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Robot Drawing Vehicle

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ABSTRACT:

This paper presents designing of the Robotic Drawing Vehicle. Robotic drawing vehicle is a three-wheel robot car. It contains servo motor, two stepper motor drive wheels and a ball caster wheel. It can draw its own movement tracks on the surface.

Robotic drawing vehicle is a robot that draws using stepper motors to make precise shapes on paper, combining the precision of a computer-controlled motor with the analog quality of a marker. Hear we used G code converter software for drawing image on paper or table. G code converter software is the software designed for robotic drawing vehicle.

After installing the G code converter software, you can import images that you wish your robot to draw. It can import different format picture in PC, and then control robotic drawing vehicle to draw the picture.

The usage of the software is not complex, basically is mouse operates and import picture and drawing also are one-click task.

INTRODUCTION

EMBEDDED SYSTEM

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, sometimes with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use.

Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

LITERATURE SURVEY

The two wheel drawing robot is a very popular project in the fields of robotics and control engineering.

Therefore is a lot of work that has been done and more work is still been done on a two wheeled drawing robot. Some of the work done on the two wheel balancing robot includes; Nbot by David Anderson, Joe le-Pendule by Felix Grasser et.al, Legway by Steve Hassenplug, Equibot by Dan Piponi and the Segway by Dean Kamen. There are many more projects that have been done on balancing a two wheeled robot that I have not covered in my literature review. The Nbot uses a total of four sensors to measure the states of the

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system. These sensors include the optical encoders on the motors to measure position of the robot and three other sensors to measure the tilt angle and it's rate of change. The three sensors include an accelerometer, rate gyroscope and tilt sensor. The accelerometer provides a measure of the tilt angle when the rate of change of the tilt angle is constant. This signal is obtained from twice integrating the raw signal from the sensor. The gyroscope gives a dynamic measure of the tilt angle. That is a measure when the rate of change of the angle is not constant. The signal from the rate gyro is integrated once to give the tilt angle.

Finally the inclinometer or tilt sensor measures the tilt angle.

MICROCONTROLLER

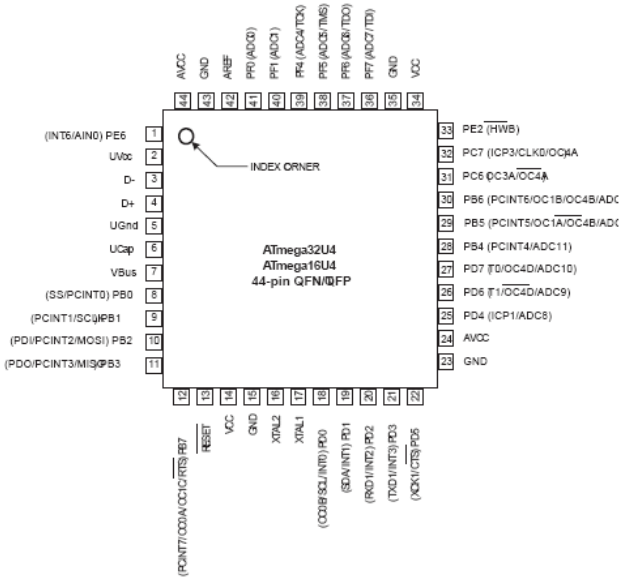
ATMEL MEGA AVR MICROCONTROLLER:

Atmel® megaAVR® microcontrollers (MCUs) are the ideal choice for designs that need some extra muscle. For applications requiring large amounts of code, megaAVR devices offer substantial program and data memories with performance up to 20 MIPS. Meanwhile, innovative Atmel picoPower® technology minimizes power consumption. All megaAVR devices offer self-programmability for fast, secure, cost-effective in-circuit upgrades. You can even upgrade the Flash memory while running your application.

Based on proven, industry-leading technology, the megaAVR family offers our widest selection of devices in terms of memories, pin-counts and peripherals. These include everything from general-purpose devices to models with specialized peripherals like Peripheral Touch Controller (PTC), USB, LCD controllers, as well as CAN, LIN and Power Stage Controllers (PSC). You will easily find the perfect fit for your project in the megaAVR product family.

All these devices are supported by the Atmel Studio development platform, which further reduces your time-to-market.

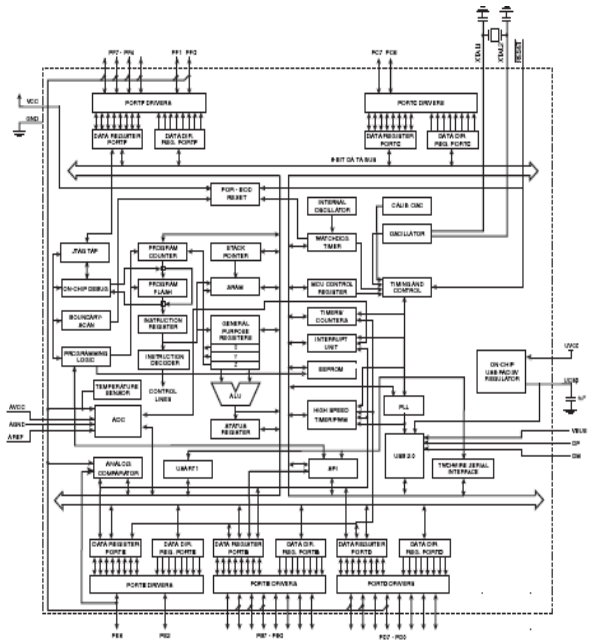
PIN CONFIGURATION:



OVERVIEW:

The ATmega16U4/ATmega32U4 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 device achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

BLOCK DIAGRAM:



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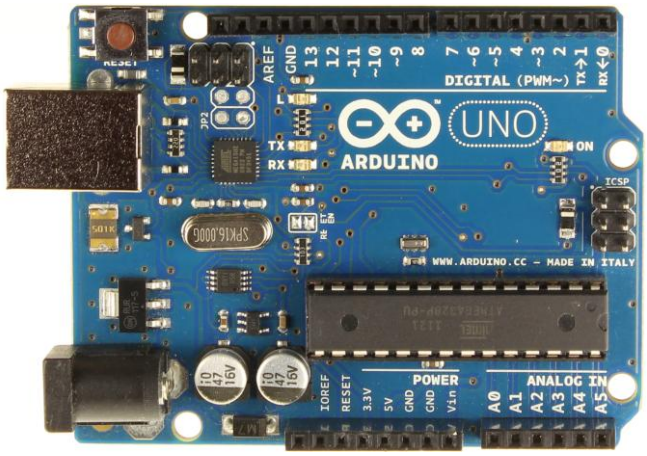
ARDUINO BOARD:

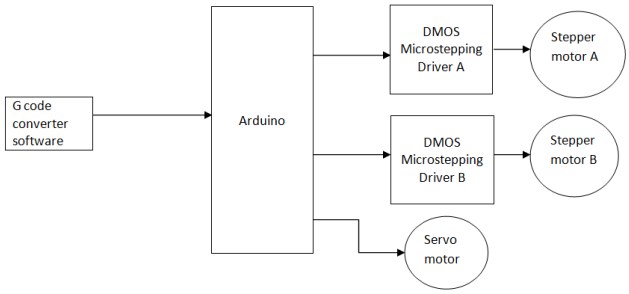
Arduino is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.



The project's board designs use a variety of microprocessors and controllers. These systems provide sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. The microcontrollers are mainly programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

HARDWARE IMPLEMENTATION BLOCK DIAGRAM:



REGULATED POWER SUPPLY

A variable regulated power supply, also called a variable bench power supply, is one where you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide.

SERVO MOTOR

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

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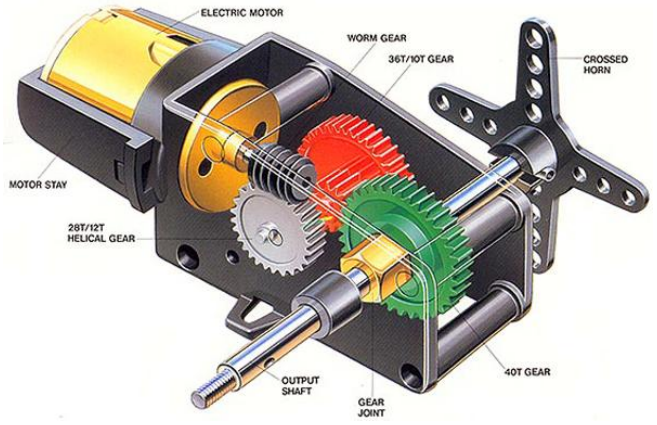


More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

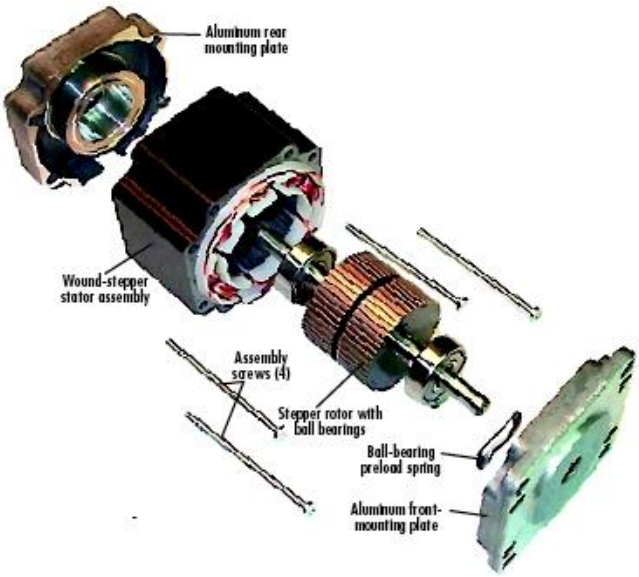
STEPPER MOTOR

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.

DC brushed motors rotate continuously when DC voltage is applied to their terminals. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.



SOFTWARE IMPLEMENTATION

ARDUINO SOFTWARE

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are:

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.

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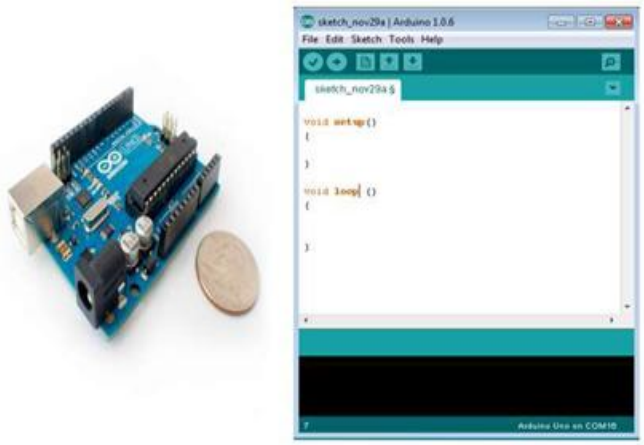
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.



WORKING PRINCIPLE

Robotic drawing vehicle is a robot that draws using stepper motors to make precise shapes on paper, combining the precision of a computer-controlled motor with the analog quality of a marker. Here we used G code converter software for drawing image on paper or table. G code converter software is the software designed for robotic drawing vehicle.

After installing the G code converter software, you can import images that you wish your robot to draw. It can import different format picture in PC, and then control robotic drawing vehicle to draw the picture. The usage of the software is not complex, basically is mouse operatesand import picture and drawing also are one-click task.

The brain of the kit is the Arduino-compatible main board with including two motor drivers. Nema17 stepper motors are used for precision in drawing and also for the ease in moving the pen holder section over the board. A 9g servo is used to lift the pen.

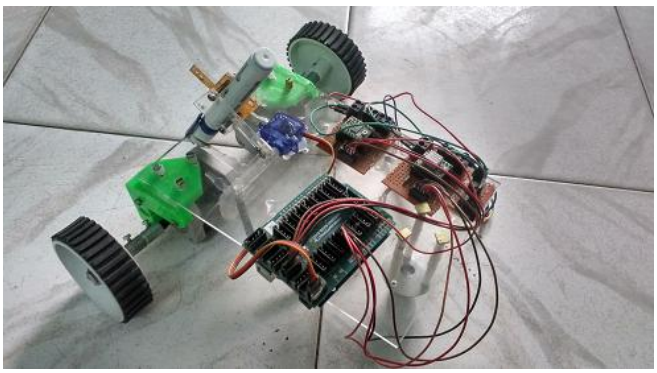
APPLICATIONS:

1. Used to draw white lines painted on the pavement indicate traffic traveling in your direction
2. Used to paint on glasses, table etc.

LIMITATIONS:

1. It draws slowly.
2. It works on less distance if we used Bluetoothrobotic vehicle

RESULTS



CONCLUSION

The project “ROBOTIC DRAWING VEHICLE” has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced IC’s and with the help of growing technology the project has been successfully implemented.

FUTURE SCOPE

Implement wireless communication from the Robots to GUI Application through the Base Station. Control up to 10 Robots from the GUI Application through the

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Base Station. Use a secured wireless channel using encryption and decryption. Consider larger bandwidth system should be onboard because video streaming service desired.

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