Design And Implementation Of A Control System For A Walking Robot With Color Sensing Using ARM

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Abstract:

For many people robot is a machine that imitates a human—like the androids in Star Wars, Terminator and Star Trek: The Next Generation. However much these robots capture our imagination, such robots still only inhabit Science Fiction. People still haven't been able to give a robot enough 'common sense' to reliably interact with a dynamic world.

The type of robots that you will encounter most frequently are robots that do work that is too dangerous, boring, onerous, or just plain nasty. Most of the robots in the world are of this type. They can be found in auto, medical, manufacturing and space industries. Line following robots is new and innovative concept. Line following robots is a very dynamic part of the robotics domain; it is based on artificial landmarks of mobile robot localization and navigation based on sensing technology. This robot works with color sensing principle. Line following robots with multiple sensors and actuators need to have highly efficient processors for precise movement. However the currently employed line following robots in the industries with conventional wheels are less efficient and require multiple loops for the movement. These defects may be improved with highly efficient robot built using LPC2148 microprocessor with omni-wheels. This vehicle can be moved using geared motors of 60RPM without anybody's control. Also this robot can take sharp turnings whenever it detects color. The ARM processor generates the desired pulse width modulated signals for motor control and quickly responds to the digital signals provided by the IR sensors. The use of multiple wheels system reduces the movement time or rotation time.

Key words: *Motors, Color sensors, ARM Processor; Sensors.*

Introduction

A robot is a mechanical artificial agent. It is basically an electro-mechanical machine which is guided by an electronic programming, and is thus able to do tasks on its own. Another common characteristic is that by its appearance or movements. Although the appearance and capabilities of robot vary vastly, all robots share the feature of a mechanical movable structure under some form of control. This control of robot involves three distinct phase- perception, processing and action. In common the preceptors are sensors mounted on the robot, processing is done by onboard microcontroller or processor and task (action) is performed using motor or with some other actuators.

It is built by microcontroller, DC motor, colour sensor. Through the motion of the robot is based on colour sensing. The robot will move according to the sensed colour which will be programmed in it. The programming is done in the keil software. In this way the robot will able to move with the help of the color coding .in this way this robot will be helpful for the humans.

Literature Survey

To reduce human efforts on mechanical maneuvering different types of robots are being developed. These are too costly and complex due to the complexity and the fabrication process. Most of the robotic arms are designed to handle repeated jobs. In design of the robotic are different parameters are to be taken care. The design of mechanical structure with enough strength, optimum weight, load bearing capacity, speed of movement and kinematics are important parameters. In electronic design the specification of the motors, drives, sensors, control elements are to be considered. In the software side there configurability,

user interface and implementation and compatibility are to be considered. In simple term, the reference sources emphasize on few aspects like sorting of different colored objects can be done by using camera, but here in this project deals with sorting of both different colored objects and different size objects with the help of advanced color sensor TCS34725FN.

Design of Proposed Hardware System

With the advancement of technology, we can overcome above drawbacks we are going this proposed method. In this method we control robot direction by using color sensor input, like move front, back, left,

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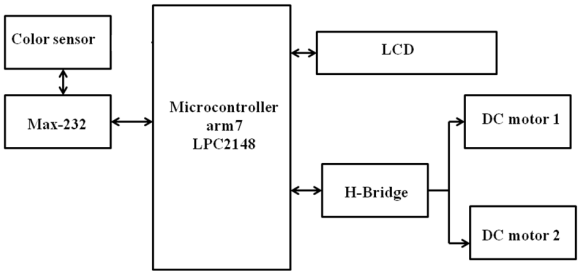


Fig.1.Robotic Section Block diagram

It is built around ARM Technology, in which using LPC2148 controller is based on a 16/32 bit ARM7TDMI-S™ CPU. By using GPIO pins of the controller we can receive the signals getting from the color sensor and thereby controlling the motor direction and speed by using H-Bridge (L293D) and PWM technique. Here the robot changes its direction and even speed whenever it detects a particular color with in Red(R), Green (G), and Blue (B).

Here using color sensor, H-Bridge, DC motors. Color sensor is used to detect the primary colors like red, green, blue. Whenever the sensor detects the color, according to the color it takes sharp turning like forward, right and left. H-Bridge is used to control the directions of motor. Here, uses 2 two DC motors to rotate the robot. These two are the major components to construct the path finding and speed control of robot.

The speed of the robot can be controlled by using PWM technique. A pulse width modulator (PWM) is a device that may be used as an efficient DC motor speed controller.

Board Hardware Resources Features

Color Sensor

Color sensor detects the color of an object by comparing with a taught in reference color. They generate a switching signal when both colors match within a specified tolerance range. Any color can be separated or combined into three primary colors Red, Green and Blue. The detected color is identified as amount of three primary color values namely Red, Green& Blue with 8 bit accuracy for each primary color. The major components of this sensor include a High glow Red LED and a photodiode The LED emits high intensity red light when current flows through it. If the emitted light of LED falls on any bright surface it is reflected back to the photo diode. example Red apples reflect red light but absorb green light whereas Green apples reflect green light but absorb red light. Photo diode is a device which is able to detect the light intensity and convert it to a corresponding electric current. Other devices present in the board read the electric current generated from the photodiode and convert it to a logic voltage level which is either logic-0 or logic-1

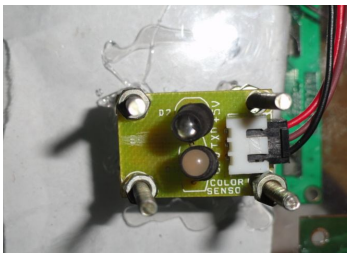


Fig.2.color sensor

H-Bridge

An H-bridge is an electronic circuit which enables DC electric motors to be run forwards or backwards. These circuits are often used in robotics. The H-Bridge arrangement is generally used to reverse the polarity of the motor, but can also be used to 'brake' the motor. The switching property of H-Bridge can be replaced by a Transistor or a Relay or a MOSFET or even by an IC. It is replacing this with an IC named L293D as the driver of DC motor. The Features of L293D driver are 600mA Output Current Capability, 1.2A Peak Output Current (non repetitive), Per Channel and Enable Facility, Over temperature Protection, Logical "0" Input Voltage Up To 1.5 V and High Noise Immunity and Internal clamp Diodes.

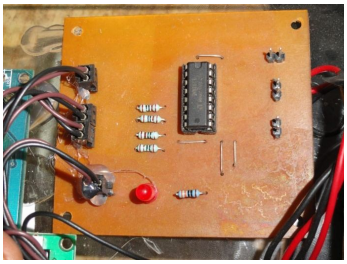


Fig 3 L293D H-Bridge

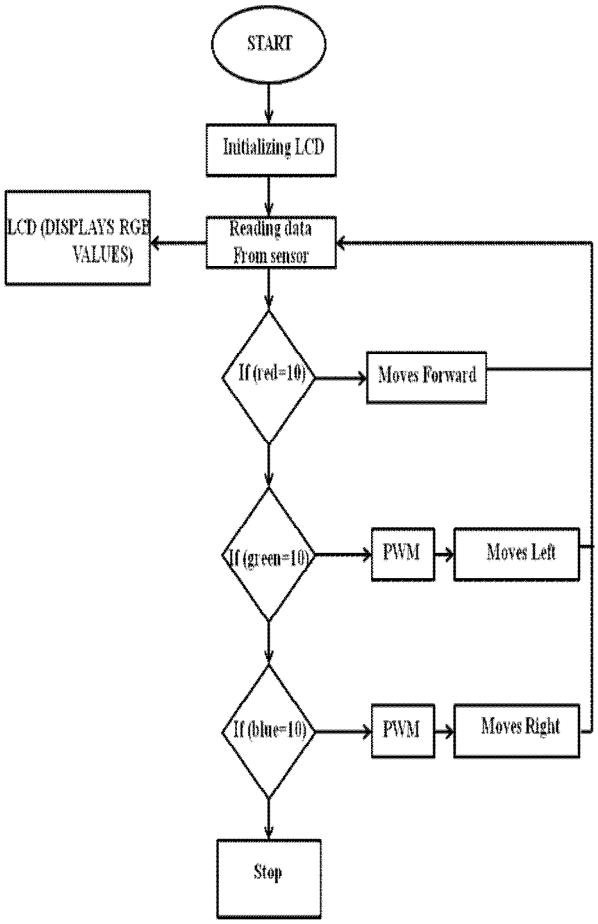
The **LPC2148** are based on a 16/32 bit ARM7TDMIS™ CPU with real-time emulation and embedded trace support, together with 128/512 kilobytes of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB PORT,PWM channels and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of sale. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

MAX-232:

The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage converter. The MAX232 has a successor, the MAX232A. The ICs are almost identical, however, the MAX232A is much more often used (and easier to get) than the original MAX232, and the MAX232A only needs external capacitors 1/10th the capacity of what the original MAX232 needs.

FLOWCHART:



Working Procedure:

The color sensor signal sends to the microcontroller. The program in the microcontroller generates necessary signals to the IR driver unit thereby adjusting the pulse width of the PWM waveform to achieve the desired speed and to the H-Bridge to control the directions of the motor. The microcontroller also sends signals to the LCD interface that indicates the values of color, and direction on the LCD screen.

RESULT

Fig 4: The red colour is sensed by the robot

Fig 5: The blue colour is sensed by the robot

Fig 6 The green color is sensed by the robot

CONCLUSION

The present work when implemented provide good re-search knowledge on robotics modeling and embedded based control hardware and software implementation provides an easier access to exercise robot manipulation using the functionalities and programming abilities of the real robots for mounting different industrial applications. The objects with different color can be determined by using advanced color sensor. It reduces the time and cost of investment is also very low as compared to other robots.

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