Available online at www.elixirpublishers.com (Elixir International Journal)

Computer Science and Engineering

Elixir Comp. Sci. & Engg. 43 (2012) 6707-6708

ISSN: 2229-712X

8051 Microcontroller based as light sequencer

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ARTICLE INFO

Article history:

Received: 29 December 2011;

Received in revised form:

19 January 2012;

Accepted: 6 February 2012;

Keywords

Mirror balls,

Microcontroller,

Light sequencer,

Electric lights.

ABSTRACT

Light sequencer is a phenomenon which has been with us since the end of Second World War. Even though it has undergone very robust modification from the mirror balls into pure electronics. The 8051 microcontroller based light sequencer incorporates the programmable capability of the 8051 microcontroller in light sequencing light. This therefore has the advantage of changing the display of lights required as opposed to changing the whole electronics of the system of non-8051 microcontroller based light sequencer for the same effects lighting.

Introduction

Light sequencing can simply be defined as phenomenon in electronics in which electric lights or light emitting diodes (LEDS) are switched on and off in a sequential (orderly) manner and this is done at a calculated intervals of time. The resulting optical phenomenon appears as an optical illusion to the human eye and this finds extensive application in the entertainment world and the advertising industry. A typical example is in the development of the disco industry. The history of light sequencing dates back many years, before the start of the Second World War, it was found that if light was shone on a ball covered with mirror that one beam of the light was reflected off every mirror surface. So when discos came along in the sixties, mirror balls were one of the first effects to be adopted. However the first real dedicated disco lights were invented in 1968 and this marked the beginning of modern light sequencing based analog electronics using transistors, thyristors and relays. Further development and improvement on the electronics resulted in a new development in the entertainment world; light sequencing with sound. This was progressed from three channels to four channel using bass, lower middle, upper middle and treble. Thus the lights were following the music and relating the visual effects to the music. Initially this was too complex for the human eye, because of the inability of the eye to achieve the fast visual effects to the sound. However in 1973 a new idea was born, instead of flashing each channel to a different frequency the new idea was to make the lights react only to the bass beat, but to light each channel in turn thus first bass beat equals light channel one, next bass beat equal light channel two, next bass beat equals light channel three, next bass beat equals light channel one. This gave an easy and dramatic sound activated effect that the eye could follow easily and thus light sequencing gave birth to sound sequencing which is still most popular way of controlling ordinary spot lamps for effects lighting (http://www.prosoundweb.com). Light sequencer includes address decoding, pin numbering, soldering of ICs to the strip board and writing working software. In the latter's case, accurate and effective time delays can be a little of a problem and therefore a series of time delays has to be tested several times in order to find the most effective delays needed. The 8051 microcontroller based light sequencer makes use of the 74LSxx family of TTL (transistor transistor logic) integrated logic devices to drive light emitting diodes. It can also be modified to drive low current and low voltage incandescent lights. As it is in logic circuits, the 8051 microcontroller based light sequencer circuit is fairly simple, but due to the high speed nature of the TTL logic devices used, care must be taken when wiring the circuit. Simply put; the neater the wiring, the better the performance (http://home.cogeco.ca).

Materials and Methods

The hardware building components of the following specifics: the 8031 microcontroller, the 74LS138 decoder, the SN74LS373 latch, the M2732A EPROM, the HD74LS273 latches, the UNLN2803 IC, Seven Gallium Arsenide (GaAsp) 2V 10mA LEDs (red), Seven Gallium Phosphide (GaP) 2.2V 10mA LEDs (green), fourteen resistors with value 16-ohm, electrolytic and polypropylene capacitors of capacitance 0.01µF, the MM74HCT04 inverter and a strip board.

Software

```
Org 0000h
ajmp  delay
start: mov dptr, #3FFFh
        mov a, #55h
      acall  delay
      movx @dptr, a
      mov dptr, #5fffh
      acall    delay
      movx  @dptr, a
      rr a
      ajmp start
delay: mov r0, #03h
time2: mov r1, #00h
time 3: mov r2, #00h
wait:   djnz r2, time3
        djnz r1, time2
        djnz r0, time1
        ret
        .end
```

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Principle of Operation of the Light Sequencer Circuit

Upon reset, the 8051 accesses the external EPROM (Erasable programmable read only memory) since pin 31(external access pin of the microcontroller has been grounded). Grounding the pin 31 forces the microcontroller to access external ROM area. All the instructions (software) necessary for the program to run are stored in the eprom,so when the 8051 access the EPROM it takes the instructions there and executes them step by step. How it does this is very simple. Just as un the main program, the 8051 upon reset, the first instruction to be executed is Mov 3FFFH, #55h so it places the decoded address, an external address, on the address bus. This address contains data in the form of binary numbers which is latched in either of the 74273 flip-flop depending on which of the latches is enabled by the address. A binary one (1) represents a +5V and so it is inverted by the NOT gate within the ULN2803 IC, which is directly connected to the 74273 flip-flop, to a binary zero and thus switches on the LED. On the other hand, a binary zero represents 0V and it is inverted again by the NOT gate withinthe ULN2803 to a binary 1 representing a +5V. in this state the LED on that line goes off because current cannot flow. A pattern of display is thus observed at the LEDs and this pattern continues to vary depending on the instructions given to 8031µC and decodes and executes the program.

Discussion

Upon reset the 8051 microcontroller thus accesses the EPROM and the executes all the displays found in the EPROM. The use of the EPROM suggests that the software in it can be changed by erasure using UV (ultraviolet) light of the right wavelength and a new software programmed. In other words it is less expensive replacing the software in the 8051µC based light sequencer as opposed to replacing the entire hardware of a non-8051microcontroller based light sequencer for the same effects lighting. Also, it is much easier and quicker to change the display of the light sequencer in the 8051 microcontroller based light sequencer than to change the whole electronics of a non-microcontroller based light sequencer for the same effects of lighting.

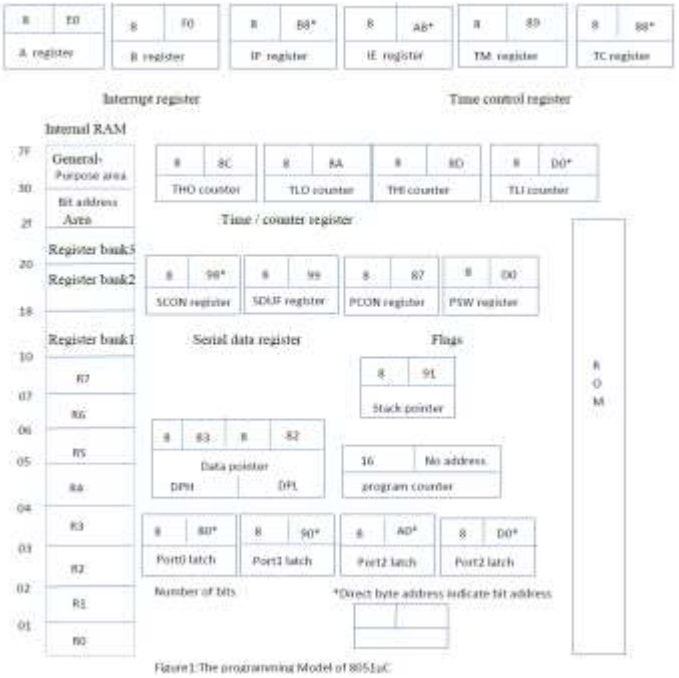

Figure1.The programming Model of 8051µC

Conclusion

The 8051 microcontroller based light sequencer is a versatile system which can exhibit both simple and complex programs. Sophisticated or complex programs with various routine will ensure varied light sequencing. This program can be improved to suit industrial applications such as conveyor belt. Thus , it depends largely on the desire of the programmer.

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6. http://home.cogeco.ca

Address Decoding

	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Y0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Y1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Y2	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Y3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Y4	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Y5	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Y6	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Y7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SN74LS138 Decoder Outputs

Y0	1FFFH
Y1	3FFFH
Y2	5FFFH
Y3	7FFFH
Y4	9FFFH
Y5	11FFFH
Y6	13FFFH
Y7	FFFFH

Only the output Y1(3FFFH) and Y2(5FFFH) of the SN74LS138 decoder were used in the 8051 microcontroller based light sequencer circuit.