
3. Store the phone number inside the GSM modem to transmit and receive messages using keypad of hardware.
4. A keypad is a set of buttons arranged in a block which bears digits.
5. The keypad contains 5 button: INC-Increment button, DEC-Decrement button, SET-Set button, MOV-Move button and ENT-Enter button, where, INC is used to increment the number, DEC is used to decrement the number, SET is used to set a new number and MOV is used to retain the previously stored number and to move the cursor to the next position and ENT is used to store the entered number.

Step3: Software Setup

1. Launch the android application from the smartphone and enter the login id and password in the login page.
2. Select the electrical appliances that you wish to control such as fan, light, computer and microwave oven.

Step4: Operation

1. The android application sends a SMS message to the number present in the GSM Modem when a button on the android application is pressed.
2. The GSM Modem sends the received message to the microcontroller.
3. According to the button pressed on the android application, the microcontroller switches ON/OFF the electrical appliances.
4. Whenever the electrical appliances are switched ON, it is displayed on the LCD.
5. The fire sensor sends an alert in the form of a SMS message to the android application via the GSM Modem whenever a fire breaks out.
6. The human detection sensor sends an alert in the form of a SMS message to the android application via the GSM Modem when it detects the infrared radiation emitted from a human.

5. APPLIANCES IMPLEMENTED

This section discusses the various appliances where the testing of the system designed is implemented to make a complete automation system using android application. The control for switching ON/OFF of the appliances are performed using the relays based on the touch control commands given through android application. It mainly consists of switches to ON/OFF [7].

1. Fan
2. Light
3. Computer
4. Microwave oven

Table 1: Touch Commands for the Appliances Control

No	Touch command	Action Performed
1.	Fan On	Turns on the fan
2.	Fan Off	Turns off the fan
3.	Light On	Turns on the light
4.	Light Off	Turns off the light
5.	Computer On	Turns on the computer
6.	Computer Off	Turns off the computer
7.	Microwave oven On	Turns on the oven
8.	Microwave oven Off	Turns off the oven

6. RESULTS

In Fig-2, snapshots of the android application is provided where the user will be asked to enter the correct username and password. After the login, remote monitoring page will appear which displays the four buttons provided to operate the four electrical appliances respectively. The user chooses to switch on the appliance by pressing ON button, and switch off by pressing OFF button. The ON is indicated by green color and the OFF is indicated by red color. Upon the user clicking OFF, the ON's color will change to grey. Mobile number of the sim inside the GSM Modem is entered in the android application. Any alert messages and the operation being carried out is displayed in the 'received message will show' status bar.
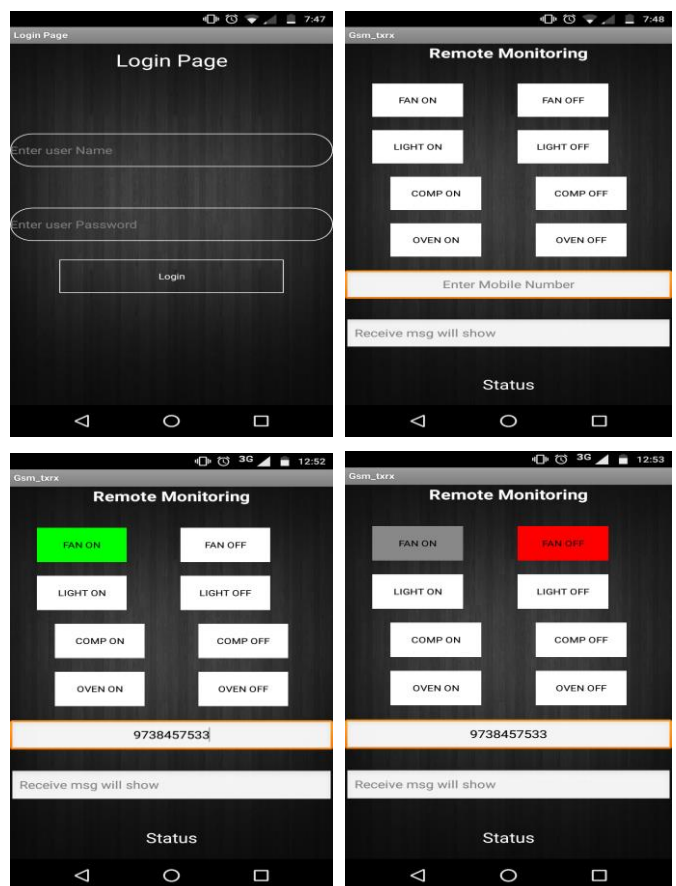
Fig 2: Gives the outlook of the Android Application developed with the Login Page and with the buttons provided to operate the electrical appliances.

In Fig-3, hardware snapshots are provided wherein the setup is done on a PCB. The LCD displays the message when

the device is switched on, and the sim is inserted inside the GSM Modem. Number of the sim inside the mobile is entered using the 5-key keypad. The mobile number entered is displayed on the LCD. After storing the number, GSM is initialized. Control the electrical appliances through the android app.
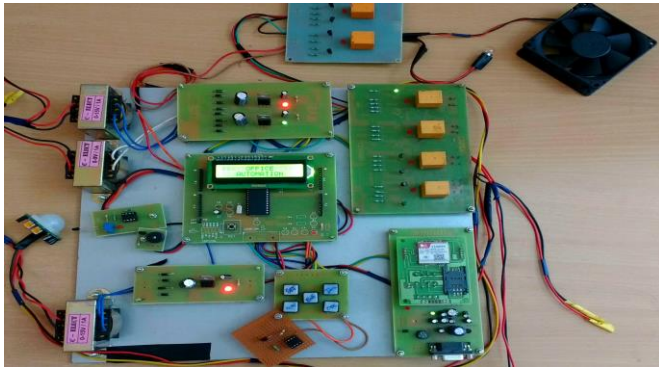
Fig 3: Shows the Hardware Assembly and its Initialization, displayed on an LCD.

3. CONCLUSIONS

The remote monitoring of electrical appliances like fan, light, computer and microwave oven through android application has been implemented and tested successfully [8]. It is exclusively targeted for the elderly, physically handicapped and for the convenience of controlling the switches without actually reaching for it. The designing of login page in android application and usage of human and fire sensors while designing the hardware keeps the system safe, highly

error-free and efficient. The system has the scope for modifications, and more devices can be added. Also, Arduino which is an open source has made possible to realize the difficult tasks quite easily because of its enriched libraries.

8. FUTURE SCOPE

In the future, we can make use of voice command technology in offices. We are already seeing the popularity of wearable devices rise in the form of fitness monitors, which are just the beginning of the possibilities for wearable technology and office automation. Perhaps in the future our wearable technology will monitor the office appliances around us for optimal energy conservation.

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