



# IoT Based Intelligent Modeling of Smart Home Parking Environment

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## ABSTRACT

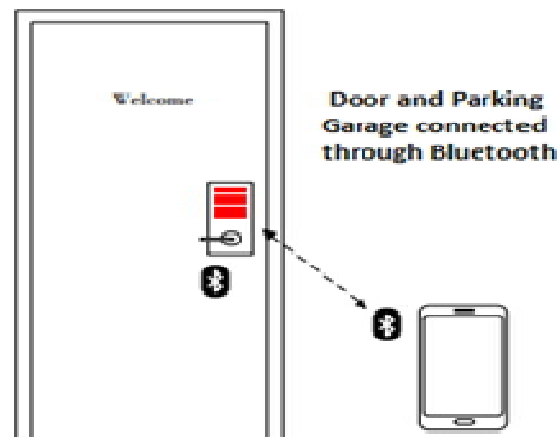
Technologies are part of human lives for utilizing day to day chores and monitoring surroundings to maintain a daily routine. From time to time humans are surrounded by numerous digital prototypes and always feel to operate parking door and parking garage shutter to control remotely with a single control system when he is away from his own native place. This paper presents a generic system for the proposed door and parking garage shutter lock/unlock automation system using Bluetooth based Android Smartphone describing the underlying design and implementation process. This paper also presents concrete guidelines for future researchers, academia and industry as well as for government to follow in developing a low-cost hardware design and software development of door garage lock/unlock practically sustainable product to bring significant personal, professional and economic benefits to national growth. We still face many challenges and hurdles in acceptance of these services. This paper also forecasts the key future challenges associated with the development and acceptance of the domain.

**Key words:** Door and Garage Automation, Internet of Things (IoT), Control System, Bluetooth, Smart Things

## 1. INTRODUCTION

Today, we are surrounded by smartphones, which have advanced capabilities and better performance in comparison to regular phones. According to ABI Research investigation, in the year 2013, "1.4 billion smart phones have been in use, 798 million of them run Android, 294 million run Apple's IOS, and 45 million run Windows Phone" [1]. Most of the phones are embedded with one or more technologies such as Wi Fi, Bluetooth, infrared, making it possible to communicate or to transfer data or valuable information via these wireless connections. For every facet of business processes and day to day activities of human being inspired for data access, computer mobility and intelligence which can

be provided with the help of smart phones [2]. Smart home technique is one of the smart phone applications that have been developed [3]. Smart home technology can be elaborated as a technology which is linked with various types of home appliances, apparatus over a local network. According to the Smart Homes Association, the smart home technique states that it is the technology that will combine several technologies and services with the help of home networking for better living style. As far this technology can be utilized to supervise, aware and implement, according to the persisting desired conditions and constraints. A technology can interact with devices of homes over the internet through telephone or regular fixed phone. Smart phones brought a huge change in human lives by making everything easier and more comfortable. On the other side home networking provide peace of mind. Wherever people roam across the world, or whether you are on work or on vacation, the smart home with this type of embedded smart technology aware us about the ongoing situation, and beside security system helps to warn against any intrusion or in any tragedy situations. For example, it is not enough to inform the owner with a warning of fire alarm, it also opens the doors and inform the fire department and also illuminate the path for safety purpose [4]. Door and parking garage connected through a smart phone via Bluetooth Module is illustrated in figure 1.



**Figure 1:** Door and Garage Connected through Bluetooth

Moreover, Bluetooth technique in smart phones is not only for transferring files, valuable data and information, from the last several years, Smart parking environment is the application of various interlinked technology with Bluetooth technique. Bluetooth technology operates over unlicensed, "it's available at a 2.4GHz frequency, it also can link digital devices within a range of 10m to 100m at the speed of up to 3Mbps but it depending on the Bluetooth device class" [5]. With these specifications of Bluetooth; we proposed a door lock/unlock and parking garage automation system based on Bluetooth technology.

## 2. RELATED WORK

While implementing and designing a system we have to consider certain factors such as it should be low priced and should be scalable so that other devices can be integrated simply into the persisting system, so as to make system user-friendly. Various types of smart systems have been considered which are controlled via certain integrated technology such as Bluetooth, internet, short message service (SMS), RFID, Wi-Fi based etc.

Smart home design applications proposed by Shinu Kumar, which allows the user to manage his home through the use of internet [6]. Requirement for smart home application is PC that will transfer the information to the internet; here PC behaves like a server that will increase the consumption of power as well as cost. According to the publisher, PC requires cost and it can be optimized with the help of microcontroller. Another publisher is Deepali that recommends for smart home is to use "Android platform version 2.3.4 Gingerbread and 3.1 Honeycomb that uses java programming language for smart home security system" that will help the senior citizens and disabled persons [7]. According to the research, wired connection is used for the connection between the Android platform and the home devices. It is more efficient to support a both wireless and wired technology that includes Bluetooth, WI-Fi, www, ZigBee etc.

Bluetooth implementation that uses ARM9 processor for home security system was introduced by Naresh[8]. Hao Shi, in his research on home lightening settings, "implemented an open source Android Development Tools (ADT), the Android SDK (Software Development Kit) and Java Development Kit (JDK) [9]. Manasee Patil had examined the home automation system using RFID, Wireless Sensor Network (ZigBee) technology and GSM. ZigBee is a low power wireless technology used for monitoring and controlling various devices [10]. R.Piyare has introduced design and implementation of a low cost, flexible and wireless solution for home automation", especially pr on/off the lamp and to on/off the television automatically [13]. However, these are not light sensors which are used for controlling the home appliances smartly without human interruption.

## 3.SYSTEM ANALYSIS

All literature work those are explained above motivated and inspired our research to make such a device that provides a safe, easy and more efficient solution for controlling door and vehicle garage automation system which can be controlled remotely.

### 3.1 Problem Definition

People face many problems in society regarding their parking areas when they are away from their homes. People especially old aged persons have a tendency to forget to lock the door, having doubts in minds which results in creating mental disturbances. Sometimes people find difficult to lock/unlock the door especially physically challenged people and old people. Sometimes by mistake, people leave the door open, which makes intruder create chaos inside secure and personal area results in a threat to property and lives. While parking car inside garage people tends to move out from vehicle to open garage shutter, which feels them cumbersome to move out and again move inside the vehicle to park in the garage.

### 3.2 Proposed System Features

In today's world, nobody has the time to run here and there in home so our proposed device saves time as it can able to control our houses window, doors, and parking garage by sitting at one place and operate them according to our own choice. As wherever be the person is, whether on the job, in the market or on vacation, he can easily find the status of his home doors and parking garage. The person in real time frame can lock/unlock the door from a remote location. With this device there is no need to move out from vehicle to open garage, rather it can be done with the help of smart phone while sitting inside the vehicle. Technology with this supervised embedded Bluetooth through smart phones android applications makes easy and more comfortable.

This system operates our home door, windows and a parking garage with the help of smart phones, as we can communicate with our system in many ways by sending commands by an android application. Some of the proposed systems features are that it is reliable which provides an easy graphical interface for operating lock/unlock feature, useful for physically challenged and old persons, easy to implement with low-cost price and results in saving time.

## 4.DESIGN AND IMPLEMENTATION

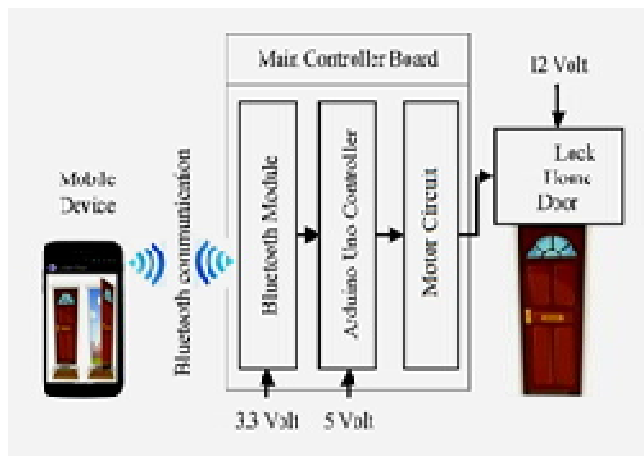
Rather than using traditional keys to lock and unlock the door of garage we will use IoT enabled smart system. The system provides better security than conventional key by using a command which is received digitally via enabled Bluetooth through smart phone android application and it responded accordingly [20]. Through Bluetooth enabled smart phone it is possible to control the system that is designed to simulate an electronic key. Arduino circuit is a connection between

Android smart phone and solenoid which is controlled by sending a command via Bluetooth for opening and closing of doors and garage.

A solenoid door lock is an electronic device often use for automated windows, doors and garage lock system. The solenoid will operate only in case it has a voltage inside it. Solenoid door will work on an average of 12 voltages. In the normal case, the lever will be normally in the locked state, if there is any voltage across the solenoid, it will automatically unlock the doors and garage. Usually, the solenoids combine with electric key lock system with an RFID reader and card access with a password. In our proposed system we combine solenoid door and garage lock with Bluetooth based smart phone.

**4.1 Hardware Architecture**

The brain of the whole series is Arduino microcontroller [13]. To perform certain functions microcontroller can be linked with other circuits. The Arduino microcontroller that uses IC AT Mega 328P –PU and works by entering the program that has been created and ready for instant 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 2:** Block diagram of a door automation system

The block diagram in figure 2 illustrates the overall proposed system. Smartphone with enabled Bluetooth feature is connected through Bluetooth module HC-05 of Arduino. This system has input from Bluetooth based smart phone using android application connected through HC-05 of Arduino, reads command through microcontroller and respond automatically through the motor circuit, which results into

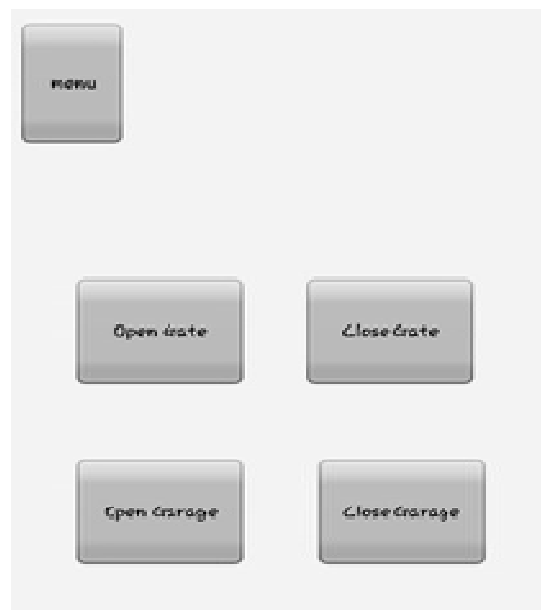
locking/unlocking of the door and parking garage. Table 1 shows the function of each block.

**Table 1:** The functions of system hardware.

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

**4.2 Software Development**

An interface needed to control the activities related to locking unlocking of the house door and parking garage. Bluetooth enabled smart phone sends a signal through an android application which is connected to the HC-05 Bluetooth module of Arduino microcontroller [21]. User interface of Bluetooth based door and garage automation system is shown in figure-3.



**Figure 3:** User interface for Door Automation System

Android application has certain command buttons to control the functionality of the door and garage to lock-unlock. Receiving commands are interpreted by the HC-05 module, which then verifies and transfer them to Arduino microcontroller to act accordingly. Flowchart showing the functionality flow of system shown in figure-4

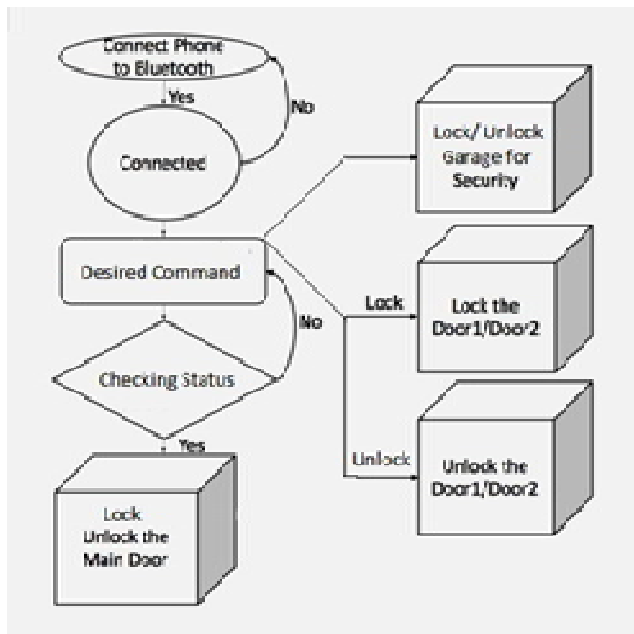


Figure 4: Flowchart for Door/Garage Automation System

## 5. EXPERIMENTAL RESULTS

Testing process is done after implementation phase. “The results of the test series show the minimum system of the Arduino microcontroller circuit system has a minimum value of 9600 Bits per second, with 8 data bits and 1 Stop Bits. The whole series in this study operate the power of 12 volts. A function of this IC is to make the input voltage 220 volts of electricity into the main 12 volts DC, so it is safe and does not damage the circuit”.

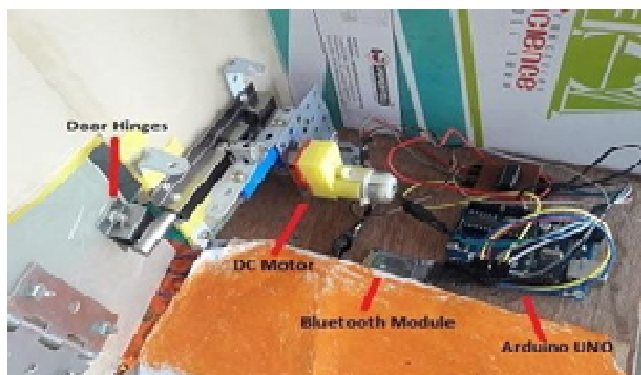


Figure 5: Experimental setup of Door lock/unlock system which is controlled through a smartphone via Bluetooth connection

Figure 5 shows the experimental setup of how to lock and unlock the system. By ensuring that the circuit has been installed correctly testing is performed. Figure-6 shows the experimental setup of door lock-unlock system through Bluetooth.

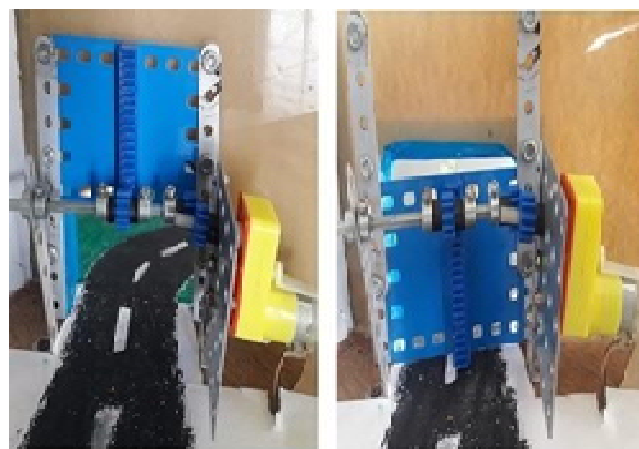


Figure 6: Parking garage door lock/unlock implementation

## 6. CONCLUSION

Our paper gives basic idea related to control the locking and unlocking of doors and vehicle parking garage gate, especially to avoid traditional door lock keys. For the indoor and outdoor key lock system we use a solenoid type DC motor control prototype system. Security features are also provided by this prototype system that is used for android phone/tab users. Implementation cost of a prototype is affordable and reasonable for a person due to open source software. Simple prototype is discussed in this paper in future it can also be extended to other branches also.

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