Development of Intelligent Line Follower's Robot

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Abstract: Now-a-days, every robot is done with the help of the microcontroller& hence the circuit is too big and tough to understand. For the reason, this intelligent line follower's robot is developed with simple concepts. This robot is a black line or path follower robot using microcontroller that detects and follows the black road drawn on white background. The path must be in a visible black line on a white surface.

To study the theory of the "Black path follower using microcontroller" go through the further pre –ference theory.

Keywords: **robot, microcontroller**

I. INTRODUCTION

The Swarm Robot is a complete, high-performance mobile platform featuring two gear motors, five reflectance sensors, two IR Cube detector sensors, two LED's, and two user pushbuttons, all connected to a C - programmable Atmega16 AVR microcontroller. A line follower robot is the black line or road drawn on white background or surface.

As these robot is developed using microcontroller ATMEGA16A. It has two sensors of IR to detect black road on the white background.

1. What is a line follower?

Line follower is a machine that can follow a path. The path can be visible like a black line on white surface or it can be invisible like a magnetic field.

2. Why build a line follower?

Sensing a line and maneuvering the robot to stay on course, while constantly correcting wrong moves using feedback mechanism forms a simple yet effective closed loop system.

As a programmer you get an opportunity to 'Teach' the robot how to follow the line thus giving it a human like property of responding to stimuli.

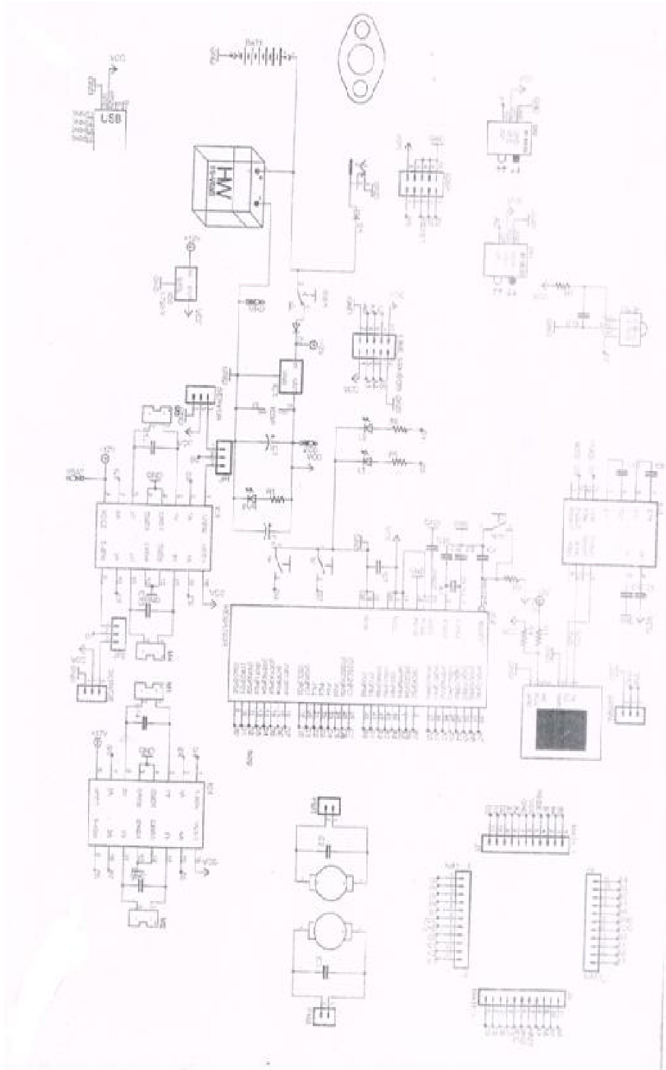
Line follower is a robot which is done by using microcontroller.

3. What is robot?

As a such no formal definition Research Engineers at Robotic companies Came up with the under mentioned Definition.

"An electrical or mechanical, programmable Multifunctional manipulator designed to move material, Parts, tools or specialized devices through various Programmed motions for the performance of a variety Of tasks."

II Overview- Block Diagram



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III HARDWARE

1 Power Supply

In the usual battery powered servo motored robot power supply, the current comes from the battery through a voltage regulator and into the processor and other electronics. The voltage drop across the regulator is the battery voltage minus whatever is needed by the electronics.

Finally, the required voltage is given to all by the regulated power supply. We need power supply less than 12v.

2 Sensors

The use of *sensor* in robots has taken them into the next level of creativity. Most importantly, the sensors have increased the performance of robots to a large extent. It also allows the robots to perform several functions like a human being. The robots are even made intelligent with the help of Visual Sensors (generally called as machine vision or computer vision), which helps them to respond according to the situation.

The Machine Vision system is classified into six sub-divisions such as Pre-processing, Sensing, Recognition, Description, Interpretation, and Segmentation.

3 LED:

A **light-emitting diode** (**LED**) is a semiconductor light source. LEDs are used as indicator lamps in robot kit and are increasingly used for other lighting. An LED is often small in area (less than 1 mm^2).

IC1 contains an infrared LED and a phototransistor. The LED emit invisible infrared light on the track and the phototransistor works as a receiver. Usually, black colored surface reflects less light than white surface and more current will flow through the phototransistor when it is above a white surface. When a reflection is detected (IR light falls on the phototransistor) a current flows through R2 to ground which generates a voltage drop at the base of T1 to make it conduct. As a result, transistor T2 start conducting and the visual indicator LED(D1) lights up. Capacitor C2 works as a mini buffer.

After construction and installation, the scanner needs to be calibrated. Initially set P1 to its mechanical center position and place the robot above the white portion of the track. Now slowly turn P1 to get a good response from D1. After this, fine tune P1 to reduce false detection caused by external light sources. Also ensure that the LED remains in off condition when the sensor module is on the black area. Repeat the process until the correct calibration is achieved.

The red colour LED (D1) is only a visual indicator. You can add a suitable (5V) reed relay in parallel with D1-R4 wiring after suitable alterations to brake/stop/redirect the robot. Similarly, the High to low (H-L) transition at the collector of T2 can be used as a signal to control the logic blocks of the robot. Resistor R1 determines the operating current of the IRLED inside IC1. The sensing ability largely depends on the reflective properties of the markings on the track and the strength of the light output from IC1

4 Two DC motor:

Motors convert electrical energy into mechanical energy through the use of electro-magnetic fields, and rotating wire coils. When a voltage is applied to a motor it outputs a fixed amount of mechanical power. The mechanical power is seen as the motor's output (usually some shaft, socket, or gear), spinning at some speed with some amount of torque.

5 Two wheels:

Two wheeled robots are harder to balance than other types because they must keeping moving to maintain upright. The center of gravity of the robot body is kept below the axle, usually this is accomplished by mounting the batteries below the body. They can have their wheels parallel to each other, these vehicles are called dicycles.

To balance, the base of the robot must stay with under its center of gravity. For a robot that has the left and right wheels, it needs at least two sensors. The previous methods would require either 2 motors, since they require 2 output axles with independent speed and direction of rotation.

MICROCONTROLLER (ATMEGA16A)

Description:

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieve throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators ,and evaluation kits.

What is TCRT sensor?

The TCRT-LFSM–Digital sensor is used as a as line sensor, but it can be used as a general-purpose proximity or reflectance sensor. The module consists of 5 IR emitter and receiver (phototransistor) pairs each phototransistor. Theses high performance TCRT sensors IRLEDs emits IR light and phototransistor receive that IR light after reflection. TCRT gives out different analogue voltage for different color and distance.

Then comparator will give digital output that is either Logic "High" Vcc or Logic "Low" GND. 5 sensors mounted in such a way that it can be directly used for line following and grid navigation. On board LED indicator helps user to check status of each sensor with open eyes without using any additional hardware.

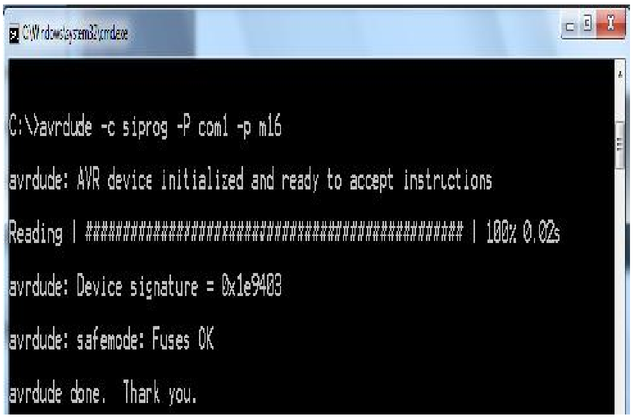
How to use?

A serial cable with a DB-9 type connector is required to establish the connection on the computer side, while a FRC cable is required to establish the connection on the computer side. After successfully connecting the following cables, the setup is now ready for programming the AVR Board.

On the computer, open Command Prompt (Start → Run → type — cmd—). In the Command Prompt window type the following as written below:

avrdude –c siprog –P com1 –p m16

Shown below is the image of the response after the programmer is successfully connected with the main AVR board



Here,

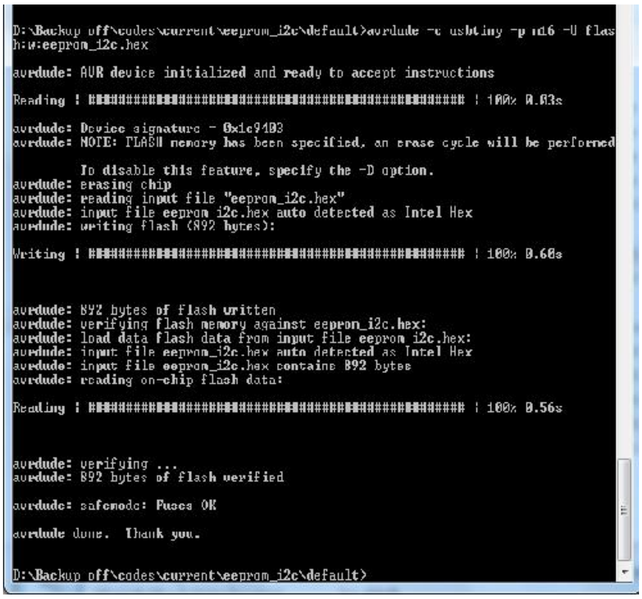
com1 —> indicates the Communication port on which your serial cable is connected.

m16 —> indicates atmega16 device

After successfully achieving the previous result, follow the steps below to burn your first program into the Micro-controller. You will have to go to the folder where your code hex file is saved.

In the Command Prompt window type the following as written below :

avrdude–c siprog –P com1 –p m16 –U flash:w:your_hex_filename.hex



IV CONCLUSION

By creating the line-following robot, we learned the basics of energy flow and exactly what building a circuit entails. We found out how voltage is potential energy, and how wires can run in series or in parallel depending on how many points the wires share. We understood the purpose of resistors, to transform excess energy into heat, and we discovered the function of transistors, the comparator, variable resistors, photo resistors, headlights, diodes, motors, and light emitting diodes (LEDs). We came to the conclusion that because we used less power than the robot built by David Cook, we could use less resistance.

After getting a working circuit, we were able to test different configurations and the extent of the robot's ability to follow a course.

V REFERANCES

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