

IoT Based Home Automation using Arduino

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Abstract— The Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring real-world objects (things) through the internet. When it comes to our house, this concept can be aptly incorporated to make it smarter, safer, and automated. This IoT project focuses on building a smart wireless home security system that sends alerts to the owner using the internet in case of any trespass and raises the alarm optionally. Besides, the same can also be utilized for home automation by using the same set of sensors. A smart home will take advantage of its environment and allow seamless control, whether the user is present or away. With a house that has this advantage, you can know that your home is performing at its best in energy performance. It is possible to explore various engineering challenges by implementing this system, including software programming, PCB design, wifi, TCP/IP protocols, Web Server logic design, and other aspects. This automation system provides excellent insights into the challenges of software and hardware design.

Keywords: Arduino UNO, MQ-6 sensor, PIR Sensor, wifi module

I. INTRODUCTION

Home automation has been a component of sci-fi composing for a long time. In any case, it has just gotten commonsense since the mid twentieth Century following the far and wide presentation of power into the home and the fast progression of data technology. Home automation alludes to the application of PC and data technology for the control of home machines effectively [4]. It is an automation of the home, housework, or family unit movement. Home automation may incorporate brought together control of Light, Appliances, Temperature, and different systems to give improved accommodation: comfort, energy proficiency, and security. Home automation for the older and debilitated can give expanded personal satisfaction to people who may some way or another require guardians or institutional consideration [5]. The notoriety of home automation has expanded significantly as of late because of a lot higher reasonableness and straightforwardness through cell phone and tablet network [13]. The "Web of Things" idea has tied in intimately with the advancement of home automation [8]. It is a mainstream open-source single-board microcontroller, a relative of the open-source Wiring stage, designed to make the way toward utilizing hardware in multidisciplinary extends more available [12]. The equipment comprises of a straightforward open equipment design for the Arduino board with an Atmel AVR processor and on-board input/throughput. The product comprises of a standard programming language compiler and the boot loader that sudden spikes in demand for the board [6] [9].

While the average cost for basic items is going up, there is a developing concentration to include technology to bring down those costs. In view of this, the Smart Home

venture permits the client to fabricate and keep up a savvy house to keep energy levels down while giving more computerized applications [10]. A brilliant home will exploit its current circumstance and permit consistent control, regardless of whether the client is available or away. With a house that has this preferred position, you can realize that your home is performing at its best in energy execution [7].

By executing this system, it is conceivable to investigate different designing difficulties, including programming, PCB design, wifi, TCP/IP protocols, Web Server rationale design, and different viewpoints. This automation system gives great experiences into the difficulties of programming and equipment design [11].

II. LITERATURE SURVEY

In this paper, S.Anusha, et al. have built up an IoT-based home automation system that utilizes a miniature controller and a java based android application. The miniature controller utilized is ATmega328. They have likewise utilized a GSM module, which enables the system to be utilized distantly [1]. In this paper, Rajeev Piyare presents an ease and adaptable home control and checking system utilizing an implanted miniature web worker, with IP availability to access and control gadgets and machines distantly utilizing an Android-based cell phone application. The proposed strategy doesn't need a devoted worker PC concerning comparative systems. It offers a novel correspondence convention to screen and control the home climate with something other than the exchanging usefulness. To show this present system's achievability and adequacy, gadgets, for example, light switches, power plug, temperature sensor, and current sensor have been coordinated with the proposed home control system [2]. In this paper, Ahmed ElShafee, Karim AlaaHamed, presents a design and model usage of another home automation system that utilizes wifi technology as an organization foundation interfacing its parts. Their system comprises of two fundamental parts: the worker (webserver), which presents a system center that oversees, controls, and screens clients' homes. Clients and system managers can locally (LAN) or distantly (webs) work and control system codes. The subsequent part is the hardware interface module, which gives a proper interface to the home automation system's sensors and actuators. Dissimilar to the greater part of the accessible home automation system on the lookout, the proposed system is versatile. One worker can oversee numerous hardware interface modules as long as it exists on wifi network inclusion. The system bolsters a wide scope of home automation gadgets like force the executives parts and security segments. The proposed strategy is better from the adaptability and adaptability perspective than the economically accessible home automation systems [3].

III. GENERAL DESCRIPTION

A. Overview of the System

A minimal effort and productive shrewd home system is introduced in this paper. This system has two primary modules: the hardware interface module and the product correspondence module. At the core of this system is the Arduino UNO microcontroller, which can work as a miniature web worker and the interface for all the hardware modules. All correspondence and controls in this system go through the microcontroller. The savvy home system offers ecological checking highlights utilizing temperature, mugginess, gas, and smoke sensors. It likewise gives changing functionalities to control lighting, fans/forced air systems, and other home apparatuses associated with the hand-off system. Another component of this system is interruption recognition, which it offers utilizing the movement sensor, and all these can be controlled from the Android Smartphone application or web application.

In the current day, home automation is getting fundamental for improving our everyday environments. Comfort and simplicity of utilizing home machines are what home automation is advertising. Home automation gives an advanced lifestyle. An individual will control his whole house utilizing a cell phone, from turning on a TV to locking/opening entryways; it likewise offers productive energy use. However, to get or procure such a system introduced will cost a ton of cash. That is the essential motivation behind why home automation has not gotten a lot of interest and consideration, adding to the multifaceted nature of introducing it and arranging it.

Along these lines it is fundamental to make it financially savvy and simple to configure; if this is conceded to individuals, they will get it in their homes, workplaces, and schools. At the end of the day, a system alteration for home automation is needed to bring down the cost of applying it to houses. Home automation offers simplicity of psyche and body to crippled and seniors in their places by only a single tick to do what they need, as expressed previously. A review of the system is appeared in Fig (i)

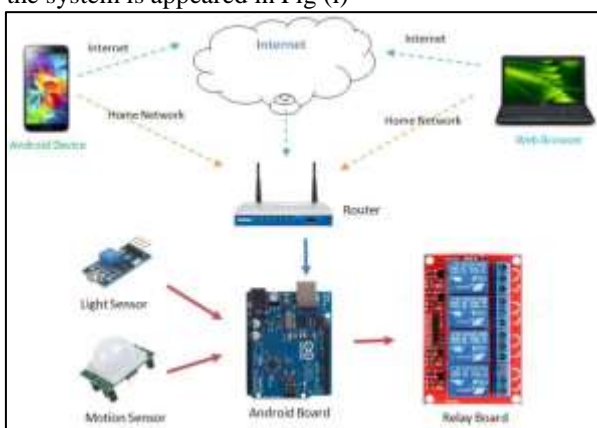


Fig. 1: Overview of the System

IV. PROPOSED SYSTEM

Our proposed system is an Arduino based home automation finished with Arduino associated with wifi and controlled through an android application or an online media network.

This system manages security in the home and shrewd home advancements, which will be cost-productive. Square Diagram of the proposed technique is appeared in Fig(ii)

Arduino can detect the environmental factors by accepting an information signal from different sensors and can influence its current circumstance by means of actuators. A simple temperature sensor is a chip that mentions to you what the encompassing temperature is. The DHT11 is an essential, super minimal effort advanced temperature and moistness sensor. It utilizes a capacitive stickiness sensor and a thermistor to gauge the encompassing air and lets out a computerized signal on the information pin (no simple information pins are required). It is sensibly easy to utilize however requires cautious planning to get information. The main genuine drawback of this sensor is you can just get new information from it once at regular intervals, so when utilizing our library, sensor readings can be as long as 2 seconds old.

The Passive Infra-Red (PIR) sensors permit one to detect movement, quite often and are utilized to identify whether a human has moved in or out of the sensor's reach. The PIR sensor is a pyroelectric gadget that distinguishes movement by estimating changes in the infrared level discharged by encompassing articles. This movement can be seen by checking for a high sign on a sign I/O pin.

They are little, cheap, low-power, simple to utilize, and don't wear out. Hence, they are generally found in apparatuses and contraptions utilized in homes or organizations. MQ6 is a semiconductor type sensor, which can suitably detect the presence of smoke, LPG, methane, butane, propane, and other hydrocarbon burnable gases. The touchy material in this sensor is tin-dioxide(SnO₂). At the point when it interacts with the gas to be checked, the sensor's electrical opposition diminishes, empowering the microcontroller to react to the circumstance.

At the point when it recognizes flammable gas focus noticeable all around, it yields its perusing as a simple voltage. The sensor can gauge convergences of combustible gas of 300 to 10,000ppm. The sensor can work at temperatures from - 20 to 50°C and burns-through under 150 mA at 5 V. To permit association for power attachments and exchanging of electrical burden inside the home; transfer switches are utilized. The transfer switches can convey a most extreme burden of 10A at 240V. This is adequate to keep up any family unit machine as these gadgets don't draw a lot of current. The wifi shield gives web network to the implanted miniature web worker, permitting web access and controls from a web application.

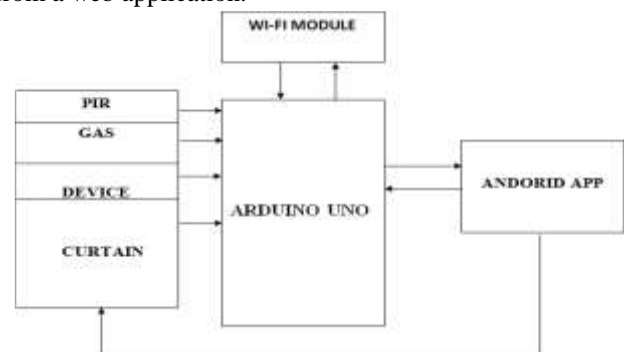


Fig. 2: Block Diagram of the proposed system

V. ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328, as shown in Fig(iii). It has 14 digital input/output pins (of which six can be used as PWM outputs), six analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.



Fig. 3: Arduino UNO

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.

Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to the ground, making it easier to put into DFU mode.

A. Motor Driver

Future Electronics has a full programmable engine driver choice from a few chip makers that can be utilized for an engine driver IC(integrated circuit), bipolar stepper engine driver, H connect engine driver, servo engine driver, DC engine driver, brushless engine driver, or for any course that may require an engine driver. Engine driver is appeared in Figure (iv)

Look over the engine driver specialized properties beneath, and your list items will rapidly be limited to coordinate your particular engine driver application needs. In the event that you have a favored brand, we manage a few semiconductor producers, for example, Free scale Semiconductor, ON Semiconductor, ROHM Semiconductor, or STMicroelectronics, among others. You can rapidly refine your engine driver item indexed lists by clicking your favored engine driver brand underneath from our makers' rundown. Engine drivers can be found in a wide exhibit of applications including Relay and solenoid switching,• Stepping engine, LED and radiant displays,• Automotive applications, Audio-visual hardware, PC Peripherals

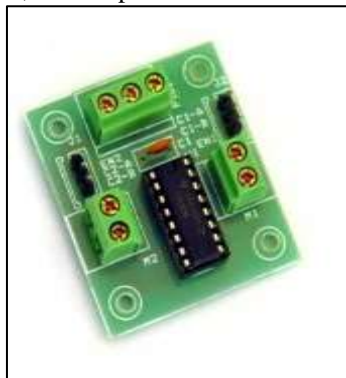


Fig. 4: Motor Driver

B. Wi-Fi Module

The ESP2866Wi-Fi Module is an independent SOC with an incorporated TCP/IP convention stack that can give any microcontroller admittance to your wifi organization. The ESP2866 can either have an application or offloading all wifi organizing capacities from another application processor. Each ESP2866 Module comes pre-modified with an AT order set firmware, which means you can attach this to your Arduino gadget and get probably as much Wi-Fi-capacity as a wifi Shield offers (and that is barely out of the case)! The ESP2866 Module is an amazingly practical board with a tremendous and ever-developing network. This Module has an amazing enough ready preparing and capacity ability that permits it to be incorporated with the sensors and other application-explicit gadgets through its GPIOs with negligible advancement in advance and insignificant stacking during runtime. Its serious level of on-chip mix considers insignificant outer hardware, including the front-end module, designed to involve a negligible PCB zone. The ESP2866 underpins APSD for VoIP applications and Bluetooth-presence interfaces; it contains a self-adjusted RF permitting it to work under every working condition and requires no outer RF parts. Wifi module is shown in Fig (v)

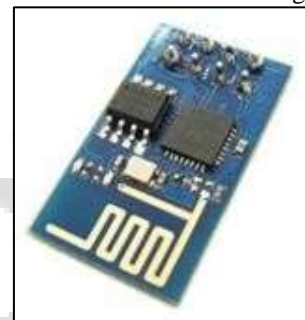


Fig. 5: Wi-Fi module

C. Sensors

A sensor is a gadget that identifies and reacts to some contribution from the actual climate. The particular data could be light, heat, movement, dampness, weight, or anybody of a critical number of other natural marvels. The yield is commonly a sign changed over to an intelligible showcase at the sensor area or sent electronically over an organization for perusing or further handling.

1) PIR SENSOR



Fig. 6: PIR Sensor

A PIR-based motion detector shown in Fig (v) is used to sense the movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. They are widely called "PIR," or sometimes "PID," for "passive infrared detector."

An individual PIR sensor recognizes changes in the measure of infrared radiation impinging upon it, which fluctuates relying upon the items' temperature and surface qualities before the sensor. At the point when a thing, for example, a human, passes before the foundation, for example, a divider, the temperature by then in the sensor's field of view will ascend from room temperature to internal heat level and afterward back once more. The identifier changes over the subsequent change in the approaching infrared radiation into a distinction in the yield voltage, which triggers the location. Objects of comparative temperature yet extraordinary surface qualities may likewise have an alternate infrared emanation design. Accordingly, moving them concerning the foundation may trigger the locator.

PIRs come in numerous designs for a wide assortment of applications. The most well-known models have various Fresnel focal points or mirror sections, a critical scope of around ten meters (thirty feet), and a field of view under 180 degrees. Models with more far reaching zones of view, including 360 degrees, are accessible commonly designed to mount on a roof. Some bigger PIRs are made with single portion reflects and can detect changes in infrared energy more than thirty meters (100 feet) away from the PIR. There are likewise PIRs designed with reversible direction mirrors, which permit either wide coverage (110° wide) or very narrow "curtain" coverage or with individually selectable segments to "shape" the content.

VI. MQ-6 SENSOR

This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000 ppm. This sensor has high sensitivity and fast response time. The sensor output is an analog resistance. The drive circuit is straightforward; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC. This sensor comes in a package similar to our MQ-3 alcohol sensor and can be used with the breakout board below



Fig. 7: MQ6Sensor LPG Gas Sensor (MQ6) Features:

- High Sensitivity to LPG, iso-butane, propane
- Small sensitivity to alcohol, smoke
- Detection Range: 100 - 10,000 ppm iso-butane propane
- Fast Response Time: <10s
- Simple drive circuit
- Heater Voltage: 5.0V Dimensions:
- 18mm Diameter, • 17mm High excluding pins

Applications include Gas leak detection system, Fire/Safety detection system, Gas leak alarm, Gas detector

VII. HARDWARE IMPLEMENTATION

A model house is worked for the home automation system. A movement sensor is fixed at the entryway of the house to recognize any development close to the entryway. Light 1 will turn on naturally when the light sensor distinguishes the haziness. A cooler/Fan will turn on when the room temperature surpasses the set edge and, thus, lessens the room temperature. The gas sensor MQ-6 is set in the kitchen to identify any gas spillage; if any spillage is detected and the corridor's caution is raised. Transfer is utilized to switch the electrical machines like light, fan, and so on The Intel Galileo is set instore a room or carport. The Intel Galileo is associated with a wifi card with radio wires for network with the web. Another component of this system is interruption identification, which it offers utilizing the movement sensor, and all these can be controlled from the Android Smartphone application or web application.

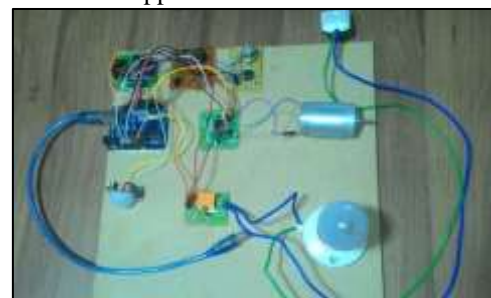


Fig. 8: Hardware Implementation



Fig. 9: APP screen shot

Any spot on the planet can control the App with the assistance of a wifi module. This can be helpful to mindful of home machines in any event, during work hours. We can deal with the home apparatuses utilizing this App and furthermore tense free at any second. The strategies utilized in this App will bode well when contrasted and people.

VIII. CONCLUSION

An epic engineering for minimal effort and adaptable home control and observing system utilizing an Android-based Smartphone is proposed and executed in this task. The proposed design uses a miniature web worker and Bluetooth correspondence as an interoperable application layer for conveying between the far off client and the home gadgets. Any Android-based Smartphone with worked in wifi backing can be utilized to access and control the gadgets at home. At the point when a wifi association isn't accessible, versatile

cell organizations, for example, 3G or 4G can motor, accordingly disposing of the requirement for an outer voice acknowledgment module.

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