

Line Following Robot

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INTRODUCTION

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What is Line Follower?

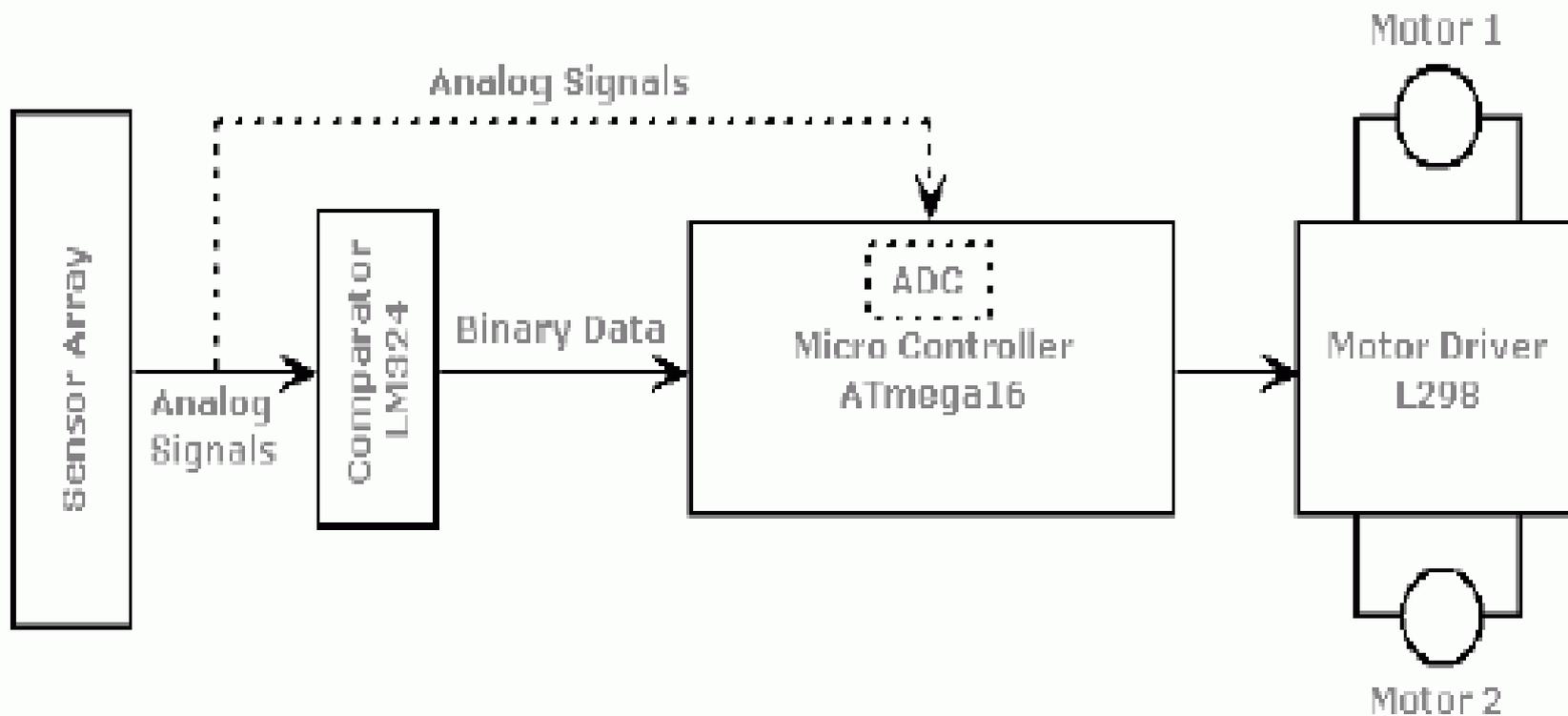
Line follower is a machine that can follow a path. The path can be visible like a black line on a white surface (or vice-versa) or it can be invisible like a magnetic field.

Why to built a Line follower?

Applications:-

Automated cars running on roads with embedded magnets(ESC electronic stability control), guidance system for industrial robots moving on shop floor etc.

BLOCK DIAGRAM



Block Diagram

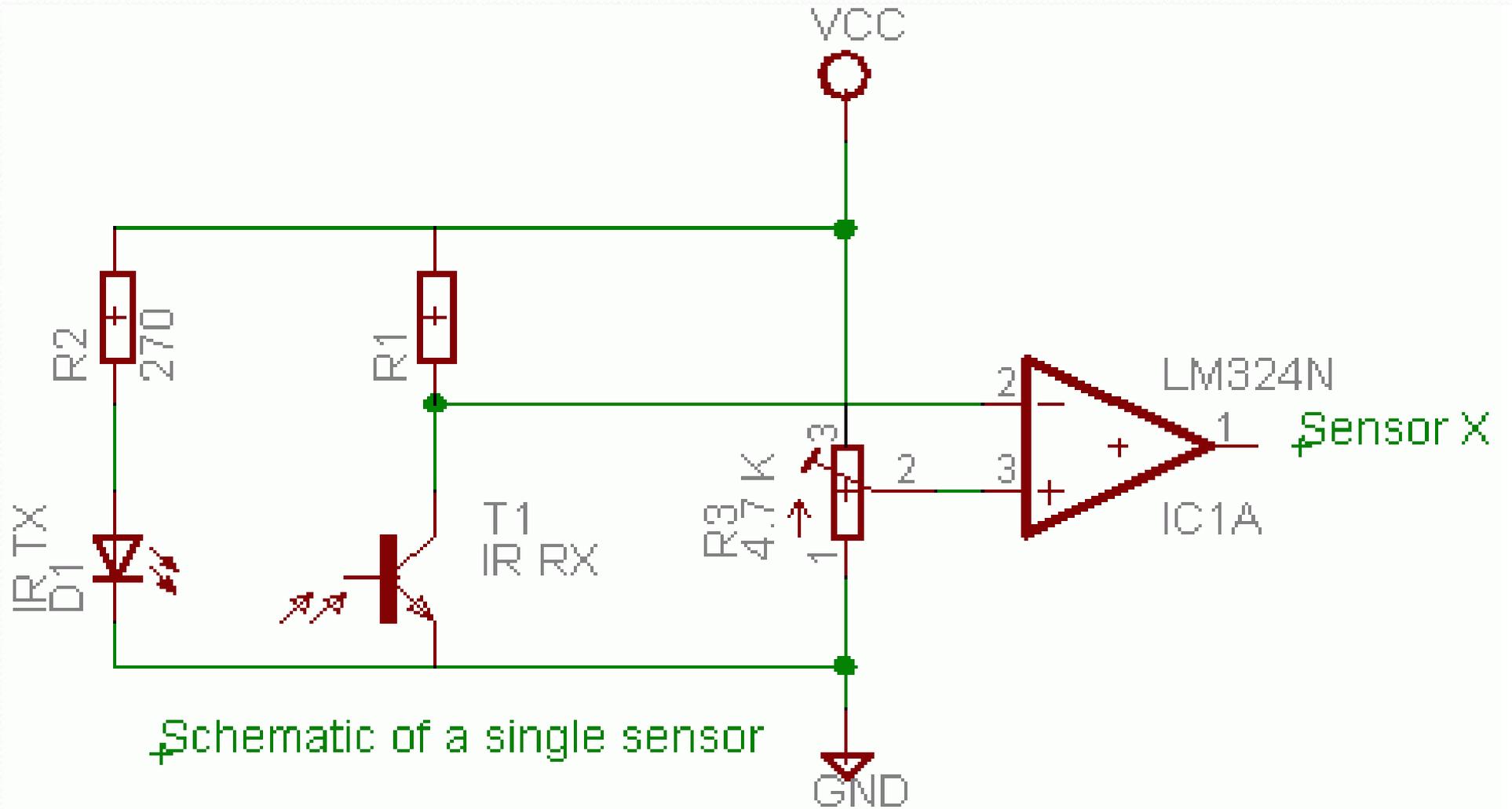
ALGORITHM

3. Move Clockwise if line was last seen on Right
Move Counter Clockwise if line was last seen on Left
Repeat step 3 till line is found.
4. Goto step 1.

COMPONENTS

- AVR SERIES MICROCONTROLLER ATMEGA16
- DUAL FULL BRIDGE DRIVER L298
- LOW POWER QUAD OPERATIONAL AMPLIFIER LM324
- THREE TERMINAL POSITIVE VOLTAGE REGULATOR 7805
- SINGLE PHASE BRIDGE RECTIFIER IC
- INFRARED TRANSMITTER RECIEVER

IMPLEMENTATION OF SENSOR CIRCUIT



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The resistance of the sensor decreases when IR light falls on it. A good sensor will have near zero resistance in presence of light and a very large resistance in absence of light.

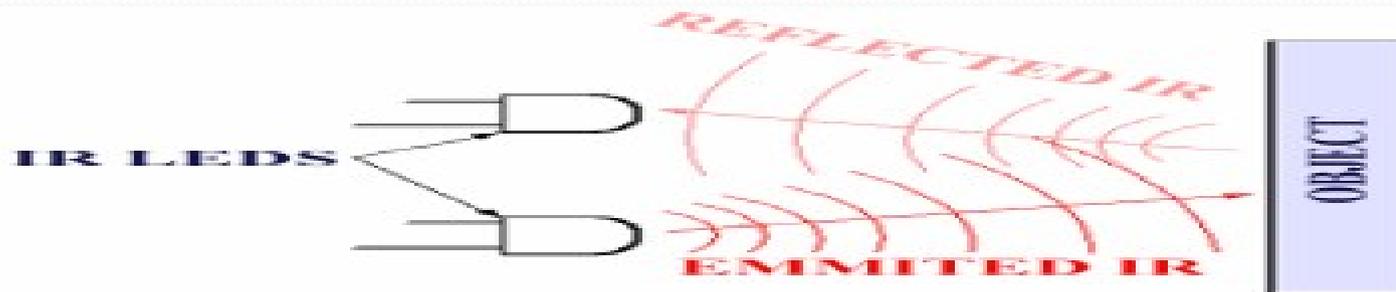
We have used this property of the sensor to form a potential divider. The potential at point '2' is

$R_{\text{sensor}} / (R_{\text{sensor}} + R_1)$.

Again, a good sensor circuit should

give maximum change in potential at point '2' for no-light and bright-light conditions.

OBJECT DETECTION USING IR

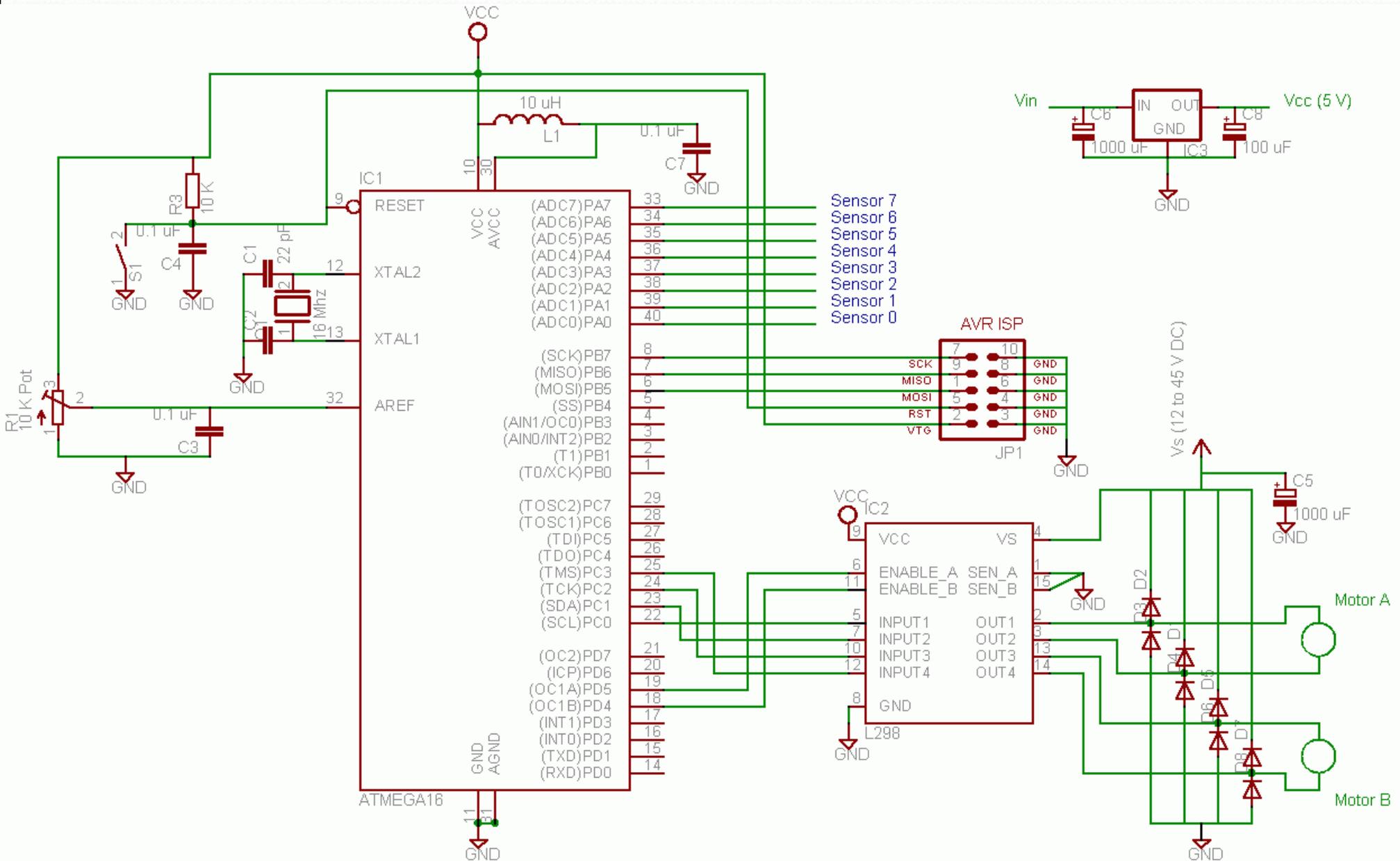


The electronic Circuit

It is the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IRLEDs, which is then reflected by any object in front of the sensor.

This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led Produce a voltage difference across its leads when it is subjected to light. As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the leds can't be in any way used to generate electrical power from light, It can barely be detected. that's why as you will notice in the schematic, we are going to use a Op-Amp (operational Amplifier) to accurately detect very small voltage changes

MOTOR INTERFACE CIRCUIT



CIRCUIT DESCRIPTION

The 8 sensors are connected to PORTA. The L298 Motor Driver has 4 inputs to control the motion of the motors and two enable inputs which are used for switching the motors on and off. To control the speed of the motors a PWM waveform with variable duty cycle is applied to the enable pins. Rapidly switching the voltage between V_s and GND gives an effective voltage between V_s and GND whose value depends on the duty cycle of PWM. 100% duty cycle corresponds to voltage equal to V_s , 50 % corresponds to $0.5V_s$ and so on. The 1N4004 diodes are used to prevent back EMF of the motors from disturbing the remaining circuit.

L298 is used as a coil driver instead of L293D L298 as it has current capacity of 2A per channel @ 45V compared to 0.6 A @ 36 V of a L293D. L293D's package is not suitable for attaching a good heat sink, practically you can't use it above 16V without frying it. L298 on the other hand works happily at 16V without a heat sink, though it is always better to use one.

PROGRAMING PART

- WRITING A CODE IN C
- COMPILING CODE USING CODEVISION AVR
- CONVERTING IT TO HEX USING CODEVISION AVR
- SIMULATION OF THE HEX FILE IN THE AVR STUDIO 4.0
- DOWNLOADING THE PORGRAMIN TO MICROCONTROLLER USING XELTEK'S UNIVERSAL PROGRAMMER



VIDEO OF PROGRAMMING AND SIMULATION PART

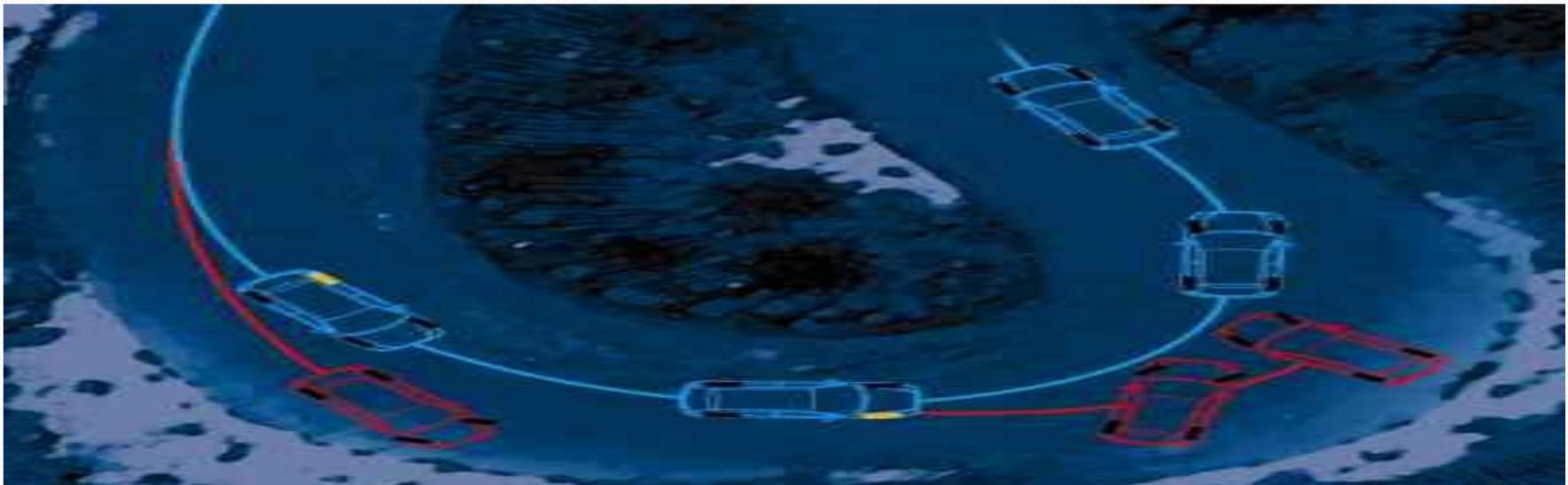


DESIGN OF MECHANICAL STRUCTURE

APPLICATION

Automated Stability control

- Much like antilock brakes work to allow the driver to steer while braking on slippery surfaces, stability control works to help the vehicle stay on its driver-intended path in turns. Sometimes a driver will enter a curve too quickly and exceed the tire's ability to hold the road through the turn. When this happens, the vehicle begins to spin or skid. Stability control pulsates the brakes of individual wheels to help "rotate" the vehicle to the driver's intended path.



- Steering wheel angle sensor : determines the driver's intended rotation; i.e. where the driver wants to steer. This kind of sensor is often based on AMR-elements.
Yaw rate sensor : measures the rotation rate of the car; i.e how much the car is actually turning. The data from the yaw sensor is compared with the data from the steering wheel angle sensor to determine regulating action.
- Numerous studies around the world confirm that ESC is highly effective in helping the driver maintain control of the car and saving lives and reducing the severity of crashes.^[3] In the fall of 2004 in the U.S., the National Highway and Traffic Safety Administration confirmed the international studies, releasing results of a field study in the U.S. of ESC effectiveness. NHTSA concluded that ESC reduces crashes by 35%. Additionally, Sport utility vehicles (SUV's) with stability control are involved in 67% fewer accidents than SUVs without the system. The Insurance Institute for Highway Safety (IIHS) issued its own study results in 2004 concluding that universal use of ESC could save 7,000 lives a year in the United States. In June 2006, the IIHS released a second study showing that up to 10,000 fatal US crashes could be avoided annually if all vehicles were equipped with ESC^[4] The 2006 study concluded that ESC reduces the likelihood of all fatal crashes by 43%, fatal single-vehicle crashes by 56%, and fatal single-vehicle rollovers by 77-80%.

APPLICATION

AGV(Automated guided vehicles)

Transbotics Corporation is a publicly held corporation specializing in tailor-made Automated Guided Vehicles (AGVs) integrated into a total automation solution.

- AGVs are driverless, computer-controlled vehicles that are programmed to transport materials through designated pickup and delivery routines within a particular facility (usually a manufacturing or distribution facility) and to transmit information concerning system status, inventory tracking, and system controls to a system controller. The Company's AGV system products and services have been used in a variety of industries, including textiles, automotive, entertainment, newspaper publishing, and electronics.

- These control products are designed to be of such general applicability as to be incorporated into many kinds of material handling vehicles. Consequently, they are used not only in custom-designed AGV vehicles and systems, but also to automate conventional material handling equipment such as forklifts and pallet jacks.
- Automatic guided vehicles can be guided between pick-up and delivery points by several methods. The traditional method is an inductive loop, called a wire guide path, which is embedded in the floor of the facility when the AGV system is installed. The vehicles in a traditional AGV system are equipped with a sensor and guidance equipment that causes them to follow the guide path. The Company promotes an advanced laser guidance technology, (LGV), that employs a rotating laser beam emitted from a vehicle to sweep the room and calculate angles to detected reflectors. The vehicle's computer uses the data gathered in this manner to determine its location and progress towards its destination. The vehicle can be rerouted remotely by computer. In most cases, laser guidance is superior to inductive loop technology because it permits the end user to alter the designated routines of AGVs without extensive reconfiguration of the facility.

RESOURCES

Atmel Corp.

Makers of the AVR microcontroller

<http://www.atmel.com>

AVRbeginners.net

<http://www.avrbeginners.net/>

AVR assembler tutorial

Tutorial for learning assembly language for the AVR-Single-Chip-Processors

ATMEL with practical examples.

<http://www.avr-asm-tutorial.net/>

One of the best sites AVR sites

<http://www.avrfreaks.net>



Basic Electronics

<http://www.kpsec.freeuk.com/>

Williamson Labs

Nice animated tutorials, articles and project ideas.

<http://www.williamson-labs.com/home.htm>

Small Robot Sensors

http://www.andrew.cmu.edu/user/rjg/websensors/robot_sensors2.html

Robotics India

An Indian site devoted to robotics.

<http://www.roboticsindia.com/>



THANK YOU !