

Planning And Construction of a High-Tech Garage Door

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ABSTRACT

In this post, we will discuss the planning and execution of a sophisticated garage door system. An Arduino microcontroller is at the heart of the system, with assistance from a smartphone app and Blynk's cloud server. Furthermore, the Blynk cloud server, which is linked to the web through Wi-Fi or a 3G/4G network, allows the smart garage to be controlled and accessible from anywhere, thanks to this mobile application. To accomplish this, you can get the Blynk app from the App Store or Google Play for nothing. The smart garage door may be operated using voice commands via the Google Assistant. Finally, this smart garage door application has been put throughout its paces, and the stats indicate that it can perform the necessary tasks of a smart garage door, exactly as was envisaged at the stage of initial design and development.

Keywords:

INTRODUCTION

The Iot is the most recent instance of ground-breaking disruptive technology and has quickly become a major new computer paradigm. The IoT's ability to interoperate with other applications and systems has stimulated and encouraged a previously unimaginable variety of uses throughout all of human endeavour, particularly in the home. These uses span the scientific, engineering, commercial, medical, recreational, and domestic spheres. The installation of home automation has become increasingly popular during the past several years. The concept of a "smart home" is predicated on the premise that most, if not all, of a household's appliances may be automated by means of networked computing. Users can get things done before they get home, with minimal disruption from neighbours.

As part of the development of the "smart home," a network-based interface for domestic appliances has been built). Because of this interface, mobile apps can be used for monitoring and control. Further, research has advocated for the creation of a smart home system that improves both comfort and energy savings. Around the same time as the first "digital technologies" were being constructed, the idea of the Web of Things (IoT) developed and rapidly gained popularity. The term "Internet of Things" (IoT) is used to describe the interconnected digital infrastructure between everyday items in the house. The Internet of Things has helped make smart homes more secure and more convenient for their residents. The automatic garage door is a popular IoT application in smart projects at home

. The development of this system helps to enhance the comfort and ease of daily life for people in private residences. By leveraging networking protocols and Web of Things (IoT) sensors, smart garage doors allow users to operate the door from afar. In addition, the smart garage door makes its use much more convenient by allowing its owners to enter and leave the garage at will through the use of a mobile app accessible on their smartphones. As a result, fewer people will need to work to close and open the garage door. The advent of the smart garage door also aids in the reduction of trespassing because the open and closing of the doors may be controlled by the house owners via the smartphone is through a mobile application. The installation of IoT sensors has also made it possible for homeowners to operate the garage door from anywhere in the globe, using their smartphone. The various benefits of a smart garage door system have been highlighted by previous studies. Yet the research has also highlighted the high expense of constructing such a device and the wasteful energy consumption by such a system. Because of this, the number of homes with smart garage doors is still quite small.

LITERATURE SURVEY

An easy way to boost home security is by installing Internet of Things (IoT)-enabled smart garage doors. Increases in safety, security, and ease of use when opening and closing garage gates can be attributed to the widespread adoption of internet-of-things technologies in recent years. The addition of IoT capabilities to the door frame has also produced some welcome side effects. *Kim et al.* point out a few advantages, including the ability to open and close the door from afar, an increase in security as only authorised residents can access the premises, and an automatic shutoff feature if the driver's door is left open for an extended period of time. According to the research of *Shawki et al.*, there are two main drawbacks to implementing IoT technology in a garage door. Despite the previously mentioned benefits, certain drawbacks or issues exist. Here are the problems: 1) Networking problems, and 2) Privacy and Security concerns. Because of the networking problems, it is possible for unauthorised individuals to break into the system and gain entry to the building. Garage door errors are not communicated to users or homeowners, which raises privacy concerns. (The door, for instance, did not shut all the way.) With these issues in mind, it's clear that smart garage doors need more work in the design and development stages before they can become a reality.

It has been established via prior investigation that the development of the automated garage door system is motivated by a desire to help homeowners realise their dreams of a more pleasant, safer, more secure, and more productive home environment. In addition, it's part of the smart home's integrated infrastructure and may be controlled remotely (via mobile application). However, there are a number of worries regarding the intelligent garage door system's use, development expense, and practical installation. One of the issues that has been brought up repeatedly in the studies conducted by Mtshali et al. is the cost of development and design associated with installing a smart garage door. According to *Rafique et al.*, the constantly changing state of Iot technology has spawned a number of difficulties in the areas of user home equipment integrations, high installation costs, and the personalization of IoT device connection across various types of users.

Therefore, the purpose of this study is to develop a low-cost prototype method for designing and fabricating a smart garage door. Furthermore, this research project's objective is to create a smart

screen door that can be accessible by Android smartphones by means of an easy mobile application system. The purpose of this study is to create a mobile app for Android that can control garage doors remotely via Wi-Fi, 3G, or 4G. The submission form will serve as a data source. The garage door can be operated remotely if a network signal can be received there. This mobile app has support for the Google Assistant, so you can ask it to open or close the garage door for you.

PROPOSED METHODOLOGY

The first order of business for this investigation is to specify its key objectives. The research project is subsequently broken down into its constituent pieces according to predetermined criteria . The software and hardware specifications for finishing this project are shown in Figures 2 and 3, respectively. Following that, the research project's overarching framework must be built. The IoT architecture of the system is made up of different functional levels, such as the sensor layer, the network layer, and the application layer. The interplay between these layers is what allows Internet of Things apps to function (refer figure 3). Then, the system's mobile application's user interface is built. The smart garage project's designers and developers have given great thought to each interface in order to meet every need. Some screenshots of the UI may be seen in Figures 4 and 5. The next step is to create a working prototype.

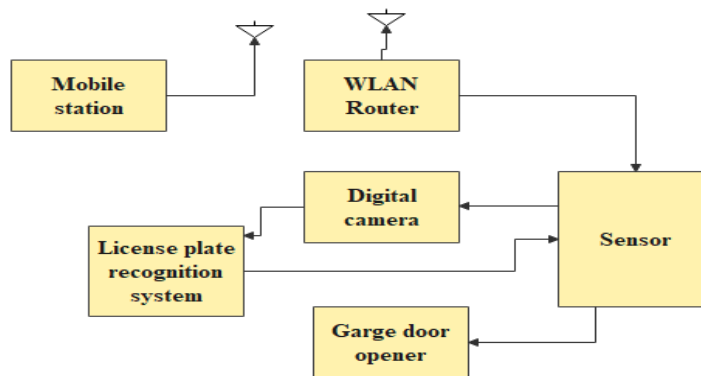


Fig 1: Proposed Smart garage system

Software needed	Hardware needed
Arduino	RFID Sensor
Android 11	Garage door
Windows 11	Things board
Blynk	LED light
MS Word	Laptop/pc

Table1: Hardware and software requirement

At this point, the whole of the research undertaking is taken into account, along with all of the connections between its many parts. Hardware, software, networks, and integrating all of these elements together are all part of this. At this stage, the chosen software and hardware will be integrated and given the necessary coding. The interface that was planned before the prototype was developed will also be linked to the scripts. This state-of-the-art garage door runs on the Arduino platform and is Blynk-compatible. Especially with regards to horizontal scalability, it is crucial that the construction of an Iot device system adheres to the most crucial requirements. In addition, the following features should be incorporated into the construction of an Iot device if at all practicable :First, the solution must be flexible enough to accommodate changes in the user's wants and circumstances.

Second, we'll be able to look back and make predictions based on the access records we've kept, which will help us be more efficient with our resources and strike a better balance between workers' convenience and productivity.Reducing power consumption by better utilising power consumption resourcesThis study makes use of the three-tiered structure of the of Things architecture, that comprises of the "perception" layer, "network" layer, and "application" layer. The above criteria were used to choose which layers to use. Then, the cloud server (here, Blynk) and the mobile application are connected to the various layers through their respective source codes that are housed in the Arduino IDE.

In the design concept (which can be discovered in the next sentence), the intelligent garage door system's physical layout is displayed. This prototype consists of two distinct halves: the hardware framework and the Web of Things (sensors). The prototype's design will show how the micro controller, Iot, and mobile app all work together in practise. This prototype was made to demonstrate the concept behind this study and to highlight the work that went into its development.

RESULTS AND DISCUSSION

After extensive testing, it was concluded that this smart garage door was not only functional, but also efficient. We put the smart door door through its paces, checking out its graphical interface, requirements of the users, and user satisfaction. Every aspect of the study's findings was fruitful. All of the test results will be broken down in the next section.

USER PURPOSE

The purpose of this evaluation is to obtain feedback from participants (testers) on how satisfied they are with the user interface of the smart garage phone app. You can see the results of the experiment in Figure 2. According to the presented data, the smart parking mobile app's design was well received by the majority of users.

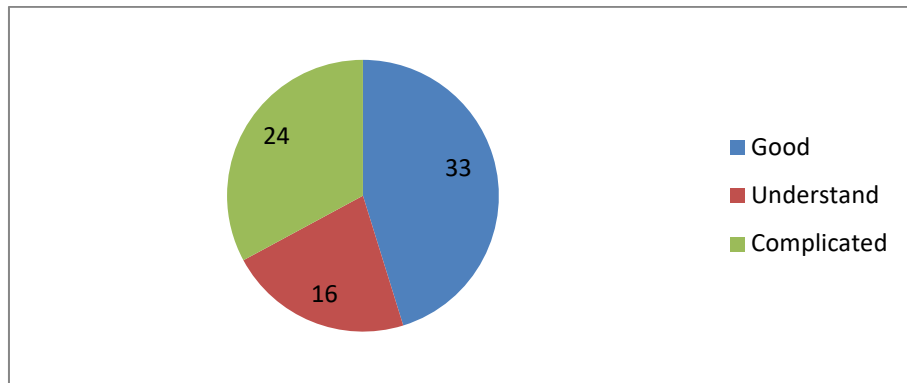


Fig 2: User interace test

USER EXPECTATION

The purpose of this evaluation is to find out if the users of the smart garage phone app can make sense of the data that the app provides. The user's expectations paint a more precise picture, which highlights the system's development and design. Figure 9 displays the results, showing that 83% of respondents understand the information provided by the smart parking smartphone app.

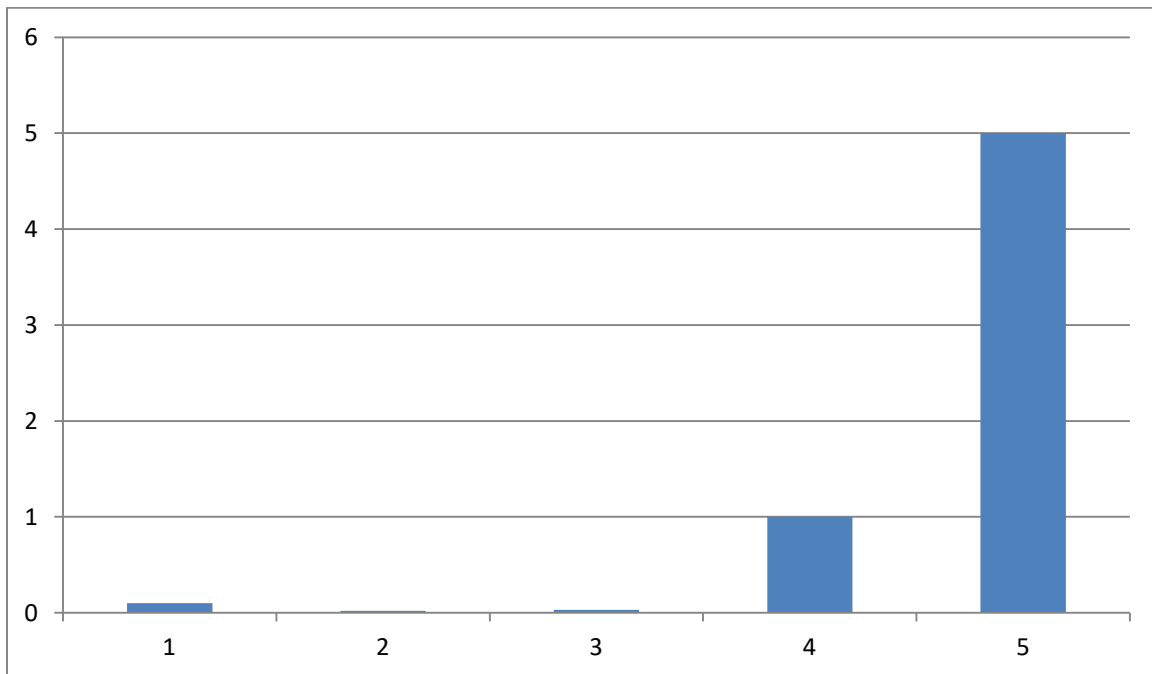


Fig3 : User satisfaction test

USER SATISFICATION

In general, how satisfied customers are with the smart parking mobile app can be gleaned from the results of the satisfaction survey. It would appear from the data that clients are very pleased (score 5) only with outcome of the research effort. The results suggest that this smart garage smartphone app may also help consumers address the problems identified in the prior study.

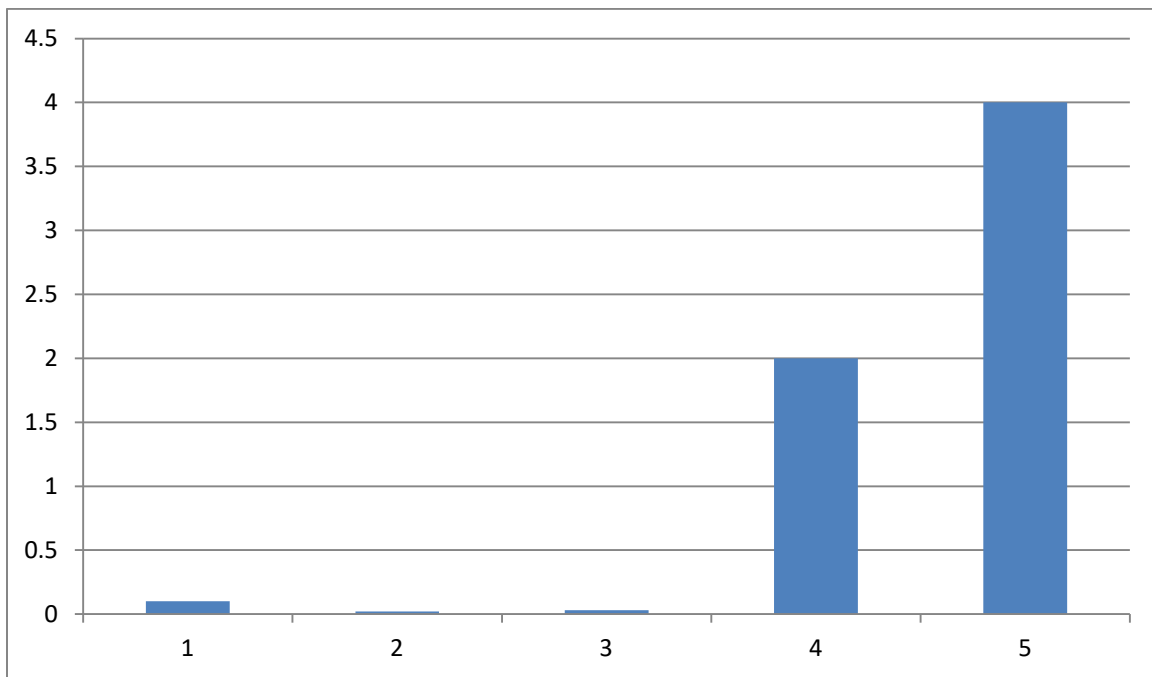


Fig 3:overall satisfaction test

CONCLUSION

In conclusion, the main goal of this study is to design and develop a smart garage door that can be controlled by a mobile application. In the end, we will have reached our objective. Additionally, an Arduino microcontroller was utilised to manage the system via a wireless link established via the Internet of Things. As a result of this research project, garage door access will be enhanced through the use of a mobile application, making it easier and quicker.

The findings of this study benefit homeowners since they show them that there is a quick and easy way to create their own automated garage door. This study benefits homeowners by giving them access to a less complicated option that yet offers safety, fuel efficiency (low operating costs), and ease of use. Through its incorporation of the Google Home feature into the smart garage door smartphone app system, this study adds to the current body of research as well. This functionality is especially important for busy homeowners who can't always be reached through their cell phones. The requirements for the security level must be considered while developing the smart door system for future work. Integration of biometric authentication methods like facial recognition, fingerprint scanning, and speech recognition into the Internet of Things is a must (IoT). Making greater use of mobile apps inside this system is also crucial, as mobile applications represent the system's final apparent frontier before it is completed.

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