



Sensors Based Modern Home Automation System Using Android Mobile App

Kalari Pradeep | K Kiran Kumar

Department of Computer Science and Engineering, Chalapathi Institute of Engineering and Technology, Lam, Guntur

*Corresponding Author Email ID: pradeepkalari1237@gmail.com, kommineni.kiran11@gmail.com

To Cite this Article

Kalari Pradeep and K Kiran Kumar. Sensors Based Modern Home Automation System Using Android Mobile App. International Journal for Modern Trends in Science and Technology 2022, 8(05), pp. 239-245. <https://doi.org/10.46501/IJMTST0805034>

Article Info

Received: 02 April 2022; Accepted: 06 May 2022; Published: 09 May 2022.

ABSTRACT

Automation of any task is the uses of control systems and information technologies to minimize the need for human work in the produce of goods and services. In the scope of industrialization, automation is a step beyond mechanization. This project presents a lower cost, Secured and flexible home monitoring and environmental control system. It employs an auto embedded server in Arduino microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely. These devices can be controlled through a web application or via Bluetooth Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor, gas sensor and motion sensors have been integrated with the proposed home control system. In modern age it would be a good application for both paralyzed people and home security.

Here using PIR sensor, Gas Sensor, Temperature sensor, LDR, GSM, WIFI, Buzzer, LCD, Fan and Bulb. When the PIR sensor detected automatically bulb will be ON Otherwise OFF condition. When the Gas, Temperature, LDR sensors detected automatically Fan and Buzzer will be ON condition for controlling the home condition and also displays on LCD , APP and also send messages to the concerned person.

KEYWORDS: *Arduino UNO, WIFI Module, Relay, DC Motor, Mobile Phone, Sensors*

1. INTRODUCTION

Home automation has been a feature of science fiction writing for many years, but has only become practical since the early 20th Century following the widespread introduction of electricity into the home, and the rapid advancement of information technology. Home automation refers to the application of computer and

information technology for control of home appliances easily. It is a automation of the home, housework or household activity. Home automation may include centralized control of Light, Appliances, Temperature and other systems, to provide improved convenience. Comfort, energy efficiency and security. Home automation for the elderly and disabled can provide

increased quality of life for persons who might otherwise require caregivers or institutional care. The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity through Smartphone and tablet connectivity. The concept of the "Internet of Things" has tied in closely with the popularization of home automation. Through the integration of information technologies with the home environment, systems and appliances are able to communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits. As we are using Arduino Uno. It is a popular open source single-board microcontroller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board. Arduino hardware is programmed using a Wiring based language (syntax and libraries), similar to C++ with some slight simplifications and modifications, and a Processing-based integrated development environment.

2. LITERATURE REVIEW

In this paper a design and prototype implementation of new home automation system that uses WiFi technology as a network infrastructure connecting its parts. Their system consists of two main components; the first part is the server (web server), which presents system core that manages, controls, and monitors users' home. Users and system administrator can locally (LAN) or remotely (internets) manage and control system code. Second part is hardware interface module, which provides appropriate interface to sensors and actuator of home automation system. Unlike most of available home automation system in the market the proposed system is scalable that one server can manage many hardware interface modules as long as it exists on Wi-Fi network coverage. System supports a wide range of home automation devices like power management components, and security components. The proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems

"Smart Energy Efficient Home Automation System using IOT", by Satyendra K. Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra.

This paper presents a step-by-step procedure of a smart home automation controller. It uses IOT to convert home appliances to smart and intelligent devices, with the help of design control. An energy efficient system is designed that accesses the smart home remotely using IOT connectivity. The proposed system mainly requires, Node MCU as the microcontroller unit, IFTTT to interpret voice commands, Adafruit a library that supports MQTT acts as an MQTT broker and Arduino IDE to code the microcontroller. This multimodal system uses Google Assistant along with a web based application to control the smart home. The smart home is implemented with main controller unit that is connected with the 24-hour available Wi-Fi network. To ensure, that the Wi-Fi connection do not turn off, the main controller is programmed to establish automatic connection with the available network and connected to the auto power backup.

"IOT Based Smart Security and Home Automation", by Shardha Somani, Parikshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Laturkar.

This paper focuses on a system that provides features of Home Automation relying on IOT to operate easily, in addition to that it includes a camera module and provides home security. The android application basically converts Smartphone into a remote for all home appliances. Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of house entrance in real time. This notification will be received by the owner of the house via internet such that app can trigger a notification. So owner can raise an alarm in case of any intrusion or he/she can toggle the appliances like opening the door if the person is a guest. The system uses Raspberry Pi, a small sized computer which acts as server for the system. The smart home consist two modules. Home automation that consists; fan light and door controller, and security module that consists; smoke sensor motion sensor and camera module.

"A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System", by Tui-Yi Yang, Chu-Sing Yang, Tien-Wen Sung.

This paper proposes an optimization of home power consumption based on PLC (Power Line Communication) for an easy to access home energy consumption. This also proposes a Zigbee and PLC based renewable energy gateway to monitor the energy generation of renewable energies. ACS and DDEM algorithm are proposed for the design of an intelligent distribution of power management system to make sure ongoing power supply of home networks. To provide efficient power management the power supply models of home sensor network are classified groups viz. main supply only, main supply and backup battery, rechargeable battery power and non-rechargeable battery power. Devices with particular features are assigned to these groups. It targets to establish real time processing scheme to address variable sensor network topologies.

3. INTRODUCTION ABOUT EMBEDDED SYSTEMS

3.1 INTRODUCTION OF EMBEDDED SYSTEM:

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner.

This is in direct contrast to the personal computer in the family room. It too is comprised of computer hardware and software and mechanical components (disk drives, for example). However, a personal computer is not designed to perform a specific function rather; it is able to do many different things. Many people use the term general-purpose computer to make this distinction clear. As shipped, a general-purpose computer is a blank slate; the manufacturer does not know what the customer will do wish it. One customer may use it for a network file

server another may use it exclusively for playing games, and a third may use it to write the next great American novel.

Frequently, an embedded system is a component within some larger system. For example, modern cars and trucks contain many embedded systems. One embedded system controls the anti-lock brakes, other monitors and controls the vehicle's emissions, and a third displays information on the dashboard. In some cases, these embedded systems are connected by some sort of a communication network, but that is certainly not a requirement.

At the possible risk of confusing you, it is important to point out that a general-purpose computer is itself made up of numerous embedded systems. For example, my computer consists of a keyboard, mouse, video card, modem, hard drive, floppy drive, and sound card—each of which is an embedded system. Each of these devices contains a processor and software and is designed to perform a specific function. For example, the modem is designed to send and receive digital data over analog telephone line. That's it and all of the other devices can be summarized in a single sentence as well.

3.2. OVERVIEW OF EMBEDDED SYSTEM :

Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'.

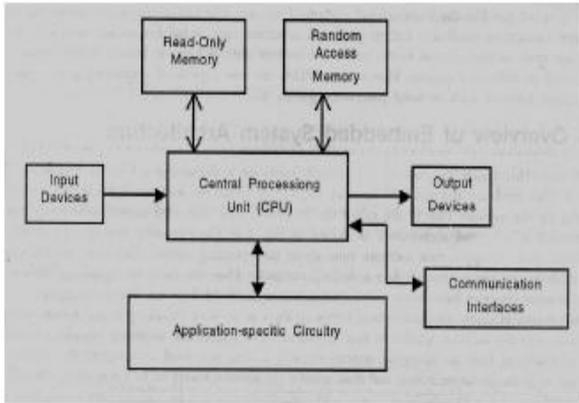
The same architecture is applicable to any computer including a desktop computer. However, there are significant differences. It is not compulsory to have an operating system in every embedded system. For small appliances such as remote control units, air conditioners, toys etc., there is no need for an operating system and you can write only the software specific to that application.

For applications involving complex processing, it is advisable to have an operating system. In such a case, you need to integrate the application software with the operating system and then transfer the entire software on to the memory chip. Once the software is transferred to the memory chip, the software will continue to run for a long time you don't need to reload new software. Now, let us see the details of the various building blocks of the hardware of an embedded system. As shown in Fig. the building blocks are:

- a. Central Processing Unit (CPU)

- b. Memory (Read-only Memory and Random Access Memory)
- c. Input Devices
- d. Output devices
- e. Communication interfaces
- f. Application-specific circuitry

Fig: 3.1 Building blocks of the hardware of an



embedded system

CENTRAL PROCESSING UNIT (CPU):

The Central Processing Unit (processor, in short) can be any of the following: microcontroller, microprocessor or Digital Signal Processor (DSP). A micro-controller is a low-cost processor. Its main attraction is that on the chip itself, there will be many other components such as memory, serial communication interface, analog-to-digital converter etc. So, for small applications, a micro-controller is the best choice as the number of external components required will be very less. On the other hand, microprocessors are more powerful, but you need to use many external components with them. DSP is used mainly for applications in which signal processing is involved such as audio and video processing.

MEMORY:

The memory is categorized as Random Access Memory (RAM) and Read Only Memory (ROM). The contents of the RAM will be erased if power is switched off to the chip, whereas ROM retains the contents even if the power is switched off. So, the firmware is stored in the ROM. When power is switched on, the processor reads the ROM; the program is executed.

INPUT DEVICES:

Unlike the desktops, the input devices to an embedded system have very limited capability. There will be no keyboard or a mouse, and hence interacting with the embedded system is no easy task. Many embedded

systems will have a small keypad-you press one key to give a specific command. A keypad may be used to input only the digits. Many embedded systems used in process control do not have any input device for user interaction; they take inputs from sensors or transducers which produce electrical signals that are in turn fed to other systems.

OUTPUT DEVICES:

The output devices of the embedded systems also have very limited capability. Some embedded systems will have a few Light Emitting Diodes (LEDs) to indicate the health status of the system modules, or for visual indication of alarms. A small Liquid Crystal Display (LCD) may also be used to display some important parameters.

COMMUNICATION INTERFACES:

The embedded systems may need to, interact with other embedded systems as they may have to transmit data to a desktop. To facilitate this, the embedded systems are provided with one or a few communication interfaces such as RS232, RS422, RS485, Universal Serial Bus (USB), IEEE 1394, Ethernet etc.

APPLICATION-SPECIFIC CIRCUITRY:

Sensors, transducers, special processing and control circuitry may be required for an embedded system, depending on its application. This circuitry interacts with the processor to carry out the necessary work. The entire hardware has to be given power supply either through the 230 volts main supply or through a battery. The hardware has to be designed in such a way that the power consumption is minimized.

4. DESIGN OF HARDWARE

This chapter briefly explains about the Hardware implementation of authentication of. It discusses the circuit diagram of each module in detail.

4.1. ARDUINO UNO

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 16 MHz ceramic resonator, a USB connection, a power jack, 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 Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Arduino board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

Fig: ARDUINO UNO



SUMMARY:

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)

Analog Input Pins 6

DC Current per I/O Pin 40 mA

DC Current for 3.3V Pin 50 mA

Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader

SRAM 2 KB (ATmega328)

EEPROM 1 KB (ATmega328)

Clock Speed 16 MHz.

Power:

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

- GND. Ground pins.

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digitalWrite()`, and `digitalRead()` functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the `attachInterrupt()` function for details.

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the `analogWrite()` function.

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the `analogReference()` function. Additionally, some pins have specialized functionality:

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with `analogReference()`.

- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

See also the mapping between Arduino pins and ATmega328 ports. The mapping for the ATmega8, 168, and 328 is identical.

5. CONCLUSION

Upon the completion of the project we have almost fulfilled the objective of our project building an automatic door control system. Our door system is applicable from simple home to large banquet, hospital, airports & so on. Our system can be used worldwide and have many applications based flow of mass. We have made the

project with the best of our abilities but with further enhancements we can definitely increase the potential of our system. Although it may appear to be stating the obvious, the project really proved to be very beneficial for us in all aspects. The project provided us with an opportunity of working in different areas of engineering, namely, electronics and software. Our Project also requires reliable mechanical system. Due to this we are able to enhance our mechanical knowledge along with electronics & software portion. To be more precise, the completion of the project has raised our confidence to a next level, where we feel more confident about our abilities as an engineer. Hence, we conclude this project perceives a lot of experience and knowledge in the field of automation Authors and Affiliations

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

- [1] Mansour H. Assaf, Ronald Mootoo, Sunil R. Das, Emil M. Petriu, Voicu Groza, and Satyendra Biswas "Sensor Based Home Automation and Security System." 978-1-4577-1722-7/12/\$26.00 ©2012 IEEE
- [2] Vishwajeet Hari Bhide, Dr, Sanjeev Wagh "i-Learning IoT: An Intelligent Self Learning System for Home Automation Using IoT" International Conference on Communication and Signal Processing, April 2-4, 2015, India
- [3] A. R. Al-Ali, Member, IEEE, M. AL-Rousan "Java-Based Home AutomationSystem" IEEE Transactions on Consumer Electronics, Vol. 50, No. 2, May 2004
- [4] R.A.Ramlee, M.A.Othman, M.H.Leong, M.M.Ismail, S.S.S.Ranjit "Smart Home System Using Android Application." 2013 International Conference of Information and Communication Technology(ICoICT)
- [5] Silviu Folea, Daniela Bordenca, Casiana Hotea, Honoriu Valean "Smart Home Automation System Using Wi-Fi Low Power Devices"
- [6] D. Bordenca, H. Valean, S. Folea, A. Dobircu, "Agent Based Systemfor Home Automation, Monitoring and Security.", International Conference on Tele - communications and Signal Processing TSP 2011, Budapest, Hungary, Aug. 18-20, pp. 165-169, ISBN 978-1-4577-1409-2
- [7] Mitali Patil, Ashwini Bedare, Varsha Pacharne "The Design and Implementation of Voice Controlled Wireless Intelligent Home Automation System Based on ZigBee." International Journal of Advanced Research in Computer Science and Software Engineering.
- [8] Sharon Panth, Mahesh Jivani "Home Automation System (HAS) using Android for Mobile Phone" International Journal of Electronics and Computer Science Engineering ISSN 2277-1959/V3N1-01-11

- [9] Vinay sagar K N, Kusuma S M "Home Automation Using Internet of Things" International Research Journal of Engineering and Technology(IRJET) e-ISSN:2395-0056
- [10] Kallakunta. Ravi Kumar, Shaik Akbar "Android Application Based Real Time Home Automation." Indian Journal of Applied Research ISSN 2249-555X
- [11] Deepali Javale, Mohd. Mohsin, Shreerang Nandanwar, Mayur Shingate "Home Automation and Security System Using Android ADK" International Journal of Electronics Communication and Computer Technology (IJECC)Volume 3 Issue 2(March 2013)

