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Smart Cleaning Device for Various Platforms

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ABSTRACT: *Objective of the project is to design and develop a cost effective and efficient device (say vehicle) to clean a particular room and to provide a germ free environment. We here, try to present and imply an idea that, a device can clean the given room by its own. The system will include dust suction system, detergent sprinkling system, wiping and finally the drying system to dry the surface. Device will be programmed to move, by giving a particular algorithm (code) to the micro-controller. Once, the device is placed in the room and switched on it will clean the room by itself.*

Keywords: *Micro-controller (8051),Kiel µvision, Flash magic, Motor driver (L293D), Chassis, DC geared motors, Suction pump, Liquid pump, Stepper motor, Blower, Brushes, Spongy Material, Batteries.*

I. INTRODUCTION

Aim of the project

To develop a system or a device to have a clean uncluttered room.

Case study

Till now, in today's world we have seen a device that autonomously cleans the room that is through vaccum suction and we also have seen manly controlled device for just wiping floors (majorly seen in airports etc,).These systems are not only costly but are also not suitable for homely environments.

The drawbacks of limited working range, very costly, less efficient, huge size and mainly not suited for every environment. Use of a microcontroller and other parts such as suction pump, liquid pump, vaccum pump and blower can overcome these difficulties.

The Control of vehicle involves three distinct phases: perception, processing and action. Generally, the preceptors are sensors mounted on the vehicle, processing is done by the on-board microcontroller or processor, and the task is performed using motors or with pumps

The vehicle is controlled by a microcontroller that is programmed with a particular type of code. Then, this microcontroller is connected to the motor driver and programmed meaningfully such that to control DC geared motors. Microcontroller is connected to 5V supply and DC motors is given with 12V supply.

Once the algorithm is burnt onto the microcontroller, the geared motors mounted chassis is ready to run according to the algorithm. After the completion of the software coding and the movement of the device, we design the mechanical assembly. Firstly, we fit in the vaccum suction at the head to clean the dust particles. Secondly, in the midst of the device, we have liquid pump sunk in the mixture water and detergent reservoir and the mixture is pumped on through the pipes (beneath the chassis) and pipes are suitably pinned to sprinkle water and the open end is given back to the reservoir. Thirdly, at the back of the device we have spongy material fixed such that it wipes the left water. For further efficiency, there is a stepper motor programmed to give an angled (say 120 degrees) movement to the brushes. Finally we have, a metal strip connected to the chassis at the back. At the end of the strip, we have fitted a blower to dry the cleaned area. The algorithm given to the microcontroller is in the fashion of saw tooth.

Hence, through all these actions a given room can be cleaned properly.

General Block Diagram

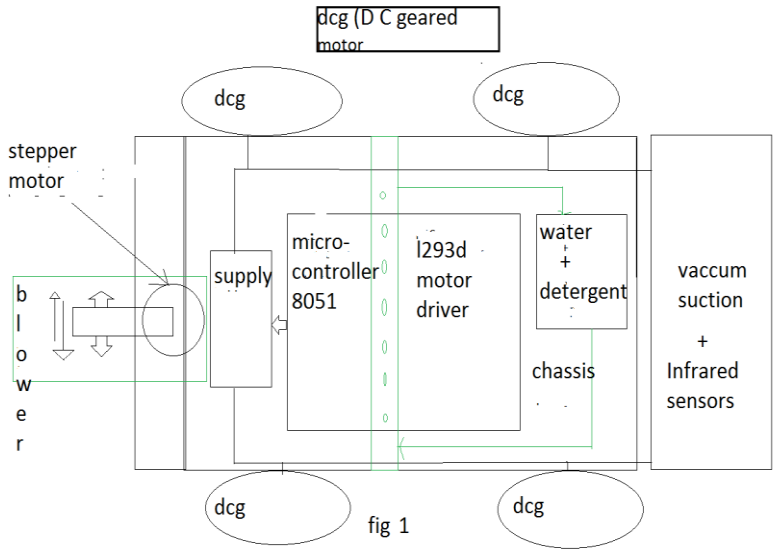

fig 1

The general block diagram Fig.1 gives a brief idea of the system In the present project the robot is controlled by a microcontroller which is connected to motor driver and supply. Here, the microcontroller is burnt with the code that is the C code using Kiel µvision and is burnt using Flash magic. The robot perceives this code and reacts accordingly to that code written. The port 0 of the microcontroller or any port from the 4 ports can be programmed and connected to the motor driver and respective supplies of 5V and 12V will be given.

Four motors will be connected in series with the L293D to act with the signals that are sent by microcontroller. In accordance to the signals we also have Infrared sensors that are placed in front of the device will detect any obstacle (say wall) and the signal from infrared signal will be passed to the interrupt pin of the microcontroller and the motors will react the interrupt signal received from the infrared sensor and left or right.Delay will be provided in the program after every rotation. Saw tooth movement will be based on the infrared detection and the motion of the motors.
Initially, as seen from the block diagram the dust will cleaned, sprinkling will be done, wiping is done and at the end blowing will complete the cleaning action for the area. The vehicle here once started will continuously run until the work is completed. Hence, no stopping of the vehicle may be expected once the vehicle starts until the end i.e. fulfillment of the job given.

II. HARDWARE DESCRIPTION

8051 Microcontroller

The microcontroller incorporates all the features that are found in microprocessor. The microcontroller has built in ROM, RAM, Input Output ports, Serial Port, Timers, interrupts and clock circuit. A microcontroller is an entire computer manufactured on a single chip. Microcontrollers are usually dedicated devices embedded within an application. For example, microcontrollers are used as engine controllers in automobiles and as exposure and focus controllers in cameras. In order to serve these applications, they have a high concentration of on-chip facilities such as serial ports, parallel input output ports, timers, counter, interrupt control, analog -to-digital converters, random access memory, read only memory, etc.

The I/O, memory, and on-chip peripherals of a microcontroller are selected depending on the specifics of the target application.

Since, microcontrollers are powerful digital processors, the degree of control and programmability they provide significantly enhances the effectiveness of the application.
8 bit micro-controller means it can read, write and process 8 bit data. Basically 8 bit specifies the size of data bus. 8 bit microcontroller means 8 bit data can travel on the data bus or we can read, write process 8 bit data.
This is mostly used microcontroller in the robotics, home appliances like mp3 player, washing machines, electronic iron and industries MC 8051 has 128 byte Random Access memory for data storage.

In 8051, 4KB read only memory (ROM) is available for program storage. This is used for permanent data storage. Or the data which is not changed during the processing like the program or algorithm for specific applications.

• This is volatile memory; the data saved in this memory does not disappear after power failure.
• We can interface up to 64KB ROM memory externally if the application is large.

Motor Driver L293D

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source.

Liquid pumps

These liquid pumps feature excellent suction performance (3 mAq) and forcing performance (40 mAq) for the size as well as the self-priming capability.

The products applying these pumps can be designed without restriction of the pump installation position with respect to the liquid level.

With the liquid temperature range from 5C to 100C, these pumps are applied widely in equipment that needs compact design and/or self priming, such as home appliances (hot pots, refrigerators, water-spraying toilet seats, steam electronic ovens, irons and washing machines), housing equipment and fuel cells.

Vaccum pumps

Our vacuum pumps feature silent operation, low pulsation and long life. They are applied in products with which stable performance and operation are critical, such as medical equipment, measuring instruments and also in cleaning purpose.

Blower

This process relies on evaporation only and no heat is used. The process quickly dries the surface and since no heat is added, the heat of evaporation lost also cools the surface. Vacuum drying is used when critical processes require absolutely dry parts and is best suited for removing thin water films that are scattered on the surface. The vacuum system is the most energy efficient drying system available, requires minimum floor space and no exhaust connections outside the plant.

Stepper Motor

A stepper or stepping motor converts electronic pulses into proportionate mechanical movement. Each revolution of the stepper motor's shaft is made up of a series of discrete individual steps. A step is defined as the angular rotation produced by the output shaft each time the motor receives a step pulse. These types of motors are very popular in digital control circuits, such as robotics, because they are ideally suited for receiving digital pulses for step control.

Stepper motors provide a means for precise positioning and speed control without the use of feedback sensors. The basic operation of a stepper motor allows the shaft to move a precise number of degrees each time a pulse of electricity is sent to the motor. The rotor of the motor produces torque from the interaction between the magnetic field in the stator and rotor. The strength of the magnetic fields is proportional to the amount of current sent to the stator and the number of turns in the windings. The rotor will require 24 pulses of electricity to move the 24 steps to make one complete revolution. Another way to say this is that the rotor will move precisely 15° for each pulse of electricity that the motor receives. The stepper motor can be operated in three different stepping modes, namely, full-step, half-step, and micro step.

Hardware Circuit Description

The controller i.e. micro-controller 8051 port 0 is connected to l293d motor driver. Then, it is given with 5V supply. Motor driver is given with 12V supply. All, the other hardware components such as vaccum pumps, liquid pump, stepper motor and blower is connected to 12V supply. Stepper motor is connected so that it gives angled movement for wiping and mechanical part is properly mounted and connected.

III. SOFTWARE IMPLEMENTATION

Here, the microcontroller is programmed to achieve a proper output. Microcontroller is programmed and given to l293d motor driver and consequently motor will rotate giving device movement.

Microcontroller port 0 or any port is connected to the L293D four input pins and then the output is given to the geared motor where the motion is controlled the flowchart is shown in **fig 2**.

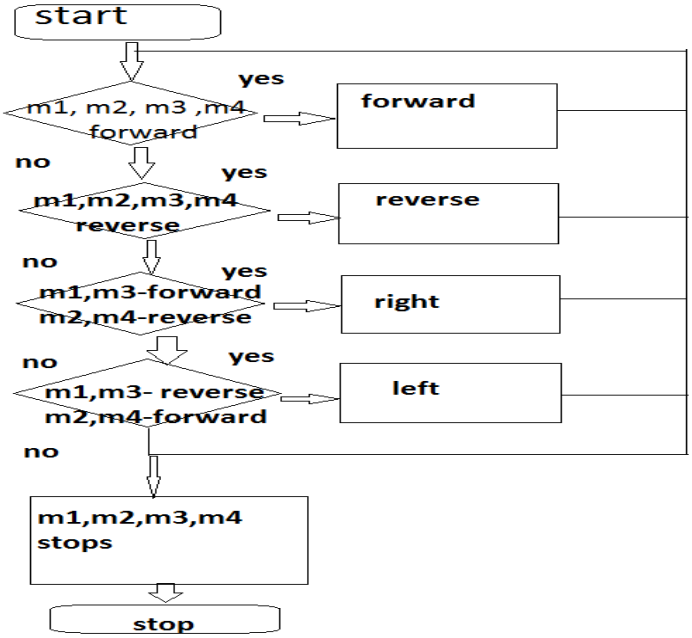

Fig 2

IV. RESULT & ANALYSIS

The motor driver L293D can drive a DC motor with enable and control inputs. Micro-controller has to be specifically programmed to control the motion.

Mainly, the mechanical assembly is carefully designed such that no circuitry damage is occurred due to the mixture of water and detergent.

Since, use of both spongy material and stepper motor to and fro motion better efficiency is obtained.

As far as the size is concerned, we have tried to reduce the size and can be further reduced.

Coming to the cost, we try to use low cost and better efficient components.

Mainly, we see that the cleaning is done properly and major efficiency is achieved.

V. CONCLUSION

In this paper, we have discussed about the self cleaning robot. We initiated our discussion by examining the motivation for the work. we then described the details for each component separately and how they worked together to bring ON the whole project. We discussed about the micro-controller, motor drivers; and some mechanical assembly such as suction pumps, liquid pumps, blowers in together with sprinkling system. Finally the project has been developed by integration of all hardware and software component together.

Applications

1. The main application of the project is to reduce the human effort by cleaning the surface automatically.
2. Our project is not only limited for the household purposes but it can be also used in airports.
3. It can also be used in the region of uncluttered surface because of its RPA algorithm.
4. It's most useful application we can say is that it can be used in nuclear power plants, where cleaning is the very important aspect and cleaning that surface is very risky, so it also avoids the risk.

Future Scope:

1. It can be modified such that it can clean the roofs as well as ceiling with the creeping algorithm.
2. It can be used as demining robot if we integrate the military application to its feature.
3. In future modification, it can detect the intensity of the dust present in the room and clean as such.
4. By using Smart Intelligence property it can be used as self chargeable robot (if its battery charge is about to sink).
5. Its size can be minimized using nano technology and its speed can be improved.

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