Mobile Control Door Lock using Arduino Uno

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Abstract: -

Nowadays the home security system is very poor. This paper is consisted of a smart door lock system in this we developed on a great solution to improve the home safety system. Arduino IDE software in this we used Bluetooth devices to operate the door lock-in the home. The microcontroller is connected to l293d driver IC that driver IC is used to operate the DC Gearmotor in forward (Open) and backward (Close) and the motor is controlling the door lock. In this method, all data are controlling by Bluetooth android application in that app we are sending the data through Bluetooth to control the home door lock one is open and another one close form the application. Nobody can hack the system it was a closed-loop and most secure system.

Keyword: -Arduino Uno, SMS, Bluetooth, Servo Motor, Firebase DB, Android App

Introduction:-

The present door lock system in a developing economy like India mostly comprises of a normal mechanical bolt or similar door locks which was traditionally used. The most important factor for these sections of the community for choosing this kind of door locks is due to the high cost of modern door locks available in the markets today. The other contributing factors would be the misunderstandings regarding these locks and the usage of this locks. Also, there are people still thinking these door locks are not up to the mark of a traditional door lock. But the truth is different, these door lock will simply outperform any traditional door lock system in their technology and features also can do even more with the budding innovations. The door locks should be better designed for the needs of the customer [1]. So that to make a door lock which can be secure, simple and cost-efficient, we have to combine the factors of a modern and traditional lock system. Bluetooth based door lock system is designed to deliver energy efficiency and the lower cost for the components tends to make it highly useful to develop a door lock within a secure environment. According to Ismail [2], the Bluetooth door lock would be helpful for physically challenged people to easily operate the door. This makes the door lock more accessible to a saturated population. The increasing popularity of the smartphones, particularly the Android operating system makes us an opportunity to deliver this to a mass public. Combing this door lock system with the highly popular device like android mobile phones extends its flexibility to reach these audiences. Magalona et al. [3] propose a door lock which can be accessed with a login system thus allowing only users with correct username and password. There are several other papers which share this topic. They are as the follows: Bhute et al. [4] define a door locking module which can access through NFC and Bluetooth. The NFC will tether the Bluetooth module and the mobile phone fast enough allowing the user to operate the door lock. Raji wade et al [5] propose a similar Bluetooth door lock mechanism that uses a server to connect with the user and looks for the correct UUID (Universally unique identifier) of each users Bluetooth communication with the Arduino. Rathod et al. [6] come up the concept of a smart door which uses an LDR sensor to measure the intensity of a particular place, while

ultrasonic sensor works to measure distance by sending a small pulse to Arduino. The Bluetooth module HC-05 is used to control the door through the application.

A door lock with an android application with a GUI interface is proposed by Potts et al. [7]. It can operate the door and can send back the status to the user. In [8], the door is locked and unlocked with the servo motor and the status of the door is displayed

on an LCD screen. The main purpose of this Bluetooth controlled door lock is to overcome the challenges faced by the people and make use of a more convenient mode of door locking system. The door lock system is implemented by an Arduino Uno board. The Arduino Uno is a microcontroller with 14 digital input/output pins.

This is connected to a Bluetooth module using a globally unlicensed (but not unregulated) industrial, scientific and medical (ISM) 2.4 GHz short-range radio frequency band. The Bluetooth module enables connection between the Arduino and the Android device where the user could operate the door lock. When a user operates the door, the data is passed through the Bluetooth module and passes to the servo motor to open or close the door. This will enable the GSM module to send an SMS alert to the administrator of the system.

Methodology: -

Consider Methodology

There are a wide variety of project management frameworks which have been evolved over a year with their own strength and weaknesses. The system development methodologies are not suitable for all projects. Thus, the methodology should be chosen based on the specific project after acquiring the required knowledge by research. The followings are the considered methodology for this project: 3.1.1 Waterfall Methodology The waterfall methodology is regarded as the traditional and oldest methodology used in project management.

Waterfall Methodology

The waterfall methodology is the sequential movement of the project through finite phases, in which the previous phases need to be verified to move on the next phase. Thus, to overcome this problem Agile methodology was developed. (Agarwal, 2020)

Spiral Methodology

This methodology is a sophisticated approach for project management which is generally used for early identification and limitation of project risks. It is usually started on a small scale and then move to another phase after identifying risk and planning for risks. (Pal, 2020)

Agile Methodology

Agile is a type of methodology which describe a set of values and principle for software development. Nowadays it can also be used for a hardware development project. Mainly, agile is used for the project management process which includes many iterations process. This plays an effective role when the project requires a lot of creativity as the task has can be simplified into small tasks. It must be designed and established to meet the dynamic set of prospects. The main goal of Agile methodology in project management is to optimize the development process by establishing communication through collaborative efforts between teams and customers and by increasing flexibility in production. (Gonçalves, 2017)

Selected Methodology

The main goal of this project is to design a smart door lock and Bluetooth based android application. Therefore, after researching and by discussing the need for a potential user Agile methodology is followed in this project. The description of the phase of agile approach for this project is presented

Phases of the methodology

Brainstorm

This phase deals with the research done about the smart door locking system by reading journals, articles, and by watching video tutorials. In this phase, the hardware components got delivered and required research was done regarding hardware components.

Design

After having all the required hardware components, circuit diagram and schematic diagrams were constructed by using Fritzing software. Many types of research were done to build the circuit diagram. Thus, by researching and after acquiring knowledge of all the components features, the circuit diagrams were successfully constructed. The design of this project is discussed

Development and Coding

After completing the designing process, the development and coding process was commenced. In this section, all the hardware components were wired together and interfaced with the Arduino board. That includes Relay module, led lights, RFID sensor, Bluetooth module, solenoid lock, which are connected using jumper wires and 12V AC adapter was used to power up the components. This phase also includes the development of Smartphone Application.

Literature Review: -

1) Various smart locks are previously available. The majority of them are expensive. In this paper "Arduino based electronic lock using RFID and password" which was proposed by "Ni Ni San Hlaing, San SanLwin". This digital door lock runs on the technology of audio-frequency identification and passcode-based with the help of an Arduino Uno MCU.

2) In another paper named "Secured password-based lock system" was put forward by "Arpita Mishra, Siddharth Sharma, Sachin Dubey, S.K.Dubey". This methodology is targeted to prevent unlocking of the door by unknown individuals. The formation of the home safety Service consists of the numeric keypad, the hook which is used for lifting, and a GSM module to establish dependable connection for communication conferred with the MCU. The control panel conferred with the device is employed because the passcode access combination opens/closes the door.

3) In another paper named "Smart Lock System Using RFID" was proposed by "ShrinidhiGindi, NaiyerShaikh, KashifBeig, AbdealiSabuwala". Here may be a Room security solution supported IoT using RFID, the system is often monitored from anywhere within the world thanks to the continual updating of the status of the door.

4) Moving forward to another paper named "An OTP-based wireless smart door locking system" was proposed by "Mr. L. David William Raj, M.Deepika, V. Bhubaneshwar, R. Harshitha, K. Haripriya". In this innovation, the key phrase for security is initially put away within the Electrically Erasable Programmable ROM . At the purpose when the client enters the proper secret phrase then the two-way confirmation of a haphazardly produced OTP is shipped off the client gadget. On the off chance that the OTP is coordinated, the framework is going to be opened, and therefore the required capacity is often started.

5) Coming to the next paper named "SMART DOOR UNLOCK SYSTEM USING FINGERPRINT" was proposed by K.Rajesh, Asst.Prof. B.VenkataRao, P.AV.S.K.Chaitanya, A.Ruchitha Reddy. In our paper, we apply the fingermark detector to scan one's character to instinctually function the gate of the car, under such situation we prefer to use a MCU for enabling for both opening and closing of the door if both the match for scanned and existing facts are true. 15 | P a g e

6) In the upcoming document termed"DOORWAY ROBOTIZATION network supported by CORDLESS for android Smartphone" was proposed by "Lia Kamelia, Alfin Noorhassan S.R, Mada Sanjaya, and W.S., Edi Mulyana". In this a tool called a automated door lock with the support of Bluetooth and Android smartphone door locks automation system using Bluetooth-based Android Smartphone's is recommended and prototyped. The equipment structure forthe door lock setup is that a combination with an android.

Implementation project of the:-

There are several step in hardware design, i.e.

- The Design of Arduino Uno Circuit

- The Design of Bluetooth Circuit

- The Design of Solenoid Lock

- The Design of Power Supply Circuit

- The Design of Relay Driver Circuit

Arduino microcontroller serves as the brain of the whole series. The microcontroller can be linked with other circuits to perform certain functions. The Arduino using works by entering the program that has been created and ready for instantly use. Bluetooth module used in this circuit is the type of HC-05, which requires a 3.3 V DC power drawn from the Arduino microcontroller circuit (pin 3.3 V), Pin (TX 1) is a pathway transmit / send data on the Bluetooth module HC-05 with microcontroller and Pin (Rx 0) as the receive path / receiver data on the HC-05 Bluetooth module with microcontroller while the path GND (Ground) is a path connecting the data between HC-05 Bluetooth module with microcontroller circuit.
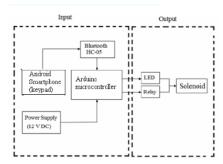
Figure-1. Block diagram of door automation system using android.

Table-1. The function of each System Block.

No	System Block	Function
1	Arduino Microcontroller	As data processing center
2	Android Smartphone (Andruino v0.11)	As data input
3	Bluetooth Module Hc-05	As data receiver
4	Battery and Adaptor (12V)	As the power supply
5	Driver Relay	As switch
6	LED	As indicator
7	Solenoid	As system output

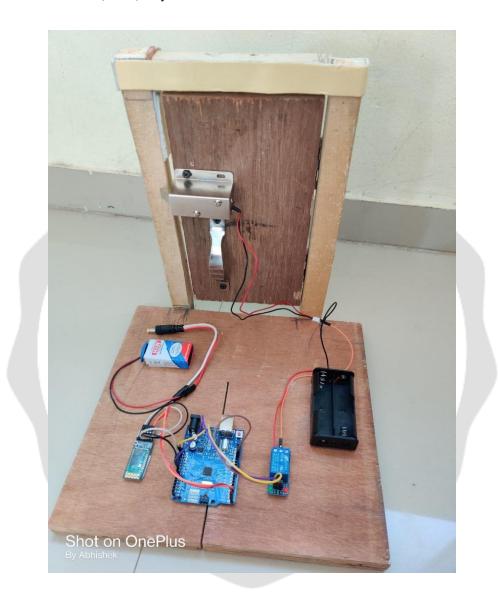The system required a program that must be Implemented to Microcontroller

Programming language for the Arduino microcontroller is C language. To run the the program and incorporate the program to the microcontroller needed software i.e. Arduino. The mechanism of device is to input a digital keypad on the software on android Smartphone first, if there is a command that is controlled by the user, the data will be instantly sent via a Bluetooth network then the input received by the Hc-05 Bluetooth module that connected to Arduino microcontroller. Arduino microcontroller circuit serves as a data processor that controls the solenoid that previously connected to a relay that functions as an on / off switch Microcontroller is the central data in processing system. Microcontroller Arduino has been equipped with an internal EEPROM, Flash memory, etc. This section will examine the input password, and give orders to the LED and relay, to fill out his program with the principle of ISP (In System Programming) so that the program can be done without removing control. Power supply circuit is used to supply power throughout the series; the power needed for the whole series is equal to 12 Volts DC. There are several components in the power supply circuit, such as transformers that serve for lowering the voltage. Capacitors are used as filters. And the last is the type LM7812 regulator IC that functions as a regulator of the power output by 12 Volt Relay a function lay has a function as an electronics switch .Relay will be active when given input from the microcontroller, and serves as a switch for the solenoid system. In this research, we use the electro mechanical solenoid 12 V with supply voltage to 12V from Adaptor.

Solenoid connected to the Relay, Relay connected to the 5V pin of the Arduino Uno for supplying coil voltage and ground Relay to ground Arduino Uno pin.

Experimental Validation:-

Main features of the prototype

- 12-volt operation • Cost Effective solution

- Wireless Connectivity through LED App

- Bluetooth Module (HC05) very Accurate

Component Required

SR.NO	Component	Quantity
1	Arduino UNO	1

2	HC05	1
3	Relay	1
4	9V Battery	1
5	Solenoid Lock	1
6	Jumper Wires	
7	LED	1
8	Connector	1
9	12V Supply	1
10	12V Supply Holder	1
11	Keypad	1
12	12v Adapter	1
13	Arduino Cable	1
14	Breadboard	1

Result –

The prototype was made according to the circuit diagram and the results were as expected.

Future Scope :-

This project can also be modified with RFID and artificial intelligence to recognize the person to open the door lock hands free. Smart door lock has huge potential in the future market. It is getting popular every day. Over the coming decade, predictions range on how exactly common mechanical devices will change. WiFi connectivity and Bluetooth are among the foremost technologies we may see. The next iteration of Ultra-Wideband (UWB) is another technology to look for. "UWB will enable hands-free access to entry and exit points," says Broiskin "It can decipher whether a credential holder is simply walking by a door or is actually walking toward the door to enter." AI is another surprising prediction for the coming years. While AI today resides mostly in the space of video and analytics, there are exciting possibilities for the future of AI with door security and locks, including knowing how many times a door was accessed at what part of the day and how a user typically behaves. This type of technology can go a long way into securing your home or business in a smart, hassle-free way.

Conclusion :-

The proposed system allows remote access to lock or unlock the door without physical user interaction. The system fulfils the requirements of supporting autonomous locking device and easy fingerprint sensing compared

to physical keys. The system has minimum requirements for hardware and supports customization of keys. The prototype-built shows that the design consumes minimal power and the locking/unlocking of the door happens in 2 seconds on an average. Thus, the system proposed is feasible.

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