International Journal of Electronic and Electrical Engineering.
ISSN 0974-2174 Volume 7, Number 1 (2014), pp. 21-26

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Microprocessor based Time Switch

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ABSTRACT:

Microprocessor 8085 is the most popular Microprocessor, which is very commonly used for setting up any system. The authors in the present paper designed a set up that will display the current time in the address and data field of the Microprocessor kit. Any electrical appliance can be switched automatically at the pre-set time stored in some memory locations. After filling the current time and the time at which any electrical appliance to be switched on in the memory locations specified for this purpose, it displays the current time working as real time clock. And the electrical appliance will be switched on automatically at exactly the required time.

INTRODUCTION:

In the present paper the authors discuss the assembly language programming of the time switch using most popular Microprocessor 8085. An electronic circuit was used for switching a device ON or OFF after a pre-set time. The software for the same was prepared in the assembly language of the Microprocessor 8085 which was checked on the M/S Vinytics kit (VMC-8506) and found to work satisfactorily. This type of microprocessor based Time Switch has the useful requirement in research laboratories. An electronic circuit was designed which was interfaced with the 8085A microprocessor through the programmable peripheral Interface (PPI) 8255A.

ASSEMBLY LANGUAGE PROGRAM:

The assembly language program of Time Switch for switching ON an electrical device is given below:

PROGRAM

Main Program

Label	Mnemonics	Operand	Comments
	LXI SP,	27FF H	; Initialize Stack Pointer (Say 27FF H).
	MVI A,	80H	; Control word for 8255-I.
	OUT	03H	; Work all the ports of 8255-I as output port.
	CALL	0347 H	; Clears the display. Stored program in kit.
AA	XRA	A	; Clears the accumulator
	MOV B,	A	; Clears the B register also.
	LXI H,	2050 H	; Initialize H-L pair to store the current time.
	CALL	05D0 H	; Displays the current time in address field. It is the program stored in Kit.
	MVI A,	01 H	; Stores 01 H in accumulator.
	MVI B,	00 H	; Stores 00 H in B register.
	LXI H,	2054 H	; Initialize H-L register pair (Say 2054 H).
	CALL	05D0 H	; Displays the current time in data field.
	CALL	ONOFF	; Calls subroutine to switch on device.
	LXI H,	2055 H	; Initialize H-L register pair with 2055 H.
	MOV A,	M	; Moves LSD of current sec. to the acc.
	ADI	01 H	; Add 01 to the accumulator.
	CPI	0A H	; Compares with 0A H.
	JZ	RR	; If Acc.= 0A H, then RR.
	MOV M,	A	; Moves acc. contents to $M_{H\text{-}L}$i.
DD	MVI B,	02 H	; Stores 02 H in accumulator.
YY	LXI D,	FA00 H	; Initialize D-E register pair with FA00H.
	CALL	DELAY	; Calls the delay program.
	DCR	B	; Decrement B- register.
	JNZ	YY	; If B $\neq$ 0 then jump to YY.
	JMP	AA	; Jump to AA for the display of current time.
RR	MVI A,	00 H	; LSD of current time is 0 & stored in acc.
	MOV M,	A	; Stores it to $M_{H\text{-}L}$.
	DCX	H	; Decrement H-L register pair.
	MOV A,	M	; Moves MSD of the current second to acc.
	ADI	01H	; Add 01 H to it
	CPI	06 H	; Compares if MSD of the current secs is 06.

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        JZ      UU      ; If Acc.= 06 (indicates MSD of sec. is 6)
                          then UU.
        MOV M,  A       ; If A ≠ 06 then stores it M(H-L).
        JMP     DD      ; Jump to DD for 1 sec.delay.
UU      MVI A   00 H    ; Store 00 to accumulator.
        MOV M,  A       ; Stores 00 to M(H-L). (MSD of sec)
        DCX     H       ; Decrement H-L register pair.
        MOV A,  M       ; Moves the LSD of the current min. to
                          acc.
        ADI     01 H    ; Add 01 H to the LSD of the current
                          mins.
        CPI     0A H    ; Compares it with 0A H.
        JZ      VV      ; If LSD of min is 0A H, then to VV else
                          next.
        MOV  M, A       ; Stores it to LSD of min addressed by
                          M(H-L).
        JMP     DD      ; Jump to DD for 1 sec delay.
VV      MVI A,  00 H    ; Stores 00 H to accumulator.
        MOV M,  A       ; Stores 00 to LSD of min. addressed by
                          M(H-L.
        DCX     H       ; Decrement H-L register pair.
        MOV A,  M       ; Moves the MSD of the current min to
                          acc.
        ADI     01 H    ; Add 01 H to the MSD of the current
                          min.
        CPI     06 H    ; Compaers if MSD of the current min is
                          06.
        JZ      SS      ; If Acc.= 06 then to SS else goes to next.
        MOV M,  A       ; If Acc ≠ 06 then stores to M(H-L
                          location.
        JMP     DD      ; Jump to DD for delay of 1 sec.
SS      MVI A   00 H    ; Store 00 to accumulator.
        MOV M,  A       ; Stores 00 to MSD of min addressed by
                          M(H-L.
        DCX     H       ; Decrement H-L register pair.
        MOV A,  M       ; Moves the LSD of the current hrs. to
                          acc.
        ADI     01 H    ; Add 01 H to the LSD of the current hrs.
        CPI     03 H    ; Compares it with 03 H.
        JZ      LL      ; If LSD of hrs is 03 H, then jump to LL
                          else next.
        MOV  M, A       ; Stores it to the memory location of LSD
                          of hrs.
        CPI     0A H    ; It is also compared by 0AH.
        JZ      WW H    ; If it is 0A H, then jump to EE else next.
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	MOV M,	A	; Stores it to M_{H-L}.
	JMP	DD	; Jump to DD for delay of 1sec.
LL	DCX	H	; Decrement H-L register pair.
	MOV A,	M	; Moves the contents of M_{H-L} to Acc.
	CPI	01 H	; Compares it with 01 H.
	JZ	GG	; If it is 01 H, then jump to GG H.
	INX	H	; Increment the H-L register pair.
	MOV A,	M	; Moves the contents of M_{H-L} to the Acc.
	ADI	01 H	; Add 01 H to it.
	CPI	0A H	; Compares it with 0A H.
	JZ	WW	; If it is 0A H then jump to WW.
	MOV M,	A	; Else stores the acc. contents in M_{H-L}.
	JMP DD		; Jumps to DD for the delay of 1sec.
GG	MVI A,	00 H	; Stores 00 H to Acc.
	MOV M,	A	; Moves 00 H to M_{H-L}.
	INX	H	; Increments the H-L register pair.
	MVI A,	01 H	; Loads Acc. to 01 H.
	MOV M,	A	; Moves the Acc. Contents to M_{H-L}.
	JMP	DD	; Jumps to DD for the delay of 1sec.
WW	MVI A,	00 H	; Stores 00 H to accumulator.
	MOV M,	A	; Stores it to M_{H-L}.
	DCX	H	; Decrements the H-L register pair.
	MOV A,	M	; Moves $M_{H-L}$to accumulator.
	ADI	01 H	; Add 01 H to it.
	MOV M,	A	; Acc. Contents are loaded to M_{H-L}.
	JMP	DD	; Jump for delay of 1sec.

Delay Subroutine Program

Label	**Mnemonics**	**Operand**	**Comments**
DELAY	DCX	D	; Decrement D-E register pair.
	MOV A,	D	; Moves the contents stored in M_{D-E} to Acc.
	ORA	E	; Contents of A and E register are ORed bit by bit.
	JNZ	DELAY	; If the result is not zero then to DELAY else next.
	RET		; Return to main program.

Subroutine Program to check the time (ON time) after every second

Label	**Mnemonics**	**Operand**	**Comments**
ONOFF	LXI H,	2055 H	; Initialize H-L register pair with 2055 H.
	LXI D,	205C H	; Initialize D-E register pair with 205C H.

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        MVI B,    06 H    ; Stores 06 H to B-register.
AGAIN   LDAX  D           ; Loads the contents of M(D-E) to the acc.
        CMP       M       ; Compares it with M(H-L).
        RNZ               ; Return if not zero.
        DCX       H       ; Decrements H-L register pair.
        DCX       D       ; Decrements D-E register pair.
        DCR       B       ; Decrements the contents of B-register.
        JNZ       AGAIN   ; Jump if not zero to AGAIN.
        MVI A,    01 H    ; Stores 01 H to Acc.
        OUT       00 H    ; D0 bit of port A of 8255 becomes high.
        RET               ; Returns to main program.
```

DATA

2050 H	-	MSD of hrs.	
2051 H	-	LSD of hrs.	
2052 H	-	MSD of Minutes	Current Time
2053 H	-	LSD of Minutes	
2054 H	-	MSD of Seconds	
2055 H	-	LSD of Seconds	
2056 H	-	01H (if wish to switch ON the electrical appliance)	

Time to switch ON the electrical appliance is filled in the similar fashion in the memory locations from 2057 H to 205C H.

Working:

This program written in assembly language is self-explanatory. As shown above the current time is stored in the memory locations from 2050 H to 2055 H. In the memory location 2056 H, 01H was to be stored if the electrical device to be connected with the PPI-8255 A; otherwise any number can be stored in this memory location. Suppose current time is 02:25:30 and switch on time of electrical appliance is 04:23:00, then the data will be stored in the memory locations starting at 2050 to 2056 and in the memory locations starting at 2057 H to 205C H respectively. For the purpose of switching ON the device an electronic circuit was designed as shown in figure 1.

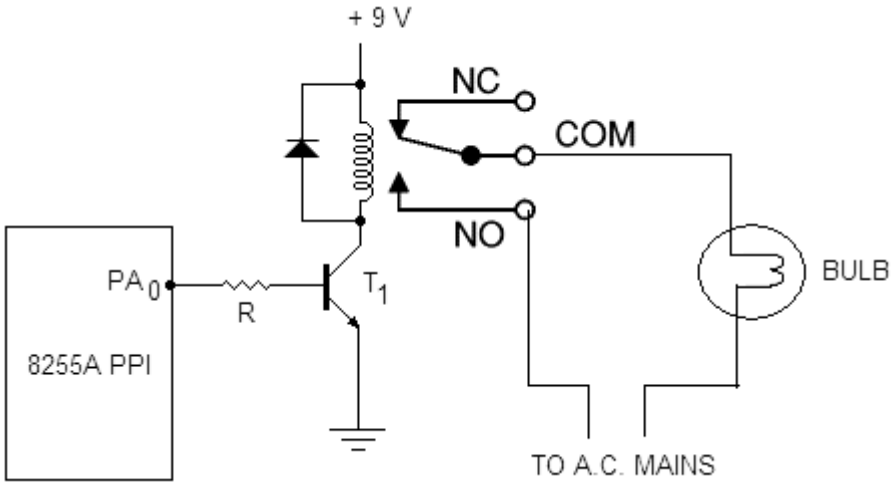

Fig.1

This circuit consists of a relay, a diode and transistor BC 107. The base of the transistor is connected to PA_0 of 8255 although a 10 k resistance. A diode IN4007 is connected in parallel with coil of 12V relay. The electrical appliance is connected to the a.c.mains through the N/O pins of the relay. When a high signal was received through the software to a PA_0 (D_0 bit of port A) of 8255-I, the transistor goes into saturation. The relay is energized. The N/O terminals of the relay get connected and electrical appliance become ON.

When the program is executed, the current time is displayed in the address and data fields of the microprocessor kit. The current time is updated after every second by the software. For this LSD (Least significant Digit) of the seconds is transferred to accumulator, which is added with 1. The contents after addition are compared with 0A H (decimal number 10). In other words LSD of the second is continuously increased (after every one second) by 1 to reach to 0A H. When it reaches to 0A H then program will jump to MSD (Most Significant Digit) of the seconds after storing 00H in the memory location 2050 H. Similar, working is seen for the minutes and it is updated in the address field so that it displays up to 59H. After that, it becomes 00 H. In the similar fashion, Hrs. is checked after every hour so that it displays the updated current time.

To switch ON the electrical appliance at the predetermined time the subroutine program is executed after every second. It checks if the current time is equal to the time of switching ON the appliance (Bulb etc.). When the current time is equal to the ON time (required time), 8255A sends a high signal to PA_0 (D_0 bit of Port A). The high signal energies the relay and appliance becomes ON. After switching ON the appliance the program will, however, continue displaying the updated time. It was found to work very accurate.