

Bluetooth-Enabled Gate Control: A Modern Approach to Home Security

E. Kalpana¹, E. Kavitha²

¹Department of ECE, Vidya Jyothi Institute of Technology, Hyderabad, Telangana, India-500075

²Department of ECE, Vidya Jyothi Institute of Technology, Hyderabad, Telangana, India-500075

Abstract— In light of increasing concerns about home security, smart gate systems have gained widespread attention. This paper introduces a novel approach to enhancing home security through the implementation of a smart gate system utilizing Bluetooth technology. The system leverages a Bluetooth-enabled device to remotely control gate operations, with an Arduino microcontroller serving as the central processing unit. The Arduino is interfaced with an L293D driver IC, facilitating motor control for gate movement in both forward (open) and backward (close) directions. Control of all system functions is facilitated through a Bluetooth-enabled Android application, enabling users to transmit commands to the gate motor. This innovative solution offers a robust means of improving residential security, addressing contemporary security concerns with efficiency and convenience.

Keywords—ARDUINO microcontroller, Bluetooth, L293D driver IC, Smart gate.

I. INTRODUCTION

In today's era, mobile phones have evolved to offer a multitude of features beyond basic calling functionalities. Recent research indicates a significant surge in smartphone usage, with India boasting an estimated 442 million smartphone users in 2022. Globally, the smartphone user base is projected to approach 2.7 billion by 2019. One of the key capabilities of smartphones is their support for short-range wireless connectivity options like Bluetooth, enabling seamless data transmission and reception via such wireless connections. This pervasive adoption of smartphones and their inherent connectivity features lays the groundwork for exploring innovative applications and solutions leveraging these technologies.

The Bluetooth android application is one of the smartphone apps that has been created recently. The goal of this project is to address the issue of home security even when the homeowner is not present. Anyone can attempt to break into a property when the owner is away, but there are a lot of tools available to aid, such as alarms and CCTV, but this project handles the issue more effectively. All of this is managed via Bluetooth.

Nowadays, Bluetooth technology can be employed for security reasons in addition to data transfer and reception. Operating at a frequency of 2.4GHz is Bluetooth technology. It has a range of 10 to 100 meters for connecting to devices. 3Mbps is the maximum speed at which data can be sent between connected devices, while actual speeds can vary depending on the device.

Numerous smart gate projects exist, including those that use RFID and fingerprint authentication to lock or unlock doors, among many others. Numerous drawbacks of the fingerprint-based smart gate system included the necessity for multiple steps to enter and remove fingerprints, an overly complicated program, and insufficient convenience. This can only be used within a specific range to operate the door lock via the control button; it is not compatible with the Internet.

Additionally, if your fingers are sweaty or wet, you cannot open the door, and it gets more difficult to open if you forget your password while your hands are wet. Moreover, things like metal and liquid can interfere with the signal from radio frequency identification (RFID), and it is not always as accurate or dependable as barcode scanners. Barcode scanners can be ten times less expensive than RFID readers.

II. LITERATURE SURVEY

One of the necessities of modern living is having access to the internet. These days, it is impossible to see someone without a smartphone. Not utilizing IoT in the system's architecture was one of the biggest obstacles we had to overcome.[5] We were adamant that the only transmission method should be Bluetooth. "Bluetooth based home automation system (2002)" shows how Bluetooth innovation is used in a systems administration environment and for home computerization. It suggests an organization with a few customer modules (home computers) and a remote, flexible host regulator. [6] Bluetooth devices facilitate communication between the host controller and the client modules. link that connects the sender and recipient. Additionally, we were adamant that the fingerprint app ought to be that basic. The Bluetooth module is a master and a slave. The 2016 book Android Based Home Automation System Using Bluetooth & Voice Command describes a home automation system that uses a smartphone to give any unsuspecting user control over any item.[7,8] By decoding the user's voice command and extracting its precise meaning, it may also support voice command for inexperienced users with command sensing. The article "IOT Based Home Automation Using Bluetooth with Security Enhancement (2019)" by Anand Kishore Azad describes how to set up an efficient home automation system using IOT and a device. [9–11] The idea of a home automation system can raise the standard of living in conventional homes. The fundamental design makes use of a Bluetooth device that can be used to remotely access smartphones [12–15].

Numerous sophisticated automated door locking systems have been developed and are widely employed in various locations, including apartments and factories. A few of these automated door lock systems use Bluetooth as their foundation.

A recent survey found that there are numerous ways to use automation to operate a door. Every design has special qualities and talents of its own. The Arduino UNO serves as a micro controller in this project.



Fig. 1: Bluetooth HC-05 Module

Design and installation of a sophisticated, low-cost, real-time door security monitoring and control system based on the Arduino UNO microcontroller. Using the Arduino, HC-05, and smartphone apps, the door can be controlled from anywhere in the house. RFID and fingerprint sensors are also used by various automatic door systems. Each of these systems is not without flaws.

A low-cost, small-form-factor radio technology that allows Internet connectivity and wireless communication between mobile phones and PCs is known by the global Bluetooth specification. The Institute of Electrical and Electronics Engineers (IEEE) is the organization that publishes IEEE 802.15 standards. Both speech and data transfers can be handled by it.

III. METHODOLOGY

Anywhere in the home may control the door with the Arduino, HC-05, and mobile apps. There are other automatic door systems that make use of RFID and fingerprint sensors. Every one of these systems has its own shortcomings. Homes can also be automated with these systems.

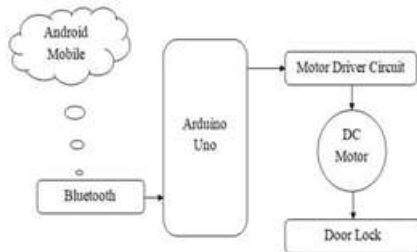


Fig. 2. Block Diagram of smart gate

The block diagram in Figure describes the overall system.

Working of Bluetooth: A Bluetooth module is a short range device of around 10 meters. Bluetooth provides both sound and data transmission. The Bluetooth device uses an IEEE 802 standards. It can provide both point-to-point or point-to-multipoint connection. In addition to the permitted baud speeds of 9600 and 19200, the default baud rate is 38400.

Bluetooth Specifications: The Bluetooth specification is a global standard for low-cost, small-form-factor radio technologies that provide wireless communication between mobile devices and computers or the Internet. The Institute of Electrical and Electronics Engineers (IEEE) publishes the IEEE 802.15 standard. Both speech and data transfers are supported. Three clients can be connected to simultaneously by a Bluetooth device, which can deliver data asynchronously. It can travel up to 100 meters if the transmit power is boosted to 100 milliwatts. Bluetooth operates at a data rate of 1 Mbps. Bluetooth is a standard for small devices (9mm x 9mm). Following delivery, data is sent via Bluetooth to a receiver using a different frequency. In addition to focusing on low power consumption, it offers mobile device security.

This system uses Arduino software (v0.11) to receive input from an Android smartphone. It is fully automated, and its output is a solenoid coupled to the Arduino micro-controller circuit. The device works by first having the user enter data using a digital keypad on their Android smartphone. If they have any commands, the data is sent instantly over a Bluetooth network and is then received by the Hc-05 Bluetooth module, which is connected to an Arduino micro-controller. The Arduino micro-controller circuit acts as a data processor, managing the solenoid that was previously linked to a relay, which provides on/off functionality.

TABLE 1. Components required

System block	Function
Motor driving circuit	Converts arduino signals into electric signals
Arduino uno	Microcontroller
DC motor	Motor
Android mobile	Mobile
Bluetooth module	Bluetooth

Arduino Uno: Developed by Arduino.cc, the Arduino Uno is an open-source microcontroller that is based on the Microchip ATmega328P microcontroller. The board features sets of digital and analog input/output (I/O) pins that can be interfaced to various expansion boards (shields) and other circuits. The board may be programmed using the Arduino IDE (Integrated Development Environment) and a type B USB cable. It includes six analog and fourteen digital I/O pins, six of which can be used for PWM output Measures. Power sources for it include an external 9-volt battery and the USB cable, while it can also handle voltages between 7 and 20 volts.

Bluetooth HC-05 Module: Designed for a transparent wireless serial connection setup, the HC-05 module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module. The HC-05 Bluetooth Module is an excellent wireless communication solution because it can be used in either a Master or Slave configuration. With a full 2.4GHz radio transceiver and baseband, this serial port Bluetooth module is fully qualified for Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps modulation. It makes use of the CSR Blue-core 04 External Single Chip Bluetooth System, which has AFH and CMOS technology.

L293D Motor Driving Circuit: a motor driving circuit is an integrated circuit which is usually used to control motors in autonomous robots. Robot microprocessors and their motors are interfaced with by motor driver integrated circuits (ICs). The L293 series of motor driver integrated circuits—L293D, L293NE, etc.—is the most widely utilized range. Two DC motors can be controlled concurrently using these integrated circuits. The L293D is made up of two H-bridge. The most basic circuit for managing a motor with a low current rating is the H-bridge.

DC motor: Any rotary electric motor that transforms electrical energy from direct current into mechanical energy is referred to as a DC motor. The most often used kinds depend on the forces generated by magnetic fields. Almost all varieties of DC motors contain an internal mechanism—electromechanical or electronic—that allows the motor's portion of the current to be periodically reversed.

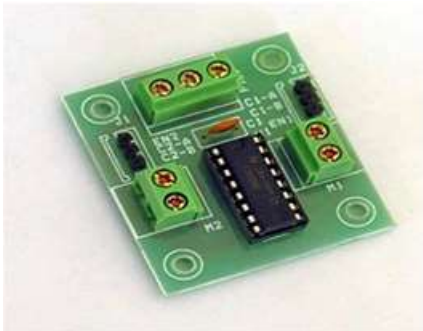


Fig. 3. L293D Motor Driving Circuit

IV. RESULTS AND CONCLUSION

A micro controller and Bluetooth are used by the smart gate to operate. The smart gate needs to be first paired with your Android smartphone via Bluetooth. We are unable to use our Android mobile phone to transmit commands to open or close the gate if the connection is lost. We can operate the gate using your Android smartphone if the connection is made and the Android device is in the smart gate's range.



Fig. 4. Smart Gate using Bluetooth

V. CONCLUSION

As a prototype for an interior and outdoor key lock system, we are using a solenoid door lock system in this project. For users of Android phones and tablets, it also offers security and ease of use. This project is built on the free and open source Arduino and Android platforms. Therefore, the

implementation rate is low and reasonable for the average person. The microcontroller's ability to establish a wireless Bluetooth connection makes system installation easier. The system, which uses an Android phone with Bluetooth capability and bluetooth modules via HC-05, has been successfully created and prototyped to control the door condition.

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