Construction of Electrical Appliances Control System by Using Handclap

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Abstract

The aim of this paper is to describe that the sound of hand clapping controls the electrical appliances. This system can control to on/off the electrical appliances by the sound of hand clapping. The sound sensor module used to convert the sound of a clap to electrical signal. The obtainable signal is sent to Arduino microcontroller. The microcontroller counts the number of claps to control the electrical components. Microcontroller is used for controlling the whole process. The five light bulbs and one fan represent for demonstration with electrical appliances. The other electrical devices can be used instead of this electrical component. This system is generally used for a light, television, fan or similar electronic devices that the person will want to turn on/off from bed. Difficulty of blind people to find out the switch board or remote to control appliance can be eased by the help of this system.

1. Introduction

People feels to control their home appliances like fan and light etc. in a more convenient way rather than by **the** switch board as they must walk across the room to either on or off such appliances. This motivated the researcher to develop such devices which **allow** the user control the electrical appliances wirelessly without using conventional switch board. One of the ways to control electrical appliances **is** by using IR or RF remove control unit. But it is not convenient in the sense as a user requires a little walk across the room in order to retrieve the remote-control unit and sometimes when remove control is lost, it usually needs extra time and rest to find remove control. For further convenience, hand clap is used as the signal that control electrical appliances instead of certain remote controllers. The researcher has already done several **of** such works. The main drawback of handclap system may be that the clapping is the only main control and unwanted sounds. Several electrical appliances **can be controlled** by hand clapping. A first clap can on a first bulb. The second clap can open the second to fourth bulbs and close first bulb. Third clap can on fifth bulb and off second, third and fourth bulbs. The fourth clap can on **the** fan and off fifth bulbs. The fifth clap can off a fan. A consider sound sensor the signal of **the** user clap **to** microcontroller, microcontroller process the signal to remove bouncing and also count the number of successive claps to control the appropriate appliance. Here, an 8-bit microcontroller **ATmega328P** is used and **the** program is written in Arduino software [1] – [3].

The rest of this paper is arranged as follows. In section 2, there are facts concerning "Electrical Appliances Control System by Clapping" and summary of various researchers on this system conducted around the world. In the circuit construction and circuit operation are described in Section 3. The analytical results and discussion are reported in Section 4. Conclusion of results is given in Section 5. Figure 1 shows the block diagram of the system.

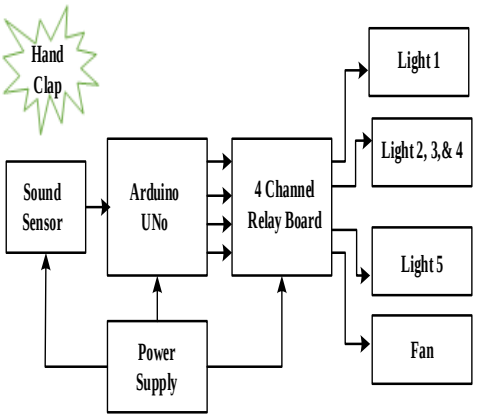

Figure 1. Block diagram of the system

2. Hardware Components

In this section, researcher describe the devices used in this research.

2.1. Arduino UNO Board

For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++. The **ATmega328P** is used **as the** main device of the Arduino UNO microcontroller board. Figure 2 show the pin diagram of **ATmega328P**.

The Arduino UNO board consists of 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, an ICSP header and a reset button. Arduino Software IDE version 1.0 and UNO board are referenced the versions of the Arduino, the newer versions of are evolved now **[4],[5].** The pin description of Arduino UNO board is shown in Figure 3.

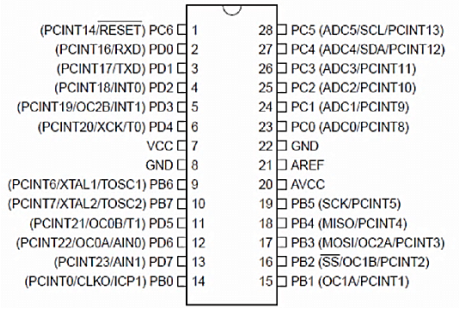

Figure 2. Pin diagram of ATmega328P

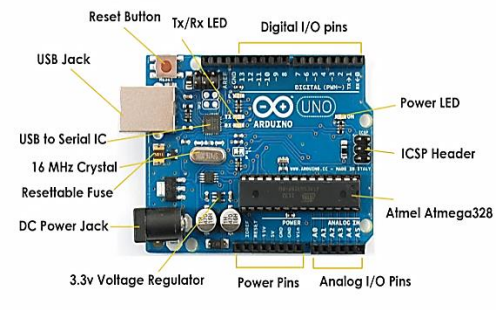

Figure 3. Pin diagram of Arduino UNO board

2.2. Sound Sensor Module

The sound sensor module has four pins that needs to be connected to an Arduino. The top one (A0) is should be connected to the analog input on the Arduino (A0). The one beside that is grounded (GND), which is connected to ground, the Vcc connected to +5V. The last one is D0, which is the digital output of the module and should be connected to digital pin 2 on the Arduino.

The sensitivity of the sound sensor is adjustable, user may adjust it by the potentiometer. On the top of the sound sensor is a little flathead screw (potentiometer) user can turn to and an analog output of the sound sensor. To calibrate the sound sensor user can make some noise and keep turning it until user start seeing the sensor LED on the module starts blinking with the rhythm[6],[7]. It is simply put a Microphone with the sound processing circuit. Using sound sensor, users can measure the intensity of sound from different sources like knocks, claps, loud voices, snaps, thuds, taps, etc. The photograph of sound sensor is shown in Figure 4.

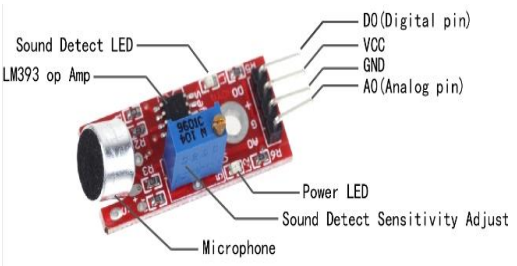

Figure 4. Photograph of sound sensor

2.3. 4 - Channel Relay Module

The 4-channel relay module could be considered like a series switch: 4 normally open (NC), 4 normal close (NO) and 4 common pins (COM). The normally close is connected with common when INT 1 is set low and disconnected when INT 1 is high. The normally open is disconnected with COM 1 when INT 1 is set low and connected when INT 1 is high.

User **needs** to connect the Arduino +5V to the 4-relay module board Vcc pin and the Arduino ground in the 4-channel relay board GND pin. The principle of an electromagnetic attraction is work relay module. When the circuit of the relay senses the fault current. Its energies the electromagnetic field which produces the temporary magnetic field. The current flows through the coil produce the magnetic field around it **[8],[9].** Figure 5 shows the photograph of 4 – channel relay module.

Figure 5. Photograph of 4 – channel relay

3. Circuit Construction and Operation

The methodology of developing the system is described in this section. The development process includes the circuit construction and operation of the system.

3.1. Circuit Construction

The system consists of sound sensor module, Arduino UNO board, 4channel relay board, 5 AC bulbs, AC fan and other electronic components. The Arduino UNO board is used here which has **ATmega328** microcontroller. The output pin of sound sensor is connected with analog I/O pin A0 of Arduino UNO board. The digital output pins 7, 8, 9 and 10 controls 4channel relay. The electrical appliances are connected with relay module. The construction of circuit diagram is shown in Figure 6. Arduino IDE processing is shown in Figure 7. This program is embedded into the Arduino. The Arduino programming flow is shown in Figure 8.

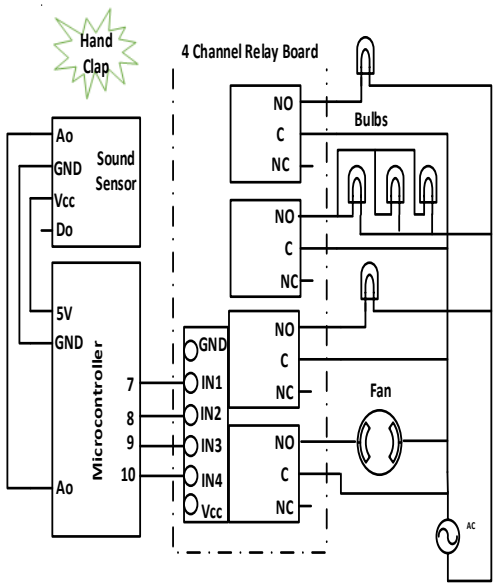

Figure 6. Complete circuit diagram of the system

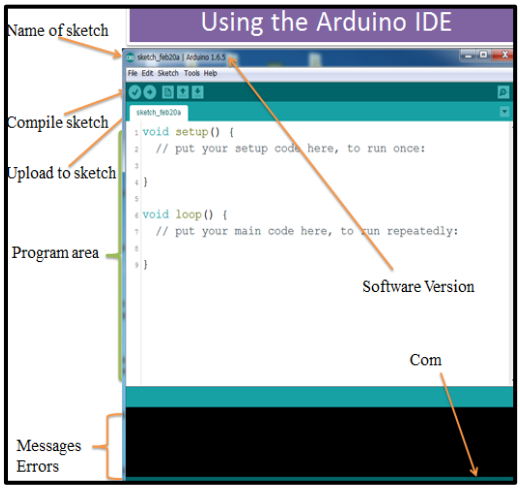

Figure 7. Using the Arduino IDE

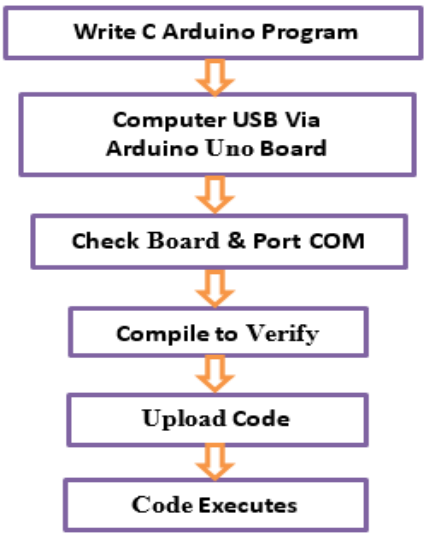

Figure 8. Arduino programming flow charge

3.2. Circuit Operation

The control system can control on /off any electrical circuit by clapping from a remote point. For example, light-bulb, fluorescent light, fan, TV and other appliances can be switched on or off by clapping. The sound sensor converts the sound of **clapping to an** electrical signal, the coil of the relay (IN1) becomes energized and establishes a connection between COM pin and NO pin of the relay. This is the principle to create a close path in the load circuits. A single clap inverts the logic state of pin 7, as a result relay [IN1] connected with this pin invert the status of the 1st bulb if the bulb is off it goes on. A 2nd clap invert the logic state of pin 8 and pin 7, as a result relay [IN2] connected with these pin invert the status of 2nd, 3rd and 4th bulbs if this load off it goes on, at the same time the logic low of pin 7, as a result relay [IN1] disconnected with the pin, the 1st bulb is off. Similarly, 3rd consecutive claps invert the logic state of pin 9 and pin 8 pin respectively. The 4th consecutive claps invert the logic state of pin 10 and pin 9 respectively. The 5th consecutive clap again inverts the logic state of pin 10. Therefore, the 5th consecutive clap closes the fan. And then, the system will return to initial state. The flow chart of the proposed system shows the Figure 9.

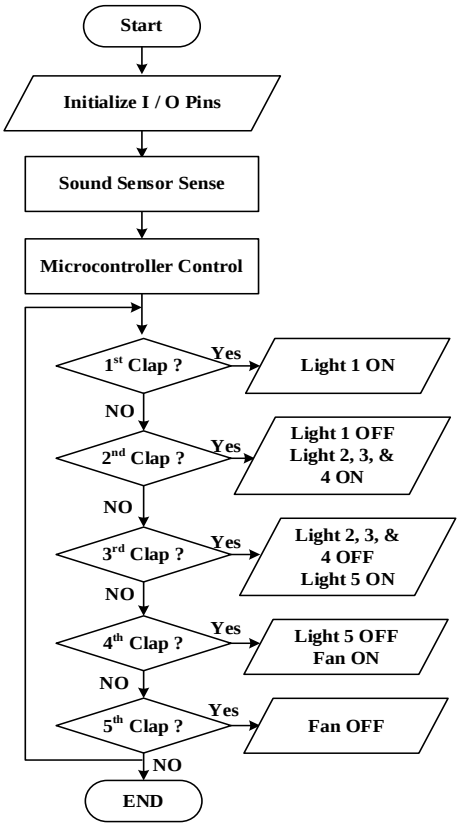

Figure 9. Flow chart of the proposed system

4. Results and Discussion

The sound sensor is used to detect whether there's is sound surround or not. The system can operate for the

claps within 2 m distance. The claps which are strong **then** limit claps can control the system more than 2 m distance. The device can take power from a 5V power supply providing current up to 1 amp or it can be connected directly 220V supply through a 5V adaptor or it can take power from a 9 V battery. This system bulb 1, bulb 2, bulb 3, bulb 4, bulb 5 and fan are connected as a load. The system is implemented as a prototype to check its eminence. The following Figures 10 to 15 show the photograph of the prototype.

Figure 10. Preparing condition when power ON

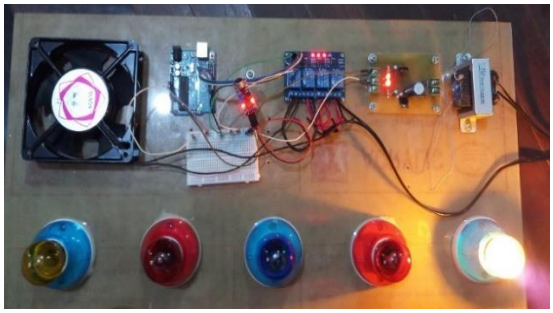

Figure 11. Light bulb 1 ON after single clap

Figure 12. Light bulbs 2, 3, 4 ON and bulb 1 OFF after 2 claps

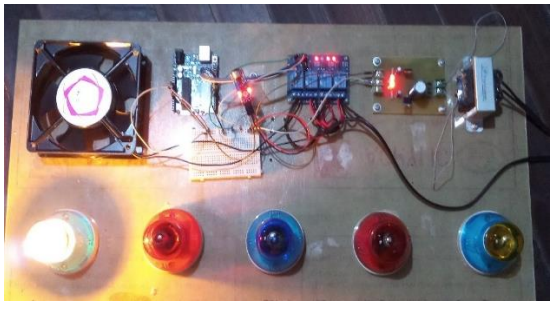

Figure 13. Light bulb 5 ON and bulbs 2, 3, 4 OFF after 3 claps

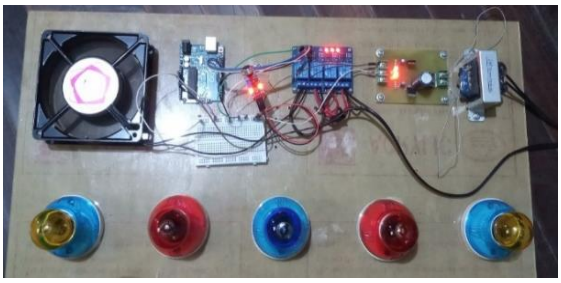

Figure 14. Fan ON and bulb 4 OFF after 4 claps

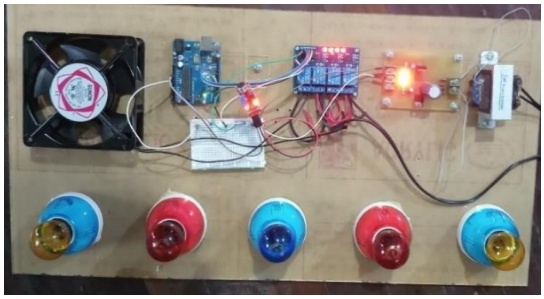

Figure 15. Fan OFF after 5 claps

5. Conclusions

The method to the differentiate clapping from unwanted sound is explained in this system. The method is developed based on analysis of synthetic and recorded handclap sounds, labeled with corresponding hand configuration. This system also works only for handclaps within a limited range because it is a wireless control system. It is useful for certain people such as disabled and blind as it is not easy for them to reach or see the RF or IR remove control.

An early model built to test a process of the system can work for the claps within 2m distance. This system eases the difficulty of the blind people to find out the switch board or remove to control appliance. The resulting device is realizable, has good reliability and it is relatively inexpensive.

References

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