Automation of the air conditioner using ARDUINO

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ABSTRCT

An inexpensive and versatile home control and environmental monitoring system is presented in this research. The Arduino Mega 2560 microcontroller has an inbuilt micro-web server with IP connection, allowing it to access and operate gadgets and appliances from a distance. A web application or a Bluetooth Smart phone app based on Android may be used to operate these devices. For example, the suggested system does not need a dedicated server PC as in prior systems and provides a new communication protocol to manage the home environment with more than merely switching functions. Devices such as light switches, power plugs, temperature sensors, gas sensors, and motion sensors have been incorporated into the proposed home management system to show its practicality and efficacy.

Index Terms— Smart Home, Home Automation, Android Smartphone, Arduino, Light Dependent Resistor, Passive Infrared Sensor, Graphic User Interface

I. INTRODUCTION

In today's world, security systems play a significant role in protecting both people and property. With the addition of multiple security subsystems to the system, such as surveillance, intruder detection control, access control and fire detection, a single control unit may be used. Lighting, heating, and technological items that can be controlled remotely through a smartphone or the internet make a house a "smart home." Controlling your house's electrical gadgets from anywhere in the world is easy with an internet-based home automation system [1]. The capacity to remotely or automatically control many aspects of one's house is provided through home automation. For example, a refrigerator is an example of a home appliance, which is a gadget or instrument intended to do a certain task. In this context, "appliances" and "devices" are used synonymously. When it comes to the fundamental chores of turning on and off equipment and beyond, either remotely or in close proximity, automation is today's reality [2]. While automation reduces human judgement to its barest minimum, it does not eliminate it entirely. The idea of being able to control your home appliances from anywhere in the globe at any time over the internet is becoming more popular.

OVERVIEW OF THE SMART HOME

Figure 1 depicts the smart home system's basic block diagram. Sensors attached to a micro-controller are used to gather information about physical conditions [4][5]. The temperature sensor and the gas sensor, for example, provide temperature readings, while the gas sensor keeps an eye out for the

presence of smoke and cooking gas to help prevent fires [6][7]. The LDR (Light Dependent Resistor) determines the intensity of the day light and controls the automated switching of the light [8][9]. When the security system is activated, a motion detector employing a Passive Infrared Sensor (PIR) is built in to detect movement in the house. The microcontroller sends control signals to a relay switch, which then relays them to the electrical device that turns on and off the lights. To verify the identity of a home user, a web portal uses a one-factor authentication mechanism (username and password). To operate the household appliances, it serves as an input device, and it also serves as an output device, reading the physical state values. This method is also used by the mobile app, which serves as an input and output device [10][11].

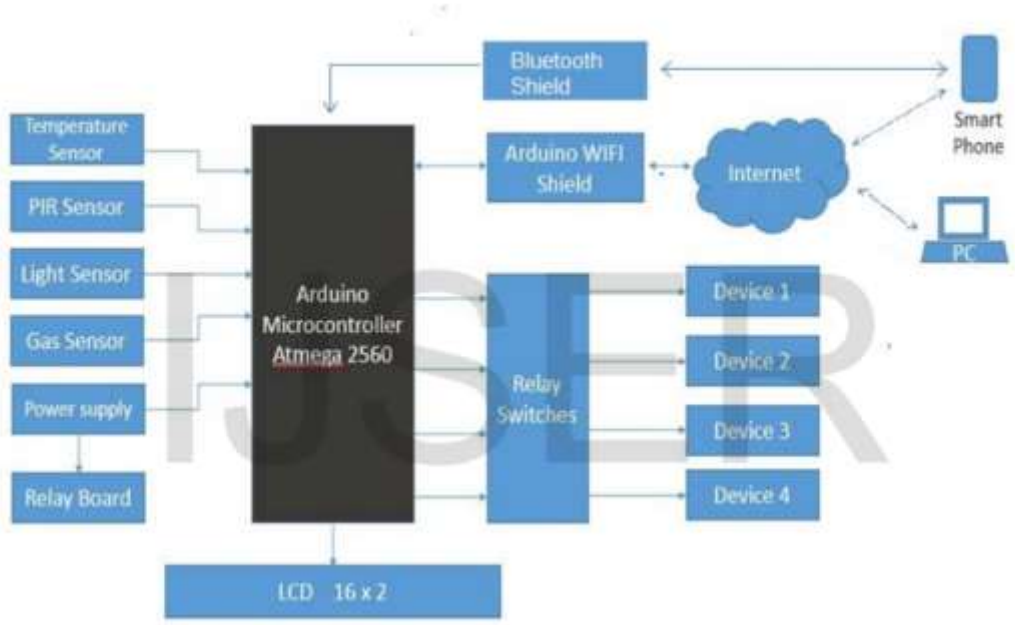

Figure 1: Block Diagram of the Smart Home System

II. DESIGN AND IMPLEMENTATION

Our concept presents a low-cost, high-performance smart home solution. The hardware interface module and the software communication module are the two primary components of this system. As well as being a mini web server and an interface for all hardware components, the Arduino Mega 2560 is fundamental to this system. The microcontroller serves as the central hub for all system communication and control [12][13].

Figure 2 shows how the temperature, humidity, gas, and smoke sensors of the smart home system may be used to monitor environmental conditions. Lighting, fans/air conditioners, and other household equipment linked to the relay system may all be switched on and off using this system. Using the motion sensor, this system also provides intrusion detection, which can be operated through the Android smart phone app or the website [14][15].

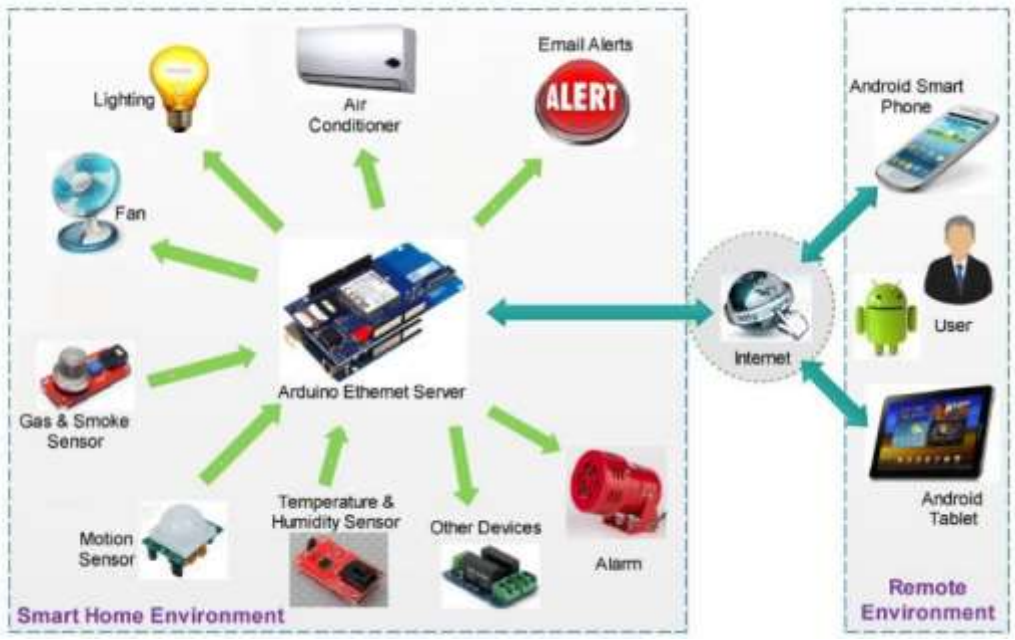

Figure 2: System architecture of the smart home system.

III. HARDWARE MODULE

A range of sensors and actuators allow Arduino to keep tabs on its surroundings and have an impact on it [16]. To put it another way, an analogue thermometer is a chip that can tell you the temperature of the surrounding air. Basic, low-cost digital temperature and humidity sensor DHT11 [17] The surrounding air is measured using a capacitive humidity sensor and a thermistor, and a digital signal is sent on the data port (no analogue input pins are required), as shown in figure 3. It's easy to operate, but timing is critical if you want to get the most out of it. When utilising our library, sensor readings might be up to two seconds outdated since the sensor only updates every two seconds [18].

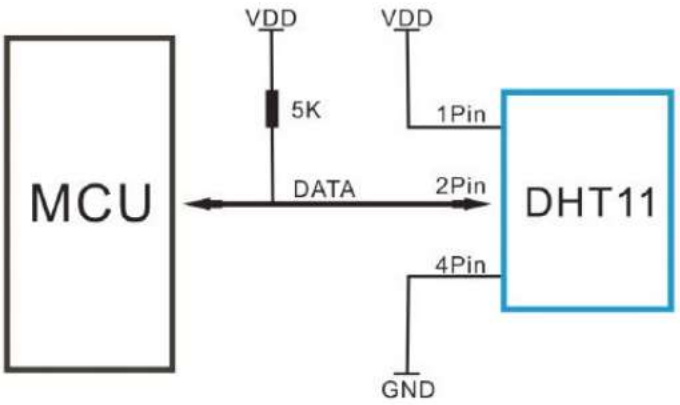

Figure 3: Pin connection of DHT11 Sensor

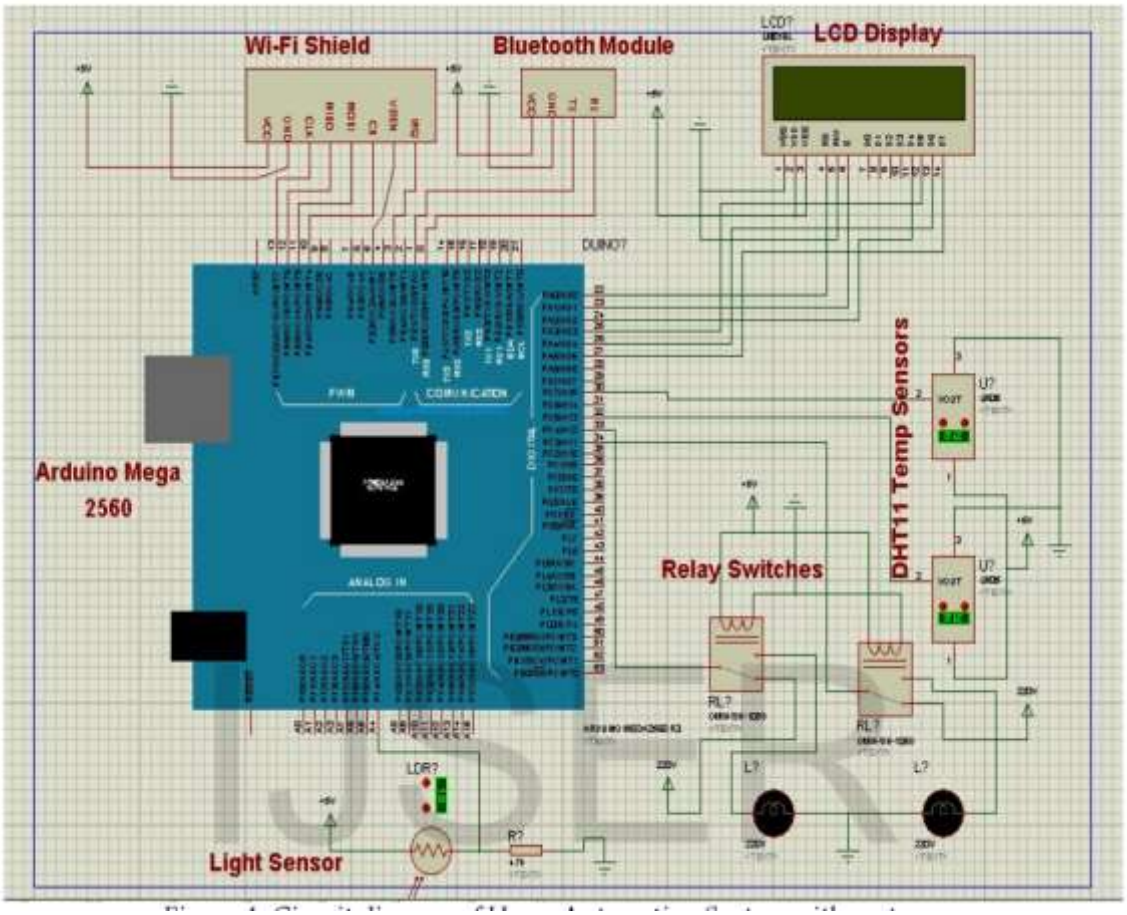

Figure 4: Circuit diagram of Home Automation System with proteus

With the use of PIR sensors, one is able to detect motion nearly constantly, and it is used to determine if a person has entered or left the sensors' region of vision, By sensing changes in the infrared intensity of surrounding objects, a PIR sensor can detect movement. Checking for a high signal level on a signal I/O pin [19] may help identify this movement. There is no need to replace them since they are compact, low-power, simple to use, and never wear out. As a result, they're often found in household and office electronics. Tin-dioxide (SnO2) is the sensor's sensitive substance [20]. The sensor's electrical resistance reduces when it comes into touch with the gas being monitored, allowing the microcontroller to react to the situation. Analog voltage is produced when it detects flammable gas concentration in the air. The sensor can detect combustible gas concentrations between 300 and 10,000 ppm. A temperature range of -20°C to 50°C is supported by the sensor, which uses less than 150mA at a 5 V supply. Use of relay switches is common in the house for connecting and switching electrical loads. At 240V, the relay switches can handle a maximum load of 10A. Due to the low current consumption of most domestic appliances, this is more than enough to power them. A Bluetooth module and a Wi-Fi shield are used to connect the microcontroller to the internet. The Arduino's serial I/O pins link to the Bluetooth, which then connects with the Android app.

IV. ARDUINO UNO

Based on the ATmega328, the Arduino Uno microcontroller board is depicted in Fig (iii). 14 digital input/output pins, six analogue inputs, a 16 MHz crystal oscillator, USB connection, power supply, ICSP header, and a reset button are all included in this device's features. It includes everything you need to get started with the microcontroller, including a USB cord and an AC-to-DC converter or battery. Figure 5 The Arduino Uno a key difference between the Uno and all previous boards is that the FTDI USB-to-serial driver is not included in the Uno. Instead, a USB-to-serial converter is implemented using an Atmega16U2 (or Atmega8U2 up to version R2) microcontroller. The 8U2 HWB line is pulled to ground on the second revision of the Uno board, making it simpler to enter DFU mode.

Figure 5. Arduino UNO

A. MOTOR DRIVER

A key difference between the Uno and all previous boards is that the FTDI USB-to-serial driver is not included in the Uno. Instead, a USB-to-serial converter is implemented using an Atmega16U2 (or Atmega8U2 up to version R2) microcontroller. The 8U2 HWB line is pulled to ground on the second revision of the Uno board, making it simpler to enter DFU mode. WHEELCHAIR CARRIERS Motor drivers from numerous chip manufacturers are available from Future Electronics, including those for use in motor driver ICs (integrated circuits), stepper motor drivers (bipolar and H-bridge), motor drivers (servo and DC), brushless motor drivers (brushless DC), and other applications. Figure depicts a motor driver at work (iv) Your search results will soon narrow down to fulfil your unique application demands if you choose from the motor driver technical characteristics below. Many semiconductor manufacturers such as Free scale Semiconductor, ON Semiconductor, ROHM Semiconductor or STMicroelectronics are represented by us if a certain brand is more important. Simply choose your chosen motor driver manufacturer from the list below to narrow down your search results. Relay and solenoid switching,

• Stepping motors, LED and incandescent displays,

• Automotive applications, Audio-visual equipment,PC Peripherals are all examples of applications where motor drivers are used.

Figure 6. Motor Driver

B. Wi-Fi Module

Self-contained SOC with integrated TCP/IP protocol stack, the ESP2866Wi-Fi Module allows any microcontroller to connect to your Wi-Fi network. "' The ESP2866 may either host an application or offload all Wi-Fi networking tasks from a different application processor, depending on the application. You can just connect an ESP2866 module to your Arduino device and receive approximately as much Wi-Fi-ability as a Wi-Fi Shield does (and that's just out of the box)! The ESP2866 module is a low-cost board with a large and active user base. Due to its robust internal processors, sensors and other application-specific devices may simply plug into the module's GPIOs, requiring no further programming or loading during operation. Minimal external circuitry (including the front-end module) is required because to its high degree of on-chip integration.

Figure 7. Wi-Fi module

The ESP2866 supports APSD for VoIP applications and Bluetooth co-existence interfaces, has a self-calibrated RF, and does not need additional RF components to operate Figure 7 shows the Wi-Fi module.

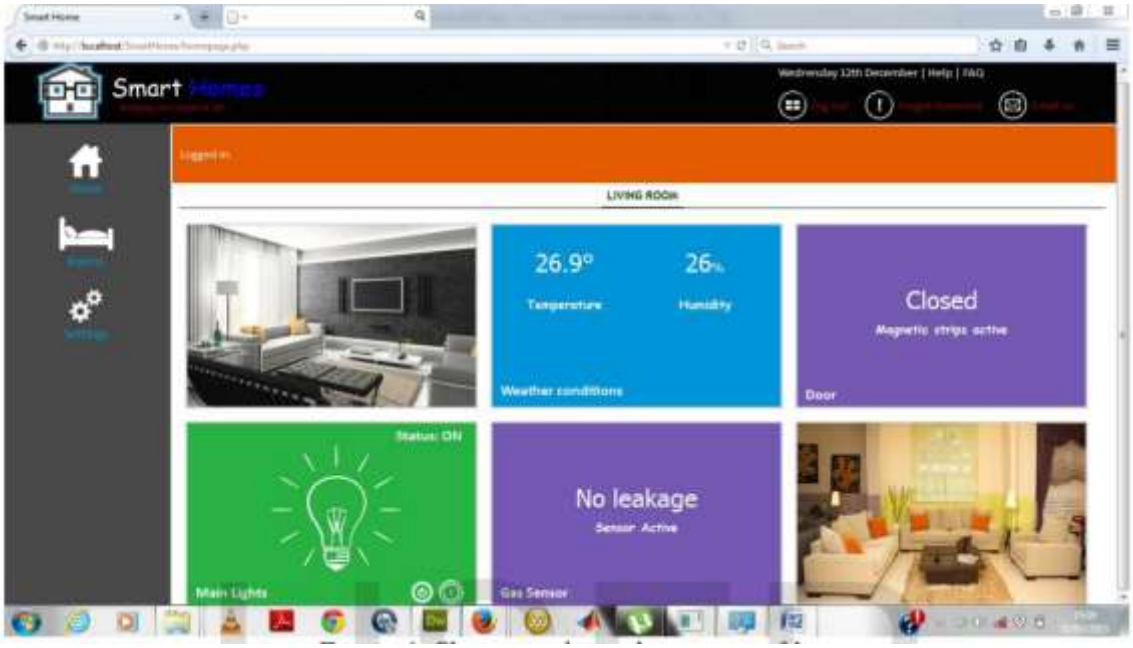

Figure 8: Showing a logged in user profile.

Ajax and JavaScript (JSON) and Hypertext Preprocessor (PHP) were our programming languages of choice for our online application, which we will refer to as a website from now on. The Arduino will be controlled by the website, which sends information to it in the form of codes[20]. Because PHP is not a client-based programming language, the Arduino microcontroller will function as the client and the PHP will serve as the server. Due to its user-friendliness and colourful presentation of online products, metro style was selected for the website design (see figure 6). Each variable read from the Arduino microcontroller will be shown on the web page, and it will also be able to carry out the same operations as the mobile application. The Wi-Fi shield attached to the Arduino board will serve as a bridge between the Arduino and the web sites. It is possible to communicate with the Arduino through the IP address that is provided by the PHP and the Ajax HTTP request when the two are linked[21] [22].

V. CONCLUSION

This study proposes and implements a unique architecture for low-cost and adaptable home management and monitoring systems utilising Android-based smart phones. As part of the suggested design, a mini web server and Bluetooth connection are used to connect the distant user to the home gadgets. The gadgets in your house may be accessed and controlled by any Android-based smartphone that has Wi-Fi integrated in. You may access the system using 3G or 4G mobile cellular networks when Wi-Fi is unavailable. A third-party voice recognition module is not required since the system makes use of Google's speech recognition engine. Wireless networks inside the home may be used to manage and monitor the smart home environment, and SMS and phone notifications can be added in the future to reduce wiring modifications in pre-existing homes.

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