MICROCONTROLLER BASED MULTI-STOREY PARKING

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Abstract--**A city like Delhi has over five million cars and two-wheelers on its roads, but not enough parking spaces. The demand for parking space has, on an average in the main markets of Delhi, outstripped demand by 43 per cent. It is not just a problem of Delhi or Mumbai; all the big cities in India are facing the space crunch. Parking space is fast becoming a major issue in other cities .**

The earliest known multi-storey car park was built in 1918 for the Hotel La Salle at 215 West Washington Street in the West Loop area of downtown Chicago, Illinois. It was designed by Holabird and Roche. The Hotel La Salle was demolished in 1976, but the parking structure remained because it had been designated as preliminary landmark status and the structure was located several blocks from the hotel it was built to service. The Hotel LaSalle multi-storey was demolished in 2005 after failing to receive landmark status from the city of Chicago. Jupiter Realty Corp. of Chicago is constructing a 49-storey apartment tower in its place, with construction underway as of March 2008.

In our paper "microcontroller based multi-storey car parking" we are going to used PIC18F452 Microcontroller which meets all the requirements of the paper.

Index Terms-- DC Motor, Module, PIC 18F452, Stepper Motor.

I. INTRODUCTION

It is a truth universally acknowledged that a Mumbai Resident owning a car must be in search of parking space. The hunt for car parking is, of course, not limited to Mumbai, but is the common frustration with which most major cities of the world grapple. But we are concerned with Mumbai, which looks like drowning in a sea of cars. Look at the statistics: there are over 15 lack cars on Mumbai's roads, but common parking space for only — hold your breath — 8,000, thanks to the 100-odd pay-and-park areas across the city. The city's vehicular density is 591 vehicles per square meter, compared to 163 in New Delhi and the international average vehicular density of 300. Not surprisingly, this leads to crises and conflict on a daily basis.

Local residents who live near the town centre and the Metro link stations often complain about inconsiderate parking by people who park for several hours in residential streets while they are at work or visiting nearby commercial premises. Local people are then prevented from parking their own vehicles outside their own homes.

Unfortunately, as the law now stands, no-one has a special right to park outside their own property and there is therefore little that the Police or the Council can do to prevent this situation. However it is an offence to block an exit on to the highway and the Police may take some action when this occurs. The Council will also paint a white line on the highway at the position of a driveway or other access to remind motorist not to cause an obstruction. There is a charge (currently £25) for this. In the longer term, the introduction of "Residents Only" Parking Schemes will help. Previously such schemes needed the support of Greater Manchester Police who controlled the Traffic Wardens. However the Chief Constable made it clear for some years that he would not support the introduction of more schemes (at present there are two in Trafford) as the Police just do not have the resources to enforce them. But this situation has now changed with the "Decriminalization" of parking.

Basically the local Council has taken over control of on-street parking and controls its own Parking Attendants. Trafford Council has drawn up a strategy for Transportation in Sale Town Centre and this is currently (June 2001) out for consultation. Your Priory Ward Councillors have already proposed several streets for consideration as Residents Only Parking schemes. However there is likely to be a flood of applications and it may be some time before they can all be processed.

A multi-storey car-park (also called a parking garage, parking structure, and parking ramp, parked or parking deck) is a building designed specifically to be for automobile parking and where there are a number of floors or levels on which parking takes place. It is essentially a stacked car park.

The first historical mention of an automated garage was in a 1931 Popular Mechanics article which featured an underground garage where the car was taken to a parking area by a conveyor then an elevator to shuttles mounted on rails. The first Kent Automatic Garages were already in service.

Automatic multi-storey car parks provide lower building cost per parking slot, as they typically require less building volume and less ground area than a conventional facility with the same capacity. However, the cost of the mechanical equipment within the building that is needed to transport cars internally needs to be added to the lower building cost to determine the total costs. Other costs are usually lower too, for example there is no need for an energy-intensive ventilating system, since cars are not driven inside and human cashiers or security personnel may not be needed.

Automated car parks rely on similar technology that is used for mechanical handling and document retrieval. The driver leaves the car in an entrance module. It is then transported to a parking slot by a robot trolley. For the driver, the process of parking is reduced to leaving the car inside an entrance module.

At peak periods a wait may occur before entering or leaving because loading passengers and luggage occurs at the entrance and exit location rather than at the parked stall. This loading blocks the entrance or exit from being available to others. Whether the retrieval of vehicles is faster in an automatic car park or a self park car park depends on the layout and number of exits.

II SYSTEM DESCRIPTION

Microcontroller PIC18F452

Microchip Technology introduces an 8-bit microcontroller called the PIC, which stands for Peripheral interface controller. This microcontroller had small amount of data RAM, a few hundred bytes of on-chip ROM for the program, one timer and a few pins for I/O ports, all on a single chip with only 8 pins. The pic18F family has the highest performance of all the families of 8 bit pic microcontrollers. The fact that pic18F is also available in 18-to 80-a pin package makes it an ideal choice for new designs because it allows an easy migration to more powerful version of chip without losing software compatibility. The pic18 has a RISC architecture that comes with some standard features. The features are shown in Table 1. ROM is used to store programs so it is called program or code ROM. PIC18 has 2 MB of program ROM space. It size can vary from 4 KB to 128 KB. It is available in different memory types such as flash, OTP (one time programmable) it cannot be used for reprogram and Masked version.

Table 1 Features of PIC18F4520

1	Operating Frequency	DC-40MHz
2	Program Memory(Bytes)	32K
3	Program Memory(Instructions)	16384
4	Data Memory(Bytes)	1536
5	Data EEPROM Memory(Bytes)	256
6	Interrupt Sources	18
7	I/O Ports	Ports A,B,C,D,E
8	Timers	4
9	Capture/Compare/PWM Modules	2
10	Serial Communications	MSSP, Addressable USART
11	Parallel Communications	PSP
12	10-bit Analog-to-Digital Module	8 input channels
13	Instruction Set	75 Instructions
14	Packages	40-pin DIP 44-pin PLCC 44-pin TQFP

Some of the PIC microcontrollers use UV-EPROM, for on-chip program ROM. To use this kinds of chips for development requires access to a PROM burner, as well as a UV-EPROM erase the contents of ROM. The window on the UV-EPROM chip allows the UV light to erase the ROM. The problem with the UV-EPROM is that it takes around 20 minutes to erase the chip before it can be programmed again.

RAM is used to store the data. There are two types of RAM. General purpose RAM (GPR) and Special function registers (SFRS).

III OPERATION

In this paper we have used the IC - PIC 18F4520 microcontroller. We have used two different motors for horizontal and vertical movement of the lift. One is Stepper motor and the second is DC motor. DC motor is used for the vertical motion and the Stepper motor is used for horizontal motion of the lift.

31	32	33
21	22	23
11	12	13

Fig.1 Matrix for 9 module arrangement

In this paper four seven segment display is used from which two will display the data of location entered by the operator and the other two will display the original position of the lift.

There are indicators provided in front of the operator so that he can identify the empty location from the 9 modules.

When we press a start switch after entering the location of free space in the controller display the lift will move towards that module of the building.

The microprocessor continuously compares the position of the lift with the module location entered by the operator. When these both matches the microcontroller will give signal to the relay and the DC motor and than Stepper motor will stop in sequential manner at that particular location.

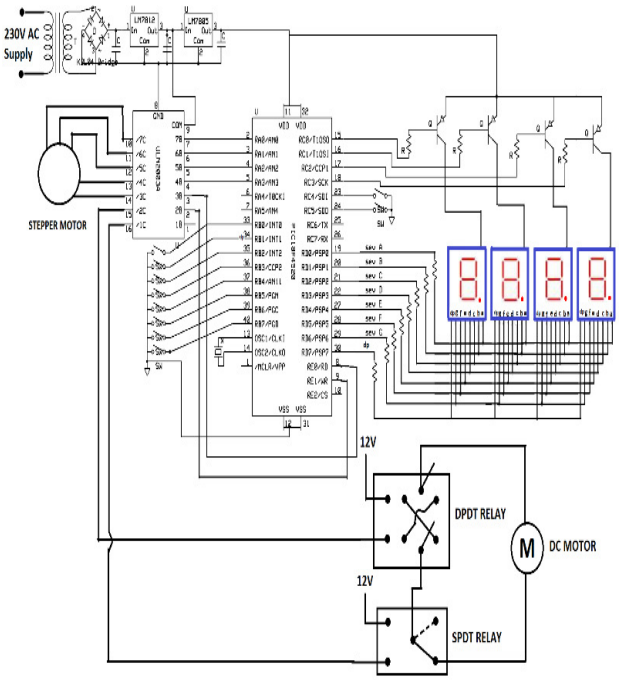

Fig.2 Circuit Diagram

The operation of this circuit can be explained by taking an example. Our parking building has three floors and each floor contains three modules.

Let assume that only 22 modules is empty. And lift is standing on 33 modules. When a car is to be park at that location the operator will enter data 22 which can be visible in first two 7-segment display. Now the controller will give signal to the SPDT and DPDT relay separately to start the DC motor. The motor will move the platform in downward direction through mechanical mechanism.

Now the micro controller will compare the actual position of platform with the data which the operator has entered. If the result comes out zero i.e. for the 1st digit of vertical position the controller will give signal to relay to stop the DC motor.

Two limit switches are provided at both the end of the worm in between which the loader has to travel from one floor to the next.

Now the horizontal position will compare with the 2nd digit of the data. If it does not match than according to the result the stepper motor will make rotation in forward or reverse (right or left) direction. When it matches with the

actual position of the lift the stepper motor is stop. This is explained in the flow chart.

IV. FLOW CHART FOR PROGRMMING PIC

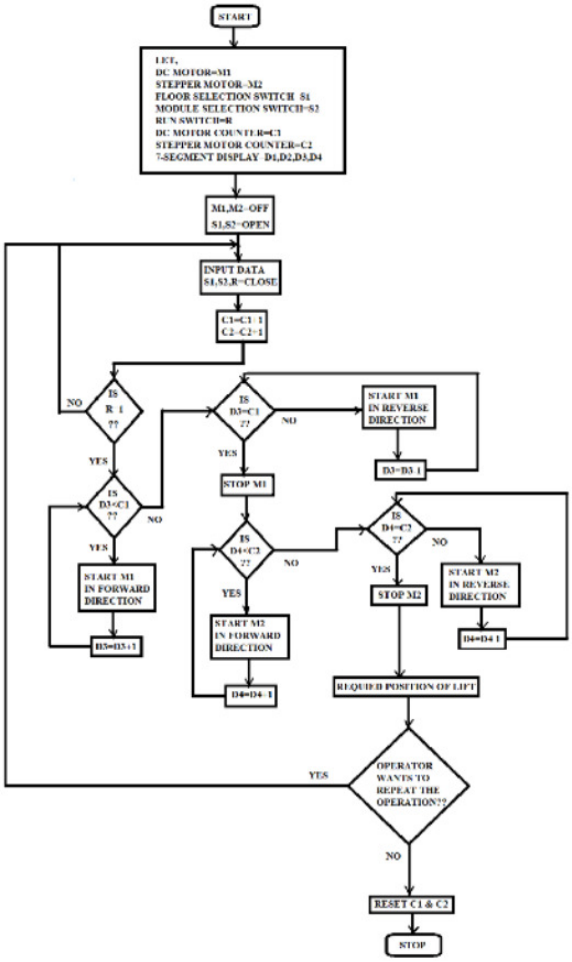

Fig.3 Flow Chart

We can extend this project by increasing number of floors and modules for the practical field application. This paper is not a simulation work rather it is a laboratory work. The LED indicator used for the indication of the vacancies of the parking modules in the building which is getting input signal from the reed relay is shown in figure.4

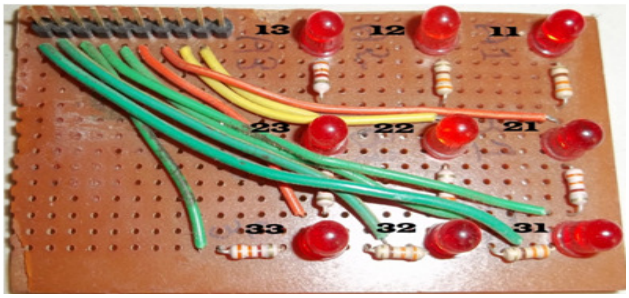

Fig.4 LED Display for module vacancies

V. ACTUAL PROTOTYPE MODEL

The mechanism for the movement of the base (lift) on which the car is placed for parking is shown in figure.5 and figure.6

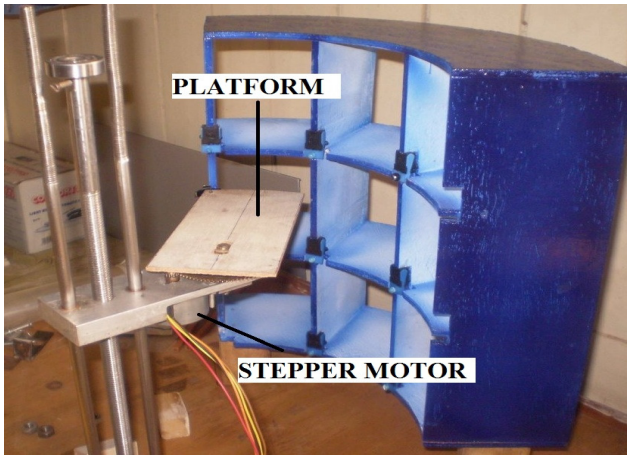

Fig.5 Mechanism of platform

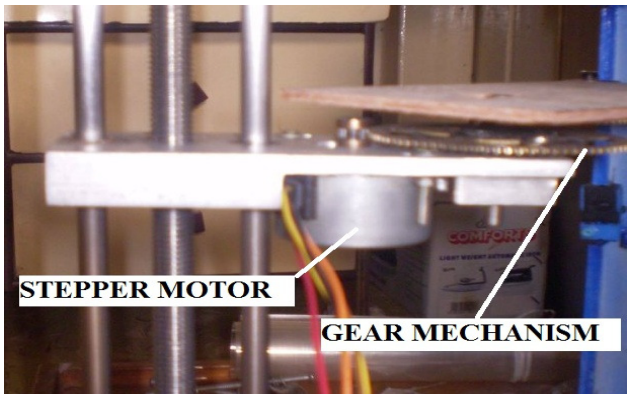

Fig.6 Gear Mechanism

The electrical circuit explained in this paper is being developed as a working model which is shown in fig.7

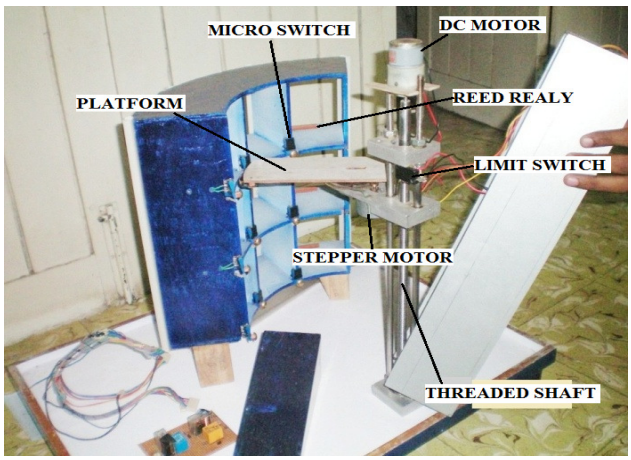

Fig.7 Building Structure with moving platform mechanism

VI. CONCLUSION

The problems related with the parking can be reduced to certain extend with these type of technologies. The Multi Storey car parking required less space as compare to manual and no reinforced foundation and ramp stairs require for car movement and also no passenger lift required. Sequential operation of two motors makes operation safe. Automated parking offers the best solution for planners, investors, operators, and for the drivers themselves. Ease to identify the car vacancies with the help of digital display. IR based floor detection sensors may give more accurate motion of loader than mechanical sensors.

Vehicles are not wasting time and energy driving up and down ramps in search of a parking space. This significantly reduces the emissions of harmful gases and ensures an environmentally clean parking facility. Instead of quarter circle building a full circular building of steel can be implemented by making some modification in mechanical design of loader (lift) which gives 360 degree rotation. The main idea behind this paper is to use of space to park the vehicles.

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