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DESIGNING AND MANUFACTURING A VOICE CONTROL SWITCHING SYSTEM OF ELECTRICAL DEVICES

M.T. HAQUE[1], M.A.K. AZAD[2] AND A.K.M. MAHABUBUZZAMAN[3]

[1]Production and development of the jute based blended fabrics in cotton processing system for textile uses, Bangladesh Jute Research Institute (BJRI); [2]Pilot Plant & Processing Division, BJRI; [3]Mechanical Processing Division, BJRI.

Corresponding author & address: M.T. Haque, E-mail: haque@hotmail.com
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ABSTRACT

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A voice controlled remote switch for various electronic appliances has been modeled, constructed and tested in this project. For voice recognition, SAPI software is used and for recognition engine recognizes the voice of a user and converts it to the signal, which passes through the printer port. A circuit is developed to convert this signal into Infrared (IR) signal. A receiver circuit is developed to receive the Infrared (IR) signal and conduct switching according to the signal. Because of converting the voice signal into Infrared (IR) signal and developing of a Infrared (IR) signal receiver, the electronic devices can operate by voice as well as IR remote from a remote place. So it may be designated as a complete remote control system. Eight voice instructions such as fan-on, fan-off, one, two, three, four, start & stop have been made for operation of the switch. The whole system acts upon this instructions and conducts the corresponding switching action for each instruction.

Key words: *SAPI, Voice recognition, IR signal, LDR, Relly, Printer port, Speech Engine*

INTRODUCTION

There is a growing demand for systems capable of controlling large number of distributed devices from a remote central location. Voice controlled system is preferred by many users in some of the fields. This system controls a remote device or switch by using user's speech. Because of their limitation, high cost and technical difficulty, voice recognition systems have traditionally been used only in a few specialized situations. Such systems are useful in instances when the user is unable to use keyboard to enter the data because of user's hands are occupied or disabled and also where voice command is more preferable to use of keyboard. When controlling of switch of a device is difficult then it can be controlled by remote device. When this remote device is controlled by the voice command then it will be easier to user.

The desirable characteristics of such a system include scalability that is the efficiency of the communication and the process of speech recognition. When somebody speaks, a microphone converts the analog signal of his voice into digital chunks of data, which can be analyzed by computer. From this data the computer must extract enough information to confidently guess the word being spoken. This is not a small task! In fact, in the early 1990s, the best recognizers were yielding a 15% error rate on a relatively small 20,000 dictation tasks, so the controlling process was very poor (Long and Brian, 2002). Then an efficient method was developed for speech recognition, which could recognize the voice or speech more efficiently with an error up to 2%. In this efficient method IR Signal generator is used for sending the signal, so the remote device controls very smoothly with a user's speech.

This software is developed for the purpose of controlling the remote electrical devices in this project through a person's voice command. Through this project knowledge of the recognition of voice by software, necessary electronic device and it's interfacing with the computer signals and controlling of a remote switch is achieved. In this project voice command are used. These command converted into electrical signal to operate relay switch (Voice XML-http://www.w3.org/TR/2003/CR-voicexml20-20030220). The objectives of the project are i) develop a software code for speech recognition ii) design and fabricate an external circuit to receive data from parallel-port and produce IR signal iii) design and fabricate an Infrared (IR) signal receiver circuit and a switching circuit and iv) test the performance of the voice control remote switch.

MATERIALS AND METHODS

Theoretical modeling

A remote switch operated by a voice control system is modeled in this project. The remote switch is activated by a signal produced in computer from the voice recognition system through an external circuit. In voice recognition process visual c++ language is used as programming language. The program is used to convert the analogue command to digital signal or binary code 0 and 1.Which passes through the printer port to external circuit as a voltage signal. The minimum voltage signal gets in the circuit before transistor, when it passes through the transistor. Then the circuit is activated to generate the IR signal from IR signal generator of a remote device for controlling the electrical appliances. Here the printer port D0 to D3 and D5 to D6 are used for sending signal, which is indicated by the software coding at the address port. The flow chart of the model is shown in Fig. 1.

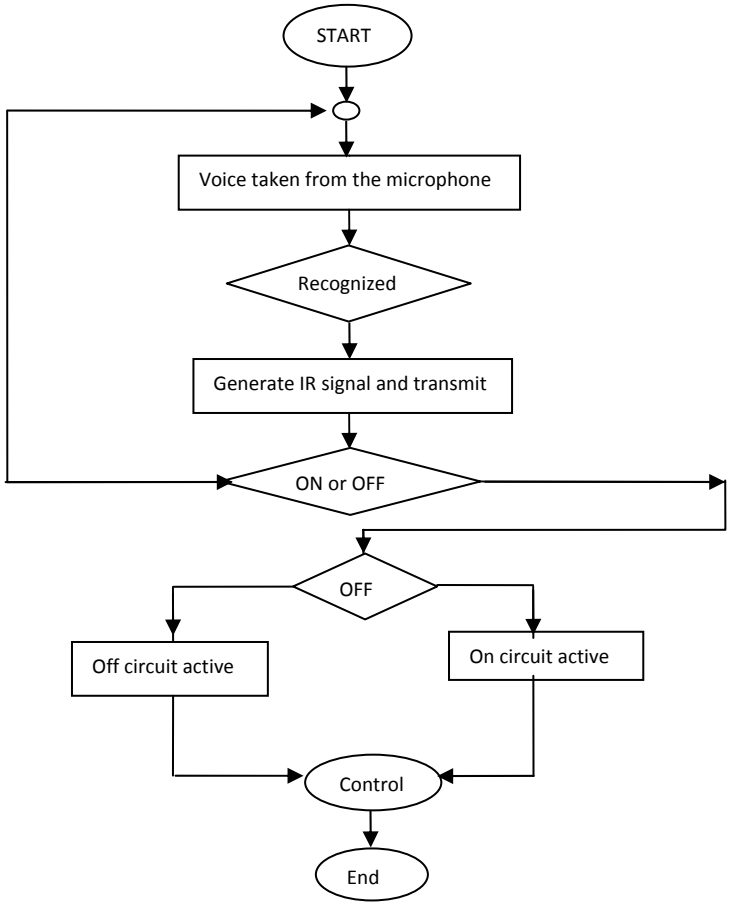

Fig.1: Flow chart of the system

Design and cons traction of various circuits that are used in this project design assumption

1. Input voltage to the external circuit from the computer = 3.27V (DC).
2. A relay input voltage from external source in IR generator circuit for the relay= 12V (DC).
3. Output voltage from the circuit is required for remote control switch = 6V (DC) for activating the relay.
4. Finally 6V is to be supplied as output from external circuit which is responsible for frequency generation in the remote switch.

The Ir signal generator control circuit

In this circuit a LED and a LDR is covered together by holder. The LED of 1.5 V is connected to the printer port with required resistance. When printer port gets a voltage then the LED is on. Then with the light beam uninterrupted, the LDR face is illuminated by the beam and present a low resistance, so little voltage appear at the RV_1-LDR junction and Q_2 and relay are off. Then the inversely connected remote switch across the relay turns on and IR signal generates. But when the LED is off, then LDR resistance increases. So a significant voltage appears on the RV_1-LDR junction and activates the relay via Q_2. Because of this the remote switch turns off and generation of IR is stop (Metha 1987).

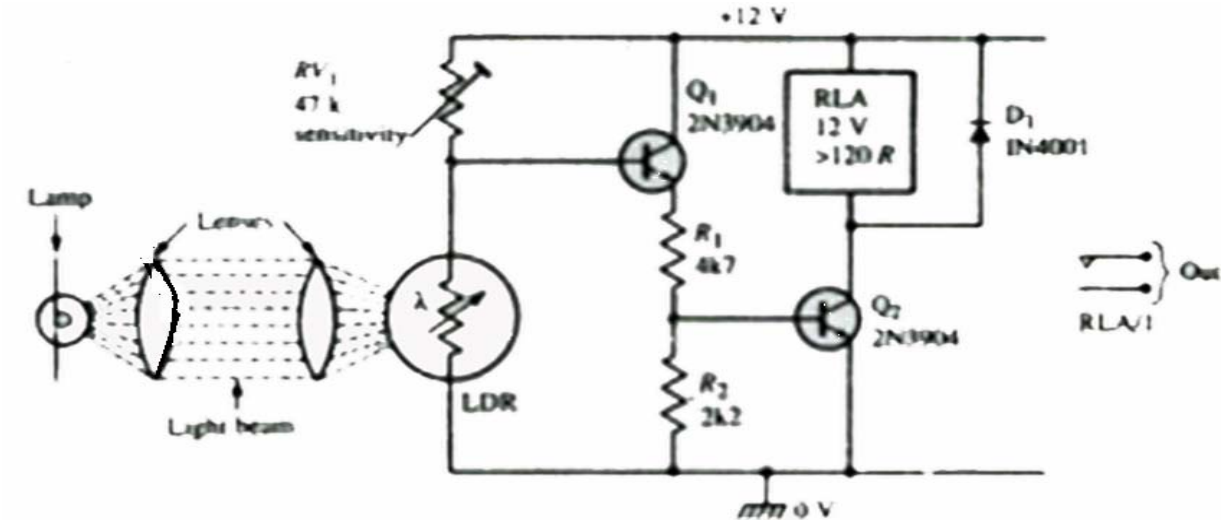

Fig. 2: Infrared (IR) signal generator control circuit

The transmitter or remote circuit

The transmitter circuit is built around a timer IC (555) wired as a stable multi-vibrator. It works off a 3V battery. When remote control switch S1 is pressed, the stable multi-vibrator built around IC1 starts oscillating at a frequency of about 38 KHz. The signal frequency at output pin 3 of IC1 is transmitted through two infrared diodes (IR LED1& IR LED2). A green LED (LED1) glows whenever S1 is pressed, indicating the presence of a signal for transmission at the output of the multi-vibrator.

The output frequency F at pin 3 of IC1depends on the timing components, *viz*, resistors R1 and R2 and capacitor C2. It is given by the following relationship:

$$F = 1.443/(R1+R2)\ C2$$

This frequency is fed to npn transistors T1 and T2 (each BC547) through resistor R4 (470-ohm) to drive the IR LEDs Resistor R5 limits the current flowing through the IR LEDs. (www.st.com/)

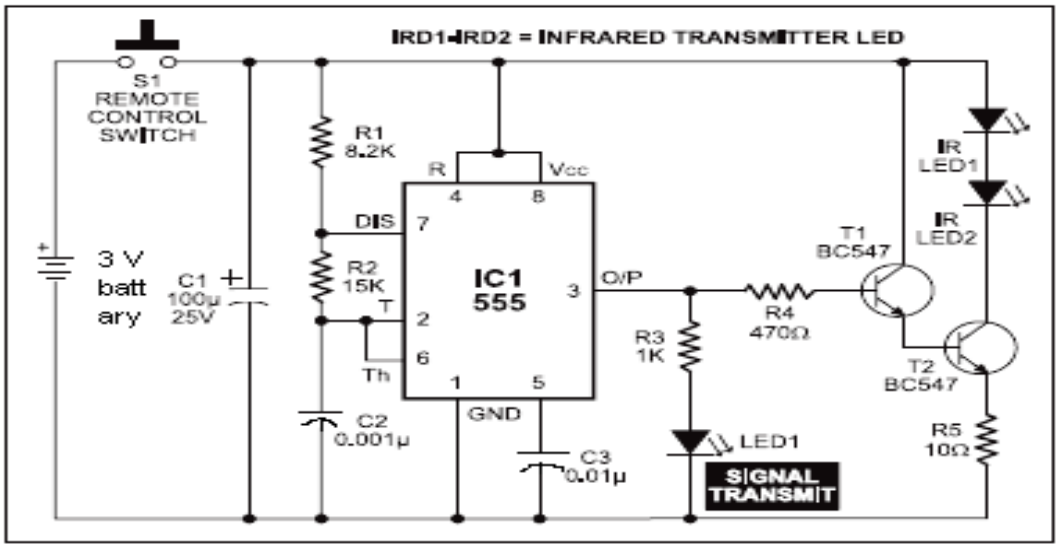

Fig.3: Remote circuit

Basic of power supply circuit

Regulated power supply can be obtained by using a voltage regulator circuit .A regulator is an electronic control which is capable of providing a nearly constant DC output voltage even when there are some variations in load or input voltage. A source of regulated DC power is essential for all communication, instrumentation,

Computers and other electronic systems. A block diagram containing the part of a typical power supply and the voltage at various points in the unit is shown in Fig. 4 below (www.atmel.com/literature).

A typical dc power supply consists of five stages

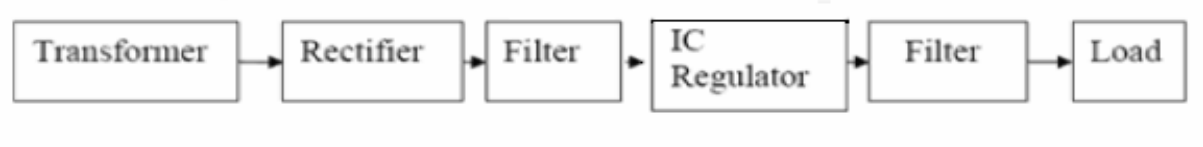

Fig. 4: Block diagram of power supply

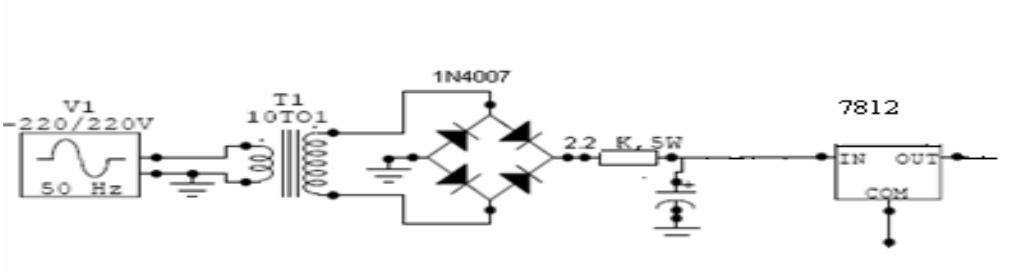

Fig. 5: Circuit design of power supply

The AC voltage typically 220V rms is connected to a transformer, which steps down that AC voltage to the level for the desired DC output voltage. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. The resulting DC voltage usually has some ripple and AC voltage variation. A regulator IC-7812 which can use this DC input to provide a DC output of 12 volt with eliminating the ripple voltage. This voltage is use to power the relay (Arif and Khan, 2002).

Ir signal receiver circuit

The 12V DC power supply for the receiver circuit is regulated by regulator IC 7805. The resistance of power in the circuit is indicated by glowing of the red LED (LED2). The IR receiver module (TSOP1738), which gets 5.1V power supply through zener diode ZD1, receives the transmitted signal of about 38 kHz. After receiving it send the signal in oscillators which oscillate the signal. The oscillated signal can be absorbed by the IC-AT89C025. It processes the signal and act as a trigger for next IC named UNL-2003. This IC is used to control the relay. This relay is attached with electric appliances, which is to be switch. This is powered by the AC main current coming through a step-down transmitter and rectifier (Dutoit 2001).

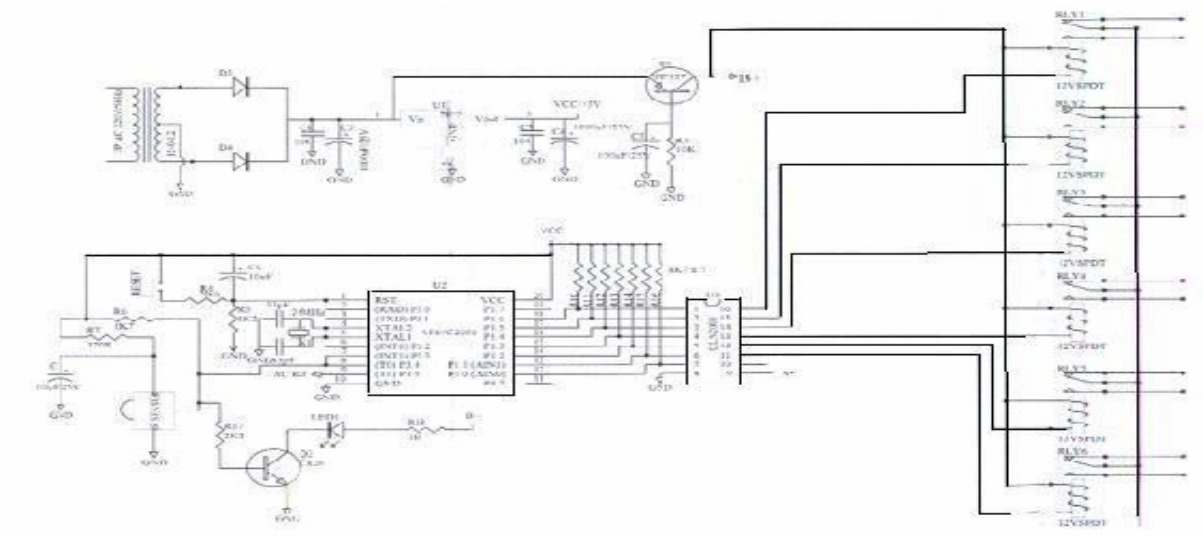

Fig. 6: IR signal receiver circuit

Performance test

The performance of a voice control remote switch was tested as follows –

Sequential operation of the system

Step 1

Before going to computer operation the IR generator circuit was connected to the printer port.

Step 2

At the very beginning of running the software the computer displayed the following window. This is the main graphical user interface

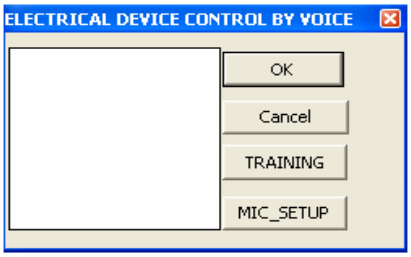

Fig. 7: Visual representation of computer output

Step 3

Some voice commands (start, stop, fan-on, fan-off, one, two, three and four) were given to the computer provided with the help of microphone to convert them analog signals.

Step 4

The software recognizes the analog signals and sends data for each specified word to the parallel port.

Step 5

The external circuit receives all these data from the parallel port and generate IR signal for each data.

Step 6

The IR signal receiver receives the IR signals from the external circuit and converted into electrical signal to operate the relay.

RESULTS AND DISCUSSION

Eight voice instructions such as fan-on, fan-off, one, two, three, four, start & stop have been made for operation of the switch. The whole system of (one socket, one fan and four lights) acts upon this instructions and conducts the corresponding switching action for each instruction. It has been tested and found that the socket operates with the command start and stop, the fan to run and stop running with the command 'fan-on' and 'fan-off'', the number one light turns on or off with the voice command 'one', the number two light turns on or off with the voice command 'two', the number three light turns on or off with the voice command 'three', the number four light turns on or off with the voice command 'four' (Leinecker and Archer, 2003).

CONCLUSION

Differentiating command from all sound is done by SAPI. This is a Microsoft's software, which interpreted the voice in text. The efficiency of this software is only 31% and Microsoft is still working to increase its efficiency. Our system's success depends upon the efficiency of this program because it send signal to printer port only when the text of the command match. As the efficiency of this software goes up, the system will perform better. Beside that we converted the signal from printer port into IR signal so that when the computer is not there (when computer is off) to recognize the voice command then the whole system can be operate by a IR remote to generate the desired IR signals.

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