Design and Implementation of a Four-Floor Lift Control System.

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ABSTRACT

This paper presents design and implementation concepts for a four-floor lift control system using PIC microcontroller. The system is to carry a passenger to which ever floor the passenger desires. The system is made of four switch, switch 0, 1, 2 and 3. Switch0 is mainly for the opening and closing of the lift door, since the lift is already at that floor. While switch1, 2 and 3 is to carry the passenger to 1, 2, and 3 floor respectively depending on the switch number pressed. After taking the passenger to that floor the door of the lift will be open for 30secs before the door will be close. Then the lift will be brought back to ground floor. The simulation of the system was done on proteus 8.4 IDE.

Keyword: Lift control system, microcontroller, stepper motor, stepper motor drivers, switch

1.0 Introduction

The inquisitive and adventurous nature of man has made man to build tall building in the old with so many staircases, for the sake of conserving land, beatification and the show of wealth and power. In recent times, due to the advent of technology, the stress of climbing so many staircases before reaching ones destination is very tiresome and the advent of lift is a relief to man. Lift are installed in tall buildings to ease the stress of moving from one floor to another via staircase and also to conserve time, which is a very important factor. With the invent of lift man can utilized a very small piece of land in building very tall building that can accommodate so many persons and there will be little stress in moving from one floor to another.

2.0 Materials and Methods

The block diagram of the system is depicted in figure 1. The system consist of a microcontroller that receives inputs signals from four request switches. Depending on the input the microcontroller received from the four request switches, the microcontroller turns the stepper motor that carries the lift to a particular level via stepper motor driver. When the system is first switched on, it waits for the any of the switch to be pressed. Each switch represent a particular floor level say switch_1 represent floor_1. Whenever any switch is pressed the lift stepper motor moves the lift to that floor, then the second stepper motor (door stepper motor) opens the lift door for 30secs and close it.

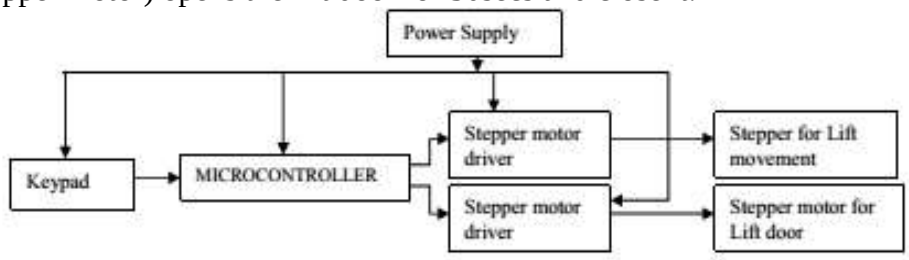


Fig.1: Block diagram of an automatic four floor lift control system

When the lift is ON, the microcontroller initializes and waits for the request switch to be pressed. These request switches send signals to the pic16873 [1] microcontroller portB pin0-3. Whenever a switch is pressed the microcontroller compares the number that the switch pressed represents with an already stored lift levels values (0-3) in the microcontrollers memory. If the switch level tallies with any of the stored values, the microcontroller will send output signals via its portC to move the lift via the driving circuit L293D [2] and stepper motor to the floor representing the input from request switch. The microcontroller sends an output signal to another separate stepper motor driver via portA pin0-4 that opens the door of the lift. The microcontroller then set a timing or delay of 30secs after which it closes the door of the lift by another signal via portA pin0-4 to the stepper motor driver. Then the microcontroller takes the lift back to the ground floor and wait for request, if there is any, it will act upon it and starts the process all over again. If there is none, the microcontroller waits still a request is made. Figure 2 shows the circuit diagram of the four-floor lift control system.

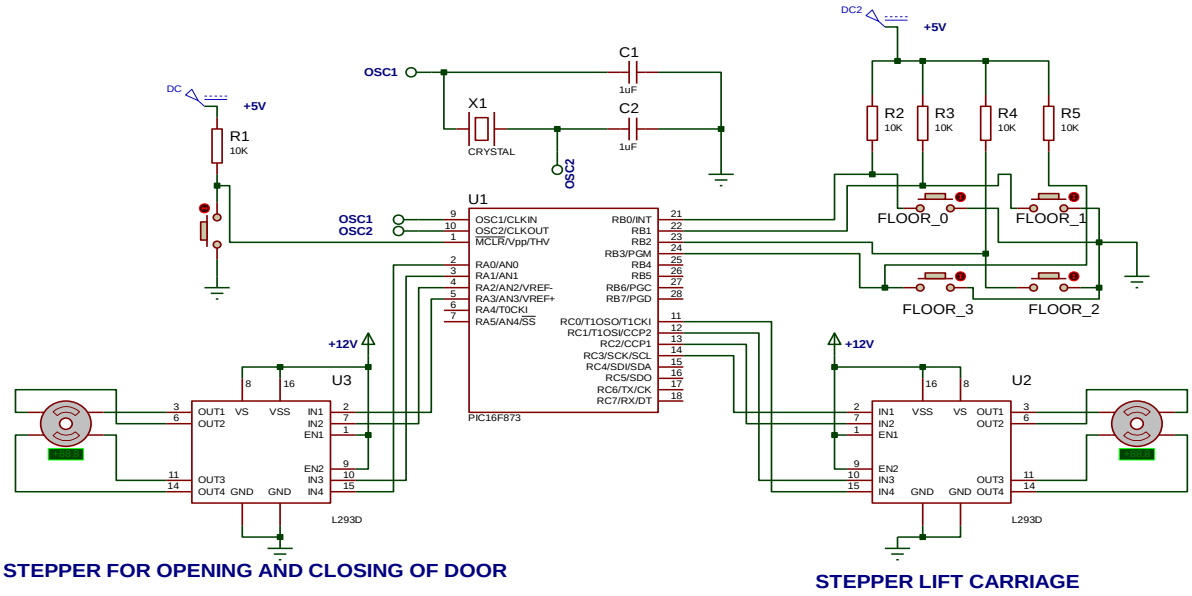


Figure 2: Circuit Diagram of Six Floor Lift Controller using Microcontroller

Figure 3 gives the flow charts of the program executed by the microcontroller. As indicated in the flow charts the microcontroller polls the input switches and after taking the appropriate decision it goes back to monitoring the switches in a continuous loop.

The lift flowchart starts initializing from the ground floor when the power is ON. It then commences the scanning for pressed request key; if any request switch is made by pressing a switch. If no switch request is pressed, the microcontroller continues to monitor if any will be pressed. When a request switch is pressed, it checks in ascending order starting from ground floor. If the first floor request switch is pressed, the lift controller moves the lift to that floor and opens the door after which the door is closed after 30secs. The lift controller then moves the lift to ground floor (the lift initial state) and waits for request switch to be pressed again. The process described above is performed for any floor that the request switch is pressed and the process continues all over again.

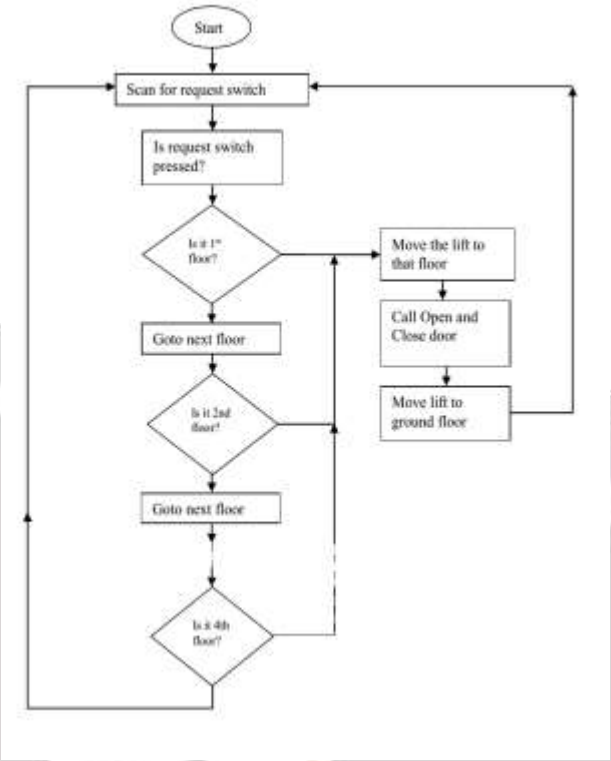
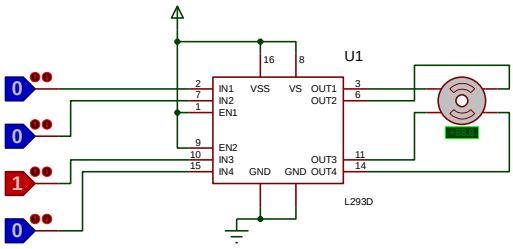


Figure 3: Subroutine for open and closing of door

3.0 Results and Discussions

The program for the microcontroller was written in C language and was then compiled into an executable file using the mickroC IDE [3]. The executable file was next imported into the Proteus Design Suite IDE [4] where the hardware circuit shown in figure 2 was designed and simulated. Figure 4 shows the stepping of the stepper motor where 0º represent floor_0 stepping, 45º represent floor_1 stepping, 90º represent floor_2 stepping, and 135º represent floor_3 stepping. Figure 5 to 9 shows the simulation of the four floor lift controller system and some operation states of the lift..



TRUTH TABLE					
A	B	C	D	DEGREE	-DEGREE
1	0	0	0	0	0
1	1	0	0	45	-315
1	1	1	0	90	-270
0	1	1	0	135	-225
0	1	1	1	180	-180
0	0	1	1	225	-135
0	0	0	1	270	-90
1	0	0	1	315	-45

Figure 4: Stepper motor driver inputs and the stepper motor degrees stepping.

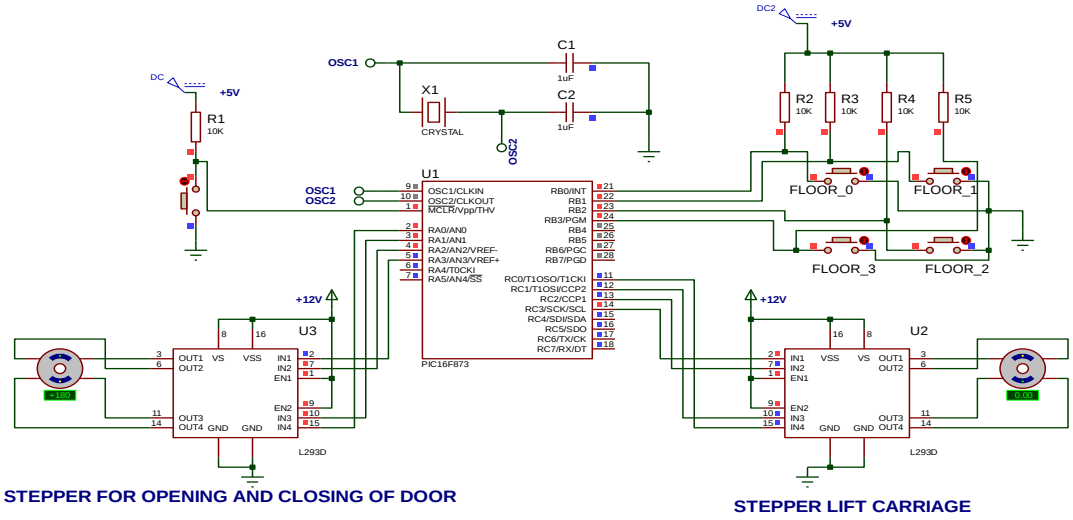


Figure 5: When Switch_0 is pressed and the door is opened

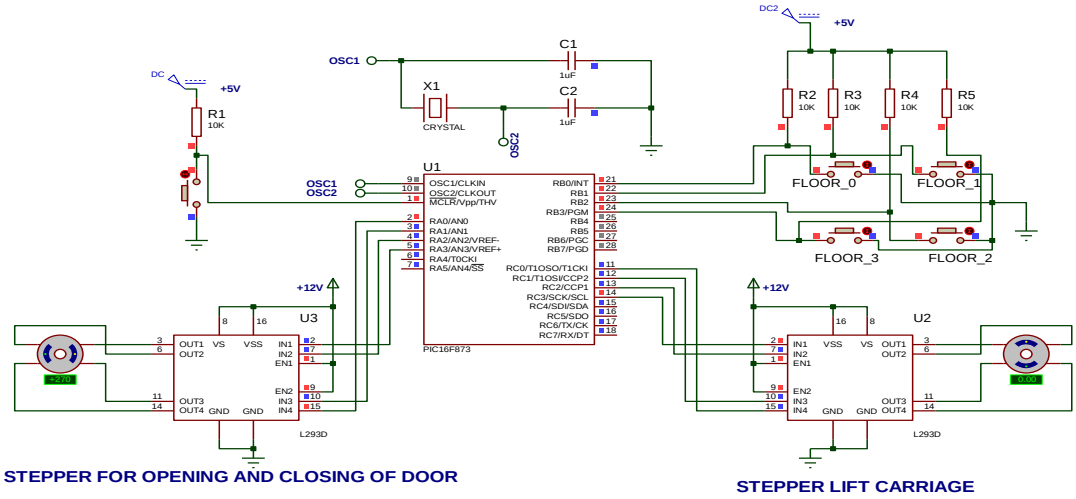


Figure 6: When Switch_0 is pressed and the door is closed.

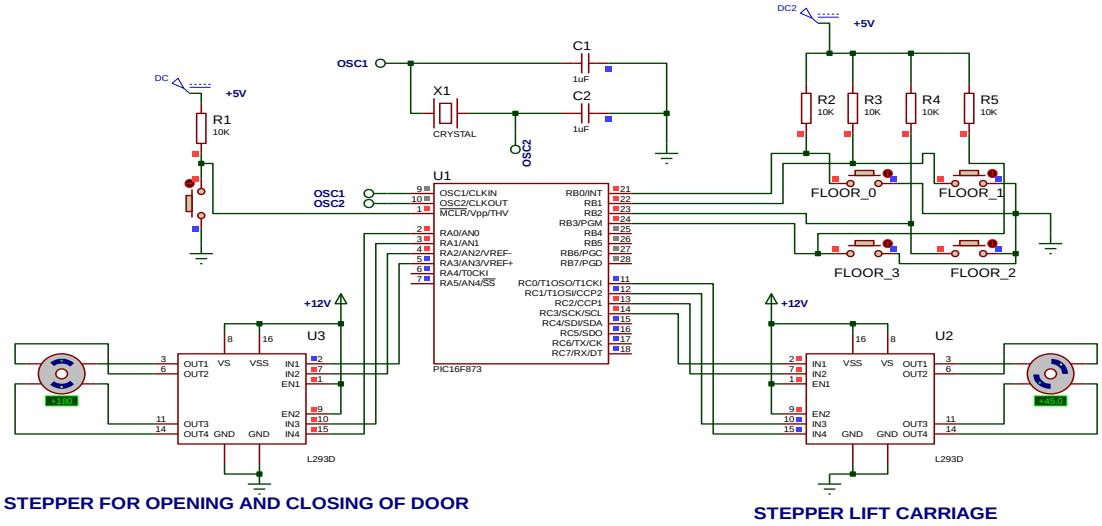


Figure 7: When Switch_1 is pressed and the lift stepper motor moves to 45º

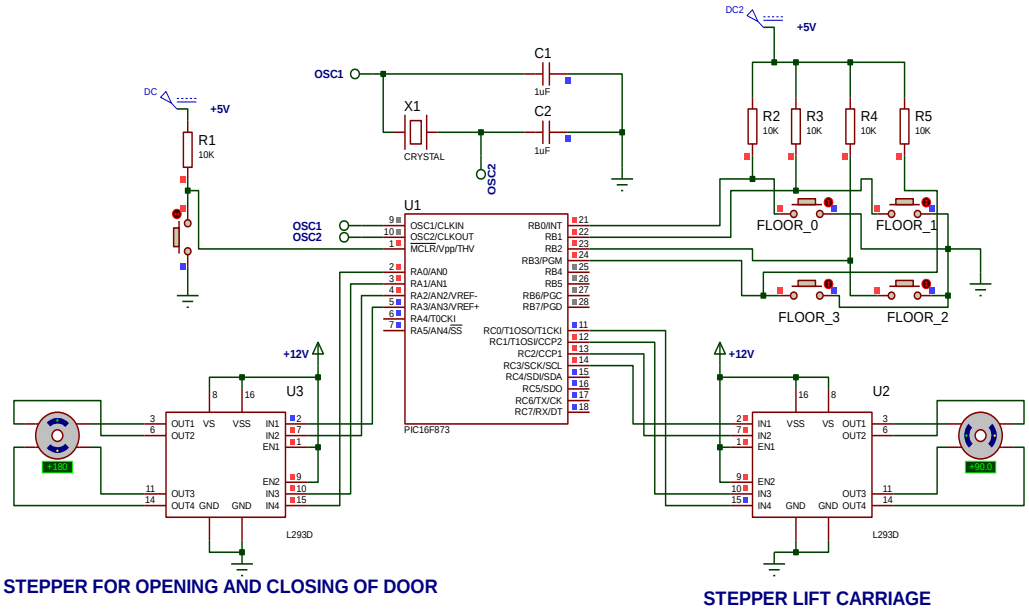


Figure 8: When Switch_2 is pressed and the lift stepper motor moves to 90º

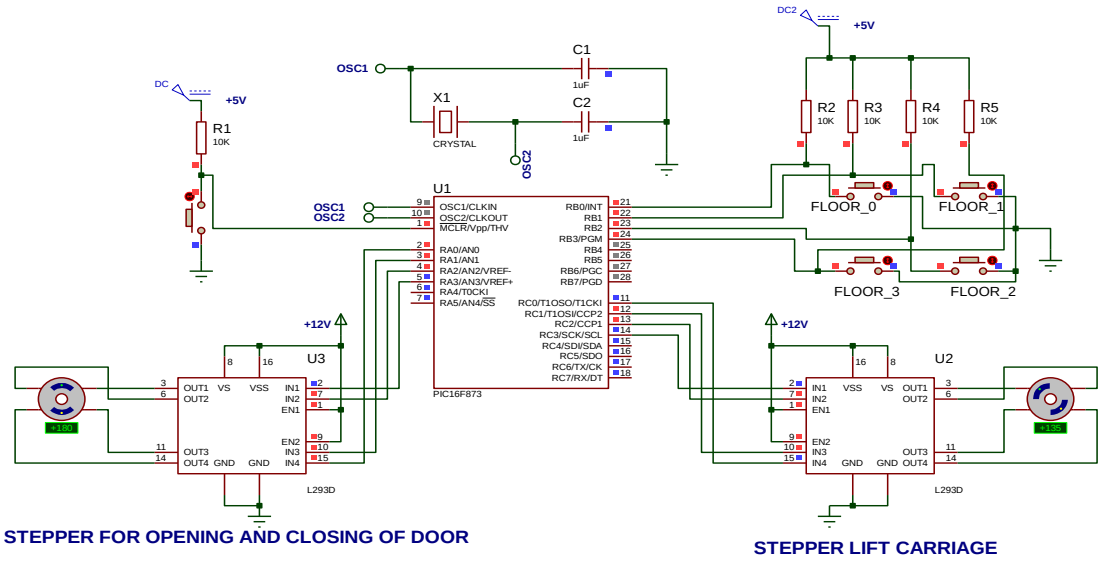


Figure 9: When Switch_1 is pressed and the lift stepper motor moves to 135º

4.0 Conclusion

The four-floor lift was designed and constructed using PIC16f873 microcontroller, and programmed using assembly language. Inputs into the device were four switches and the outputs are connected to stepper motor driver units to drive the stepper motors. The stepper motor drives the lift to the floor levels with respect to the command from the switch and another stepper motor open and close the lift door after 30secs. Two separate power supply voltages were used: +5V was used to power the microcontroller and +24V was used to power the stepper motor driver. The design can be simulated for any amount of floor level.

References

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