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SMART MULTI-STORED ROTARY CAR PARKING SYSTEM

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ABSTRACT
Today, we are living in advance country, where number of cars increasing day by day and the requirement of spaces for Parking those number of car is less. So space has become a very big problem and hence it's become a very crucial necessity to avoid the wastage of space. Lack of space availability has always been a problem. The major cities are car parked callously on the streets. Hence, rotary car parking system could be one of alternative solution. In order to handle the issue of parking in busy places various types of vehicle parking systems are used worldwide namely Multi-level Automated Car Parking, Automated Car Parking System, and many more. This makes the system modernized and evens a space-saving one. This idea is developed by using Atmega128 Microcontroller.

KEYWORDS: ATmega128 microcontroller using rotary car parking system.

INTRODUCTION

This system will work on the reduced parking space. Automatic Multi-stored rotary car parking system which can be used for parking number of cars on very less amount of place. This model is specifically designed to accommodate multiple cars in the horizontal space of two. The structure can accommodate six cars in the space of two cars and can even be customised to hold a greater number depending upon the requirements of the user and can be efficiently put to use in much space crunched areas. The system will consist of Keyboard section, Display section, Motor section and Car parking section. The car parking section consists of six pallets for parking the cars. The pallets are connected with a rotary assembly which will rotate the pallets in clockwise direction with the help of stepper motor. The rotary assembly is mechanical structure which consists of chains placed on the gears, as gears rotate the chain will also rotate and as soon as the chain rotates the pallets will also rotates. Stepper motor rotates according to the signals from the microcontroller. ATmega128 Micro-controller is used to perform various actions like Get key inputs from keyboard, Send message to display section. LCD is used to display various messages.
Automatic Car Parking system can be categorized in two types, which is conventional/self parking, and mechanical /elevator automated. Conventional Parking consists of layout, ramp and floor system. But this system consumes space. A Mechanized car park system can be defined as optimum spaced car storage with the aid of mechanical system powered by electrical source and has automatic storage and retrieval Method. Therefore it is the possible solution for parking problem. As per shown in figure. Rotary car parking concept is one of mechanized car park system where it is an automatically controlled parking system with a vertical chain drive and storage shelves arranged on both sides. The main idea is to stack six cars in a space normally occupied by two cars. A rotary chain drive is used to drive the system.

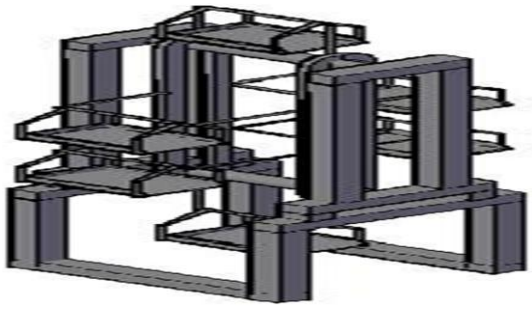

Fig. Automatic Multi-Stored Rotary Car Parking System

MECHANICAL ASSEMBLY

Mechanical assembly is nothing but car parking structure itself. Here the two gears are attached on either end of the single shaft and likewise two shafts are made. One shaft is placed on the top of the structure and other shaft is placed at the bottom side of the structure. A metal chain is placed on the gear of the both shaft in such manner that the right gears of the upper and lower shaft are connected with same chain. Same is done with left side gears.

The shafts are placed using the small ball bearings that allows the very low frictional force on the rotating structure.

MATERIALS OF MECHANICAL STRUCTURE:

- Motor –bike Chains
- Gears
- Iron rode of 1 inch width.
- Aluminum Sheet
- Iron rode of 1 inch width.
- Shaft
- Plastic Gears
- Welding rod
- Plywood
- Ball-Bearings

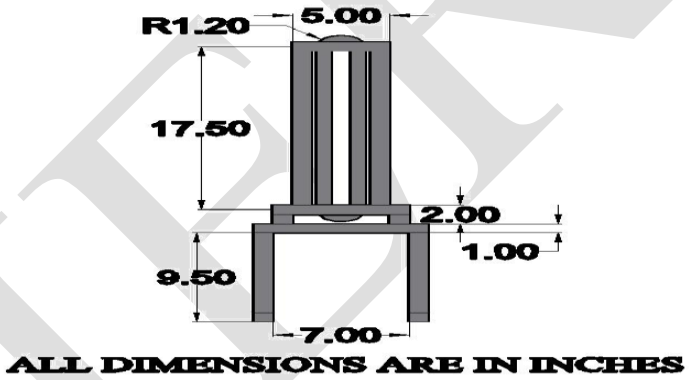

Fig. Dimensions of the structure

HARDWARE IMPLEMENTATION

This project is developed around the Microcontroller ATmega128. The ATmega128 Microcontroller was chosen because of its versatility and ease of availability. The main function of the ATmega128 microcontroller is to sense the channels and send it via serial communication.

This system was designed automatic rotary car parking system. This system is developed elliptical shape. In this system we can park minimum 6 numbers of cars in circular manner or pattern. We implemented 6 pallets to park the cars. For this system operation ATmega128 controller and we interface it with stepper motor, keyboard, and LCD display.

Stepper motor is used to rotate the pallets in circular pattern. Keypad is used to get the required pallet at the ground level so that user can park or unpark his or her car. LCD is used to display the commands like Welcome, Please wait, and Thank you.

Now the question is how does this system works?

At the start the first pallet is by default at the ground level. So any user can park his car in that pallet. Once he parked his car and come out from the system then the operator will press the enter key on the keypad and "Please wait" command will be displayed on the LCD. Hence the next pallet comes to the ground level then LCD will display "Thank you" command and next car get parked. This procedure is repeated till all the pallets are fully loaded.

But in case before the fully loaded condition any user wanted to unpark his car then also we can get his car at ground level by just simply pressing his pallet number on the keypad where he parked his car.
This is how our car parking system works. This system reduces the space which is required for ground level parking as well as it provides more security for the cars.

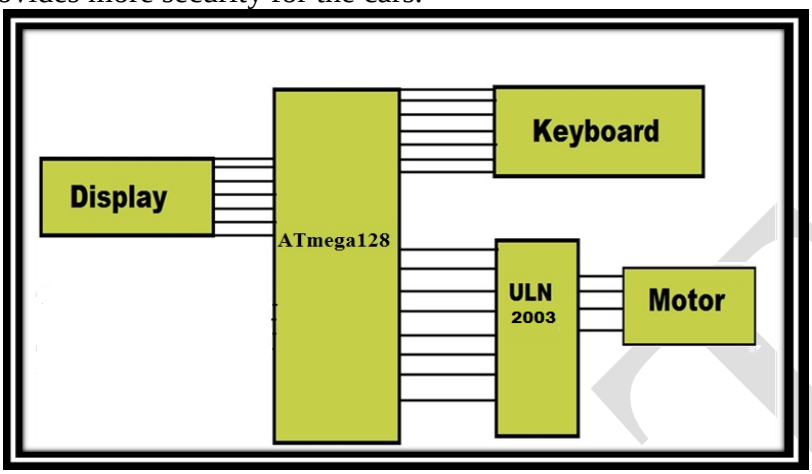

Fig. Block Diagram of Car Parking System

EMBEDDED CONTROLLING SYSTEM

1. ATMEGA128 MICROCONTROLLER

For controlling of this system, we are using ATmega128 microcontroller. The stepper motor unit (including ULN2003 motor driver IC) interface with the ATmega128 controller to rotate the mechanical structure. Each pallet is drive with the stepper motor. Keypad unit interface with the ATmega128 controller to enter the exact pallet number to park or unpark the car in desire pallet. LCD display unit interface with the ATmega128 controller to display the message or instruction for user.
ATmega128 Microcontroller can best handle the computing needs of the task most effectively. This is the main central controller of the complete hardware. Its job is to scan all the channels continuously from keypad. ATmega128 Micro-controller also accept the signals coming from the keypad and according to that it executes the instruction to rotate the stepper motor and displays regarding message on the LCD display.

2. ULN2003

A ULN2003 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows you to interface TTL signals with higher voltage/current loads. The chip takes low level signals (TLL, CMOS, PMOS, NMOS - which operate at low voltages and low currents) and acts as a relay of sorts itself, switching on or off a higher level signal on the opposite side. ULN2003 can drive 7 different loads, each with up to 500mA current. It can be used for driving external inductive and resistive loads such as unipolar stepper motor. To drive the external load you need to connect pin 3, VINE (Vin External) of the L293D output connector to either VINB (Vin supply of Board) or the external power source between 5V to 50V DC.
Load should be connected between VINE and pin OUT1 to OUT7. Use VINB only if AC adaptor /SMPS which is powering the board can give sufficient current to the motor without causing huge current surges. A TTL signal operates from 0-5V, with everything between 0.0 and 0.8V considered "low" or off, and 2.2 to 5.0V being considered "high" or on. The maximum power available on a TTL signal depends on the type, but generally does not exceed 25mW (~5mA @ 5V), so it is not useful for providing power to something like a relay coil. Microcontroller and other electronic devices frequently generate TTL signals. On the output side the ULN2803 is generally rated at 50V/500mA, so it can operate small loads directly. Alternatively, it is frequently used to power the coil of stepper motor. In electrical terms, the ULN2803 uses the low level (TTL) signal to switch on/turn off the higher voltage/current signal on the output side.
We have used the 16 by 2 LCD that means that it can display the two lines containing 16 characters each. The Pixel Matrix is of 7 by 5 pixels that are each character can be displayed using 7 columns of the pixels and 5 rows of the pixels**.** It will display the message given by the ATmega128 microcontroller.

SOFTWARE IMPEMENTATION

1. AVR STUDIO4.17

Atmel® AVR Studio® 4.17 is the Integrated Development Environment (IDE) for developing and debugging embedded Atmel AVR® applications. The AVR Studio 4.17 IDE gives seamless and easy-to-use environment to write, build, and debug your C/C++ and assembler code. This Software used for programming of the ATmega128 controller using embedded C language. Hex file of program will be burn into the controller using AVR boot loader programming technique.

2. PROTEUS7 PROFESSIONAL

Proteus is a single integrated application with ISIS, ARES and 3D Viewer modules appearing as tabbed modules. The program enables changes on the schematic to be reflected across PCB, BOM and Design Explorer in real time. Proteus stores the design (DSN), layout (LYT) and common database in a single project file (PDSPRJ).Proteus software is used for designing & implementation of circuit of project & debug analysis code through the software.

GENERAL LOGIC OF PROGRAM:

Initially msg displayed on LCD Display "Enter Your Choice: 1: Park, 2: Unpark".
If the user selected 1: choice of parking then Again msg will display on LCD Display "Enter Your Pallet:"
Key Present on keypad 1, 2, 3, 4, 5, 6, 7, 8, 9, OK, 0, EXIT.
For pallet option only 1-6 key will be enable.
In feature scope we can use all key for password protection. After pressing desire pallet key Stepper motor will move forward until selected pallet comes down. Afterward user will be able to park the car. While user doing the procedure of parking car, keypads all key will be deactivated except 'OK' and 'EXIT' Key & same motor movement will be standstill in this parking state. In this case buzzer alarm will be used for safety. This is for user safety purpose. In parking state, "Car Parked?"Press OK"
Msg continuously displayed on LCD. After Pressing 'OK' key again "Thank You" Msg will be displayed and again starting msg "Enter Your Choice:"1: Park, 2: Unpark"
Msg displayed and starting procedure will be continued.
Same procedure will be follow in case of "2: Unpark" option. While user parking or unparking the car in the pallet, by pressing the 'EXIT' key, user can exit from procedure. Logic will be varying at real time implementation.
At the start the system is in off status. When we provide the supply to the system, the "Welcome" message will be displayed on the LCD. That is "Welcome to Smart Car Parking". Now keypad comes into the picture, when we press key on the keypad, first "Please wait" message will be display on the LCD. After that the command will go to stepper motor and it will start rotating till that number which we pressed on the keypad.
Once the motor stop rotating "Thank you" message will be display on the LCD. Now next time when we press any key on the keypad then the respective pallet will come down with compare to the ground level pallet. The same process repeats continuously whenever we press any key on keypad.

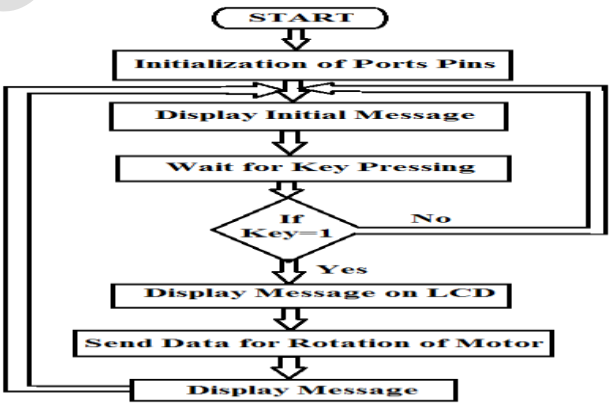

Fig. Flowchart of Working Steps

MATHEMATICAL EQUATION

- Output Step Angle.
- Power & Size Constraints.
- Running Torque.
- Load, Friction & Speed.

We are going to use Unipolar Stepper Motor for this project.

- Stepper Motor Output step: 1.8 degree at full wave drive.
- Power: 12V DC /400mA.
- Torque: choose on the base load.
- Load carrying capacity: Up to 5-8 kg around.
- Speed: 300 rpm.
- Output Step angle explained in details: Most affected parameter which we have to consider in software program.

MATHS FORMULAE:

- Step per Revolution: 360 degree / step angle degree.
- Step angle = 360 / SPR
- SPR = NR * no. of Motor phase

  Where, SPR - No. of Step per Revolution

  NR - Total No. of Rotor teeth.

Unipolar Stepper Motor Specification: 1.8 degree step angle.

- Step angle of full mode sequence =360/ 4=90 degree.
- Step angle of half mode sequence =360/8=45 degree.
- Step per Revolution = 360/1.8=200

We need to give 200 rotation commands to motor in Full Mode sequence or 400 rotation commands in Half Mode sequence.

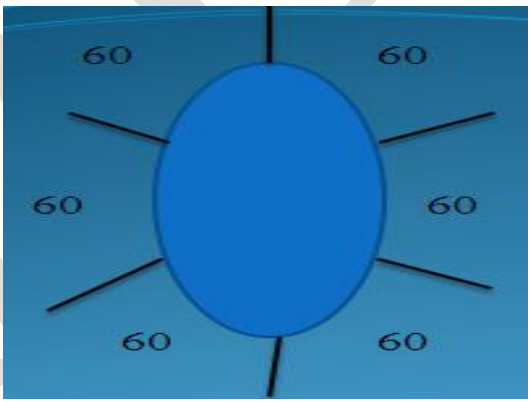

Fig. Structure Design with stepper motor angle.

Pallet located 60 degrees from each other. We need to rotate this structure as a Giant wheel with 60 degree angle only, because we have design 6 pallets in this Smart Car Parking system.

Then each pallet situates in 60 degree.

- Step per 60 degree = 60/1.8 degree = 33.33.

CONCLUSION

Right now the parking system is widely based on the ground level parking. So it required more space for the car parking. So we had designed such a system in which we can park more number of cars in less space.For that we designed a small prototype where we can park or unpark six cars. At the start we used DC motor for checking whether system will take the required load or not rotation. So we got the idea about the working of our project.

In the next step for getting accurate output we used the stepper motor. After used the stepper motor we got the accurate output than the DC motor. During the construction of a structure we faced some problems such as finding the gears of same size, and then the shaft which can perfectly matched with the inner diameter of those gears. When we started to weld the pallets on the chains we had so much trouble, so we decided to go for gas welding.

For getting proper output we used trial and error method. For that we changed our stepper motor programming at least 20-25 times. We burned our program in ATmega128 Microcontroller. At the end after faced so many problems, we got the proper output that we were looked for.

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