Fingerprint Based Smart Home Automation and Security System

Md Abdullah Al Rakib, Md Moklesur Rahman, Salah Uddin, Md Shamsul Alam Anik, ABM Hasan Talukder, Mousume Samad, and Fysol Ibna Abbas

Abstract — Wireless Controlled by Voice Automation in the Home Based on Bluetooth, a project that is moving forward with cell (application) in addition to giving the workspace to the elderly and injured, so they may control household utilities. Voice interest is based on their phone. The gadget is disguised in such a manner that it will be quick to pass on, present, figure out, run, and keep up with the dark person. Wires for house automation are also utilized to interconnect the many electrical equipment that are used in a home. This work may be run with a variety of options, such as a fingerprint sensor that will lock and unlock the door, or any other security system that will be installed in a home or business. And a leakage detector will track the system, and if it detects a leak, an automated SMS will be delivered to the user through GSM.

Keywords — Arduino Uno, Communication, Fingerprint Sensor, GSM module, Microcontroller.

I. INTRODUCTION

The automated control of electrical gadgets in our homes is known as home automation. Because these gadgets are connected to the Internet, they may be operated from afar. Home automation allows equipment to communicate with one another, allowing us to control lights, fans, and air conditioners using AMR speech applications. Fingerprint security allows us to control the house door. We can also determine the location of a gas leak by using a gas detector. The purpose of this project is to create a house motorization structure using an Android app, a microcontroller robotization structure, swap devices and devices using an electrical contraption module, create a correct circuit diagram, and design [1], [2].

This architecture is used for more than only controlling the microcontroller's connected devices. The suggested structure's course of action is divided into three parts for the most part. An android application communicates with the Bluetooth module at the perplexing stage. The microcontroller then receives the signal given by the Bluetooth module in the second stage. By that time, the microcontroller has also awarded the beginning sign, the trading module. The hand-off module, which was improved recently, changes the trade-related contraptions. This venture report favors seven districts by a large margin. The standard section depicts an idea with yielding, our project "Voice Control Home Automation," a quick description of the project, extensions, and approach. The second section contains information on history, block configuration, circuit diagram, and parts layout.

The final aspect is regarding portion depiction and our system's cost evaluation. The fourth section of the program is an evaluation and explanation of the program. Part five is dedicated to hardware execution. By then, chapter six has depicted the outcome and discussion in an appropriate manner. Finally, region seven agrees to the last statements, which are a deterrent to our game plan and concept for future efforts. The free home computerization structure project is likewise making more life works in a wide range of homes [3].

Hikmat Yar and his crew were able to regulate household appliances remotely and automatically, providing security and safety. In addition, to protect the customer's privacy, the suggested solution leveraged the edge-computing paradigm to store sensitive data in a local cloud [4]. A causal study survey was undertaken by Sheikh Muhamad Hizam and his colleagues to understand the behavioral intention regarding the usage of a biometric facial recognition system. To hypothesize the conceptual framework, the Technology Acceptance Model (TAM) was combined with Perceived System Quality (PSQ) and Social Influence (SI). Online questionnaires were used to obtain data from 475 people. The surveyed data was analyzed using structural equation modeling (SEM) and artificial neural networks (ANN) [5]. Omer Faruq Mamun and his collaborators suggested a scheme in which two bulbs are controlled by two relays and DC power is delivered to a DC power source through a transformer. The door is also locked and unlocked using the card reader. Customers can enter the residence by punching their card into the card reader via the clocking machine if they like [6]. Ponmalar A and his colleagues designed a door locking system based on a solenoid lock. A smartphone application was utilized in addition to the equipment to verify and double-check the finger impression and communicate the confirmation, as well as an id, to Arduino over Bluetooth. The

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entryway lock would be bolted and unlocked using the fingerprint sensor on the smartphone [7].

It is also often used monetarily in associations. In addition, you may utilize the adaptable android application in some circumstances nearby. Bluetooth is a wireless technology that may be used to connect PDAs and personal computers from afar. Bluetooth technology allows for moderate improvement in the face of overwhelming home automation. It’s a devalued asset with room for improvement. Several moves employ an extra magnet to operate the switch and supply electrical division between two circuits in the same way [8]-[10].

II. SYSTEM DESIGN

By employing a simple phone application, the house robotization structure allows folks to have comparably direct home mechanical parties. It’s enormous in addition to showing up on things and clients outstanding telephone programming for constructing a house robotization framework. Many houses mechanical social issues, such as lighting, entrance locks, and so on, may be supported by the device. We’ll look at the Bluetooth module (HC-05), Relay module, and Arduino UNO in this section, as well as the ‘Robotization Smart Home’ apps, Arduino compiler, Block chart, and schematic diagram of our system [11].

The square layout of the house robotization structure is given in Fig. 1, and we may operate the Bluetooth module and the hand-off module with the Arduino UNO. When the requested service is available, the Bluetooth module (HC-05) transmits an electronic yield and control unit. Currently, the control units (Arduino UNO) will issue instructions and the hand-off module will switch on and off in the same way [12], [13].

The Voice Commands AMR Voice, a free program, is used in the Home Automation project. This program moves and controls the numerous machines connected to our Arduino UNO. When the switch is turned on, the program is executed, and Bluetooth signals are delivered from our Android phone, as well as the Bluetooth module we purchased and our Arduino. The Arduino determines which signal was transmitted, as well as the points of view directed at it, as well as the predetermined signals sent for each mechanical assembly. When the Arduino detects that signal, it urges the hand-off to its electrical pin by passing 5 V through it. As wayward parts are found, the hand-off is activated, and the hand-associated off’s contraption is activated as well. Also, when the Arduino UNO is turned off, it sends a 0 V or very low signal to its general pin [14], [15].

In this work we have used Bluetooth Module (HC-05), Microcontroller (Arduino Mega), Relay Module, GSM sim 8001, Arduino voice control app, Ac to dc Converter, LCD Display, Load, Motion sensor, Buck Converter, Ac Bulb, Fingerprint and MQ2 [16].

<table>
<thead>
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<th>Component Name</th>
<th>Quantity</th>
<th>Price (TK)</th>
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<td>01</td>
<td>Bluetooth Module(HC-05)</td>
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<td>350.00</td>
</tr>
<tr>
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<td>Arduino UNO</td>
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<tr>
<td>03</td>
<td>Relay Module</td>
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<td>Power Supply</td>
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<td>Free</td>
</tr>
<tr>
<td>09</td>
<td>Wires</td>
<td>8</td>
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<tr>
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<td>LM35</td>
<td>1</td>
<td>71</td>
</tr>
<tr>
<td>13</td>
<td>MQ2</td>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Total Cost</td>
<td></td>
<td>≈2391.00</td>
</tr>
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</table>

The R307 fingerprint module has two interfaces: TTL URT and USB 2.0; the USB 2.0 interface can be connected to a computer; the RS232 interface is a TTL level, the default transmission rate is 57600, but this can be changed; can and can have a connection to microcontrollers such as ARM, DSP, and other serial devices; 3.3 V 5 V microcontrollers can be directly connected. Level conversion on the computer, a level conversion note, and a duplicate connection, similar to the MX232 circuit, are all required [18], [19].

Fingerprint sensor was connected to the Arduino UNO first. Make sure you acquire a fingerprint sensor that can communicate with the Arduino through serial. The Arduino UNO’s default serial communication pins are pins 0 (RXD) and 1 (TXD), however we’ll utilize other pins for serial

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Fig. 1. Block diagram of the proposed system.

Fig. 2. Circuit diagram of this work [17].

Fig. 3. Fingerprint sensor R307.
communication. The Software Serial library will be used in the code for this project. Here, cost analysis of this work is given below.

The following are the connections that must be made between the fingerprint sensor and the UNO:

![Fingerprint sensor connection with Arduino and lock](image)

Fig. 4. Fingerprint sensor connection with Arduino and lock [20].

MQ2 is one of the most often used gas sensors in the MQ sensor method. It's a Metal Oxide Semiconductor (MOS) type Gas Sensor, but it's also known as Chemiresistors since the ID is based on the difference in blockage of the identifying material when the Gasworks interacts with it. Gas centralizations can be detected via a key voltage divider connection. The MQ2 Gas Sensor is powered by 5V DC and consumes roughly 800mW. It can detect LPG, Smoke, Propane, Hydrogen, Methane, and Carbon Monoxide fixations in areas ranging from 200 to 10,000 parts per million.

Bulbs are grouped together in a heap. We are using three lamps and one connection for charging or plugging any required air structure gadget, as well as demonstrating how to manage devices such as a fan, TV switch, Door lock, Main Switch, and so on. This is clearly not a constant weight; rather, it tends to fluctuate in different locations and use zones [21].

![MQ2 Sensor](image)

Fig. 5. MQ2 Sensor.

Arduino is a prototype platform built on open-source hardware and software that is simple to use. Arduino boards may read inputs such as light on a sensor, a finger on a button, or a Twitter post and connect them to an output such as an active motor, an LED, or publishing anything online.

III. HARDWARE AND SOFTWARE ANALYSIS

The system employed and the language in which the program code is spread out are inferred in this section, as well as the program code dumping contraptions. In addition, the section covers the progress of the application's program. The framework programming structure is written in the Embedded C, C++ language, which has the capacity to acquire data from various parts and transfer it, as well as operate all of the machines that are connected. It is used in a variety of sectors because of its minimal force usage, necessary use, and unchanging quality. Assessment of programming is an important part of our strategy. A reasonable course of action is determined by a thing assessment. A true programming evaluation, as well as its incorporation into the Arduino Uno project, ensures a seamless conclusion.

![Flow chart](image)

Fig. 7. Flow chart of this work.

Every contraction as a worker normally has one execution method set up with the goal that every gadget has an expert association open and tuned in for affiliations. For the time being, either contraction can initiate a connection with the other and transform into a consumer. On the other hand, one device can unambiguously have the alliance and establish a worker association on demand, while the other device initiates the connection [22].

If the two gadgets aren't connected, the Android framework will normally display a blending demand notice or exchange to the client during the connection procedure, as shown in Figure. As a result, when our program tries to interface gadgets in a similar fashion, it doesn't have to worry about whether the gadgets are integrated.
Following that, we must also associate the Bluetooth with voice application, and we must also provide voice praise as well as regulate the endeavor, such as model light (ON/OFF), and TV (ON/OFF) [23].

The illustration below shows how to connect a hand-off module to an Arduino UNO. There are 5 pins on the relay module. One pin is for a pass-through to the Arduino board, while the other four pins are for four direct hand-off modules. We are exchanging the associated three contraptions on three marketplaces in this endeavor. The three-pin is all we utilize. The pins are the result of our efforts. The three pins D2, D3, and D4 on the Arduino Board are also used in the code.

The hand-off module is linked to the stores. We are using three loads in our project, as shown by the luxuriously model. Each hand-off has three pins. The NC (Normally Closed), NO (Normally Opened), and Common pins are the three types of pins. The full negative side of line voltage (220 V AC) is applied to the key pins, and the quantity of the heaps' neutrals is applied to the absolutely certain side of line voltage. A wire connects to the NO pin and stacks the negative side.

The Bluetooth module's beneficiary and transmitter pins are connected to the ATmega328p's TX and Rx pins separately. The regulator comes with an exhaust fan for the assurance hardware.

Below are the output results. The home door will be opened by submitting the appropriate fingerprint to the fingerprint sensor. If the motion sensor detects movement around the house, the relay and exterior lamp will turn on, and Berger will sound the alarm. If a fire breaks out in the house, the smoke detector will detect it, the LEDs will turn on, and Berger will sound the alarm [24].

IV. CONCLUSION

Using Arduino, we created a system that includes a smoke detector, motion sensor, and fingerprint sensor, among other sensors. This control reimagined many characteristics of the home, transforming it into the ideal home that most organizations want to construct, one that is safer and energy efficient in order to be the home of the future. House automation can help to keep your home secure. The door is equipped with a fingerprint lock that may be used to keep outsiders out. Your family will be at ease thanks to home automation. House automation allows you to operate your home from anywhere. The framework is both robust and simple to use. The cost of installing home automation is still rather expensive. In the case of a failure, repair may be both time-consuming and costly.

REFERENCES


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