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RESEARCH ARTICLE

DESIGNING AND IMPLEMENTATION OF AUTOMATIC DOOR OPENING SYSTEM BASED ON MICROCONTROLLER

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ABSTRACT

Nowadays, a smart phone has variety of uses and becomes one of the most important devices. This paper is described the design and implementation of a door opening system using smart phone through Wireless Fidelity (WiFi) technology. There are different types for transmitting data wirelessly: Bluetooth WiFi…etc. It is used the Bluetooth technology to establish communication between user's smart phone and controller board. The prototype supports manual controlling and microcontroller controlling to open and close home door. By connecting the circuit with servo motor and connecting to the Arduino controller board, it can be controlled by a Bluetooth available to provide remote access from smart phone.

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INTRODUCTION

Nowadays, more and more people use smart phone. It becomes part of the most important devices in people's daily life, likewise their applications become essential for day-to-day use. This research presented a smart phone door opening system by using Bluetooth where the door will open without key or it's called wireless door. The successfully signal from smart phone application will be received by a door Bluetooth as trigger source (Gesmb, 2004). The proposed feature and method of the smart phone door opening system will be tested and analyzed, so that the function to open the door through smart phone will meet and the connection between Bluetooth will make the notify when the door was open. This project constructed will have a power source just to power up the servo motor, Bluetooth, Arduino and other electronic components will power up solely based on wireless connection. This smart phone door opening system via Bluetooth are also design to give an advantage for disable people to open the door without get help the other and make vault door is more secure than causal door open system. The architecture of the proposed design and implementation of Arduino microcontroller based home door opening system by using Bluetooth technology is depicted in Fig (1.). The application on phone is going to check the database for any updated message and send that message via the Bluetooth connection to the control device. The hardware part consists of a Bluetooth module, which takes the control massage from phone via Bluetooth connection and transfers this data using serial communication to the Arduino microcontroller .The microcontroller outputs the control signal to power the servo motor .This system allows the user to open and close a door in a short range.

Implementation

This project presents the design and implementation of Arduino microcontroller based home door opening system by using Bluetooth .The main objective is to develop an application software in an android environment to control the movement with the use of the Internet and Bluetooth communication. By using the Bluetooth technology integrated in Android smart phones has been constructed for home security purposes. The system allows the user to open and close the doors remotely, using the Android device. Also, user can check the current status of the door if it is opened or closed. The system was designed to maximize the security by requiring a password to access the application. A hardware device consists of an Arduino microcontroller, a Bluetooth modem and a servo motor was built to be placed on the door. The communication between the smart phone and the device is through the Bluetooth connection, which can be used to create a pico net. Pico net is a network of multiple Bluetooth devices connected to each other. This network can have a maximum of eight devices. One acts as the master device and others are the salve devices. Also, by sing this network a device can communicate with another device that is 100 meters away. The

microcontroller will control the servo motor pin to open or close the door. The project is built so that the person can get some of the activities done remotely. By the end of working on this project, these intended to have the following system design features: accessibility, portability, remote access and a simple control circuit which makes the device small and easy to carry by the user. Fig 2 (a) and (b) are physical implementation of Arduino microcontroller based home door opening system by using Bluetooth.

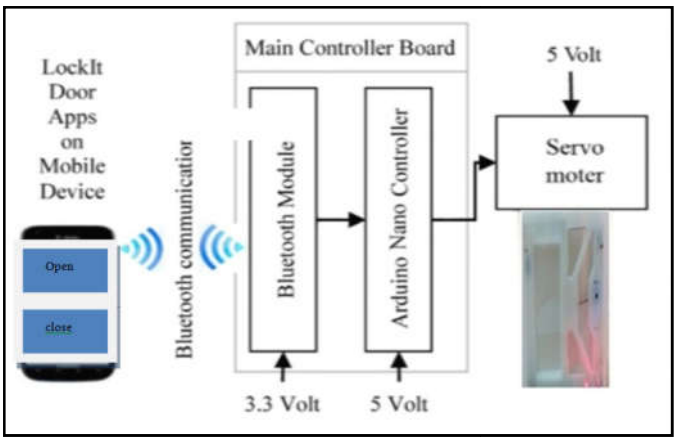

Fig. 1. Design and implementation of Arduino microcontroller based home door opening system by using Bluetooth architecture

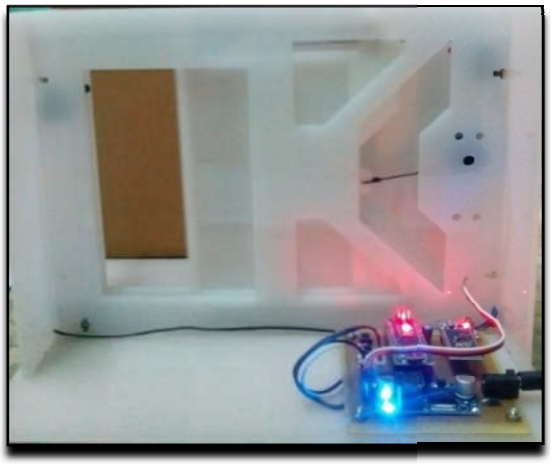

Fig. 2a. Physical Implementation of Arduino microcontroller based home door opening system by using Bluetooth

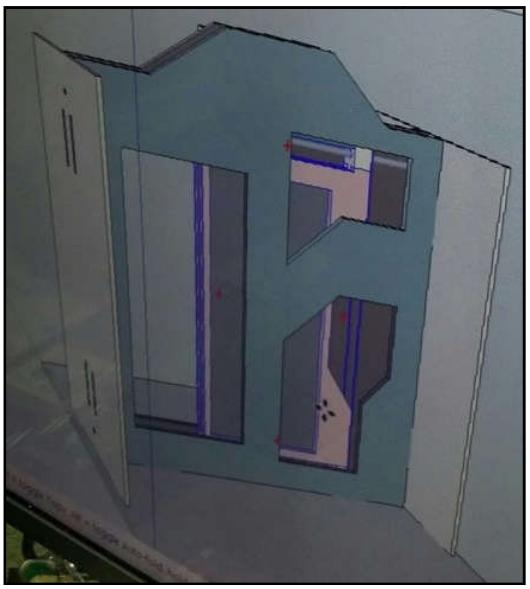

Fig. 2b. Door only system

The photo of home door opening system circuit is Fig (3).

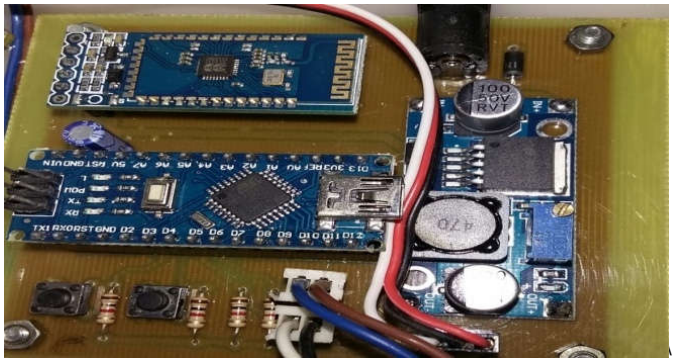

Fig. 3. The photo of home door opening system circuit

The home opening system circuit board ready to test is Fig (4)

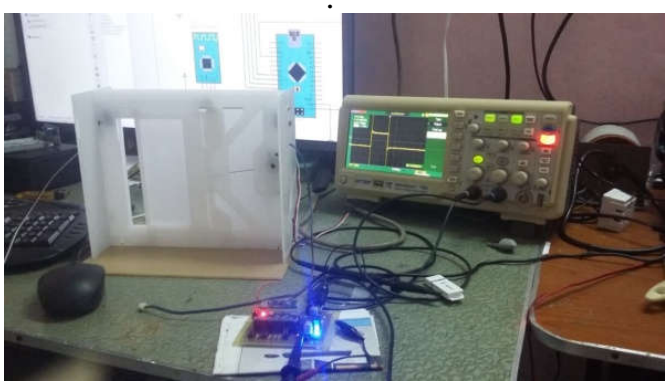

Fig. 4. The home opening system circuit board ready to test.

Servo Motors Control and Arduino

Unlike dc motors, with servo motors you can position the motor shaft at a specific position (angle) using control signal. The motor shaft will hold at this position as long as the control signal not changed. This is very useful for controlling home door, robot arms, unmanned airplanes control surface or any object that you want it to movement certain angle and stay at its new position. Servo motors may be classified according to size or torque that it can withstand into mini, standard and giant servos. Usually mini and standard size servo motors can be powered by Arduino directly with no need to external power supply or driver. Then Arduino Nano controller is used to interpret key selections and determines whether to open or close home door. The Arduino is programmed with C language. It sensed the RF signal at the input port of the controller. Usually servo motors comes with door (metals or plastic) that is connected to the object required to move see Fig (5) below.

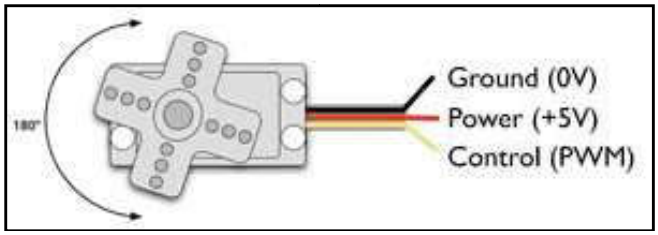

Fig. 5. Servo wires

Servo have 3 wires:

Black wire: GND (ground)
RED wire:+5v
Colored wire: control signal

The third pin accept the control signal which is a pulse-width modulation (PWM) signal. It can be easily produced by all micro- controllers and Arduino board. This accepts the signal from the controller that tells it what angle to turn to. The control signal is fairly simple compared to that of a stepper motor. It is just a pulse of varying lengths. The length of the pulse corresponds to the angle the motor turns to.

The pulse width sent to servo ranges as follows:

Minimum: 1 millisecond ---> Corresponds to 0 rotation angle.
Maximum: 2 millisecond ---> Corresponds to 180 rotation angle.

Any length of pulse in between will rotate the servo shaft to its corresponding angle. For example, 1.5 ms pulse corresponds to rotation angle of 90 degree.

This is will explained in Fig (6).

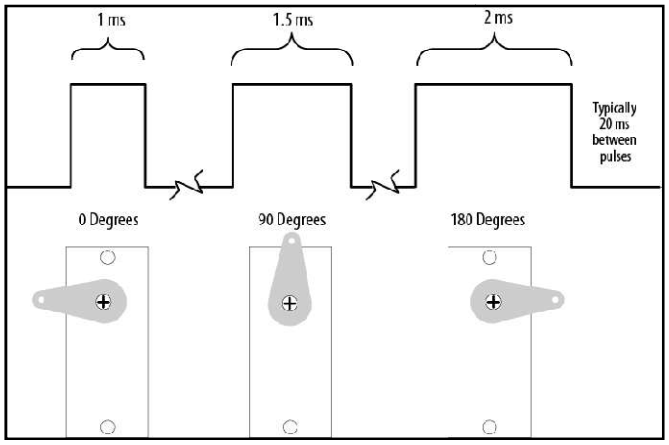

Fig. 6. The pulse width sent to servo ranges

Inside the Servo Motor

The servo motors inside look at the corresponding picture shown in Fig 4.6. A servo motor was taken apart to show the internal parts. A regular dc motor connected to a gear box and a potentiometer that give the feedback for angle position. This is represented by the diagram below in Fig (7).

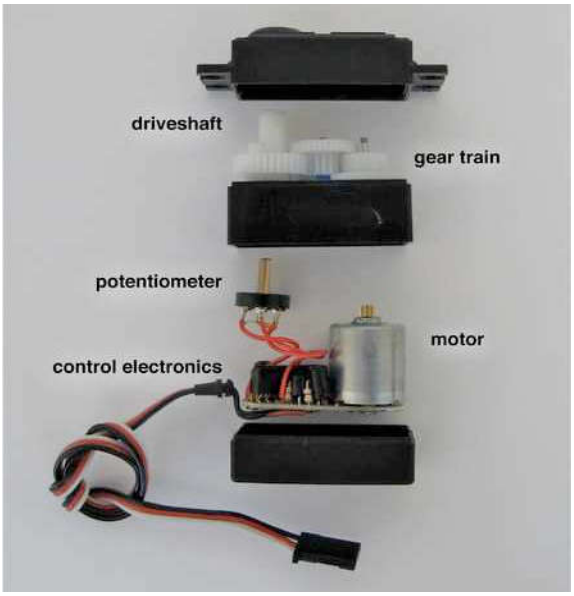

Fig. 7. The servo motors inside

Motor Control Using Arduino

Standard servo motor control using Arduino is extremely easy. This is because the Arduino software comes with a sample servo sketch and servo library that will get you up and running quickly.

1. Connect the black wire from the servo to the Gnd pin on the Arduino
2. Connect the red wire from the servo to the +5V pin on the Arduino
3. Connect the third wire (usually orange or yellow) from the servo to a digital pin - D_9 on the Arduino shown the Fig (9).

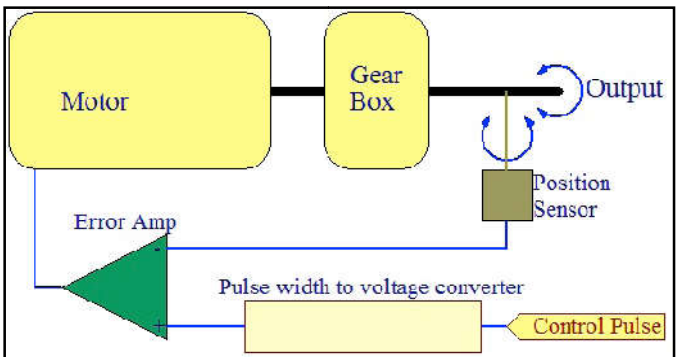

Fig. 8. The Servo Motor diagram

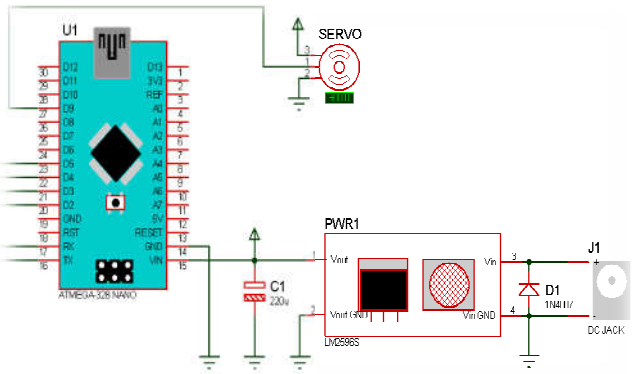

Fig. 9. Servo to a Connection of ATmaga 328

Conclusion

As smart phone technology takes a large part of our daily life and with the rapid growth of the development of its applications, a lot of researchers and software developers found it an interesting field for innovation. Indeed, the world of smart phone applications has attracted the attentions of lots of people even those who do not have experience in programming, attracted them to learn and use the available tools to develop their own applications. In the past few years, a lot of Bluetooth-based applications have been developed using an Android open source platform. Many of those applications were built to control home appliances and smart home environments. The project for different reasons to help those people who cannot move due to some issues/disabilities they have, to help those who are busy having no time to go by themselves or maybe they cannot be in a certain location at a specific time. The goal of this study is to propose a system that can help to open home door wirelessly using Android smart phone. The range aspect was considered through the use of Bluetooth technology that is embedded in mobile. The system

was able to actuate a pin to open or close the door from a short distance away by just pressing a button on a smart phone. The status of the door also has been created to make the system more complete.

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