ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

+Intelligent Robot Motion Control System for Industrial Monitoring Using Image Processing Techniques

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ABSTRACT:

The purpose of this project is to design an intelligent wheel robot, which can recognize and follow a predefined forward sign while automatically bypassing any encountered obstacle. By distributing those forward signs, the path of the robot is determined. With this concept, an image based auto pilot system with immunity against electromagnetic interference is constructed. The control system of the robot is integrated with programs of computer vision motion control. The image process program compares with the webcam image inputs with the forward signs features from training program to detect the forward sign. Once a forward sign is detected by image processing program image motion control program will rotate the robot to aim the forward sign and then move toward it. When an obstacle is detected by the ultrasonic sensors, image motion control program will launch a bypass process that means automatically the robot will take either left or right.

Index Terms:

Intelligent wheel robot, MATLAB, GUI, ultrasonic sensor.

1. OVERVIEW:

As the technology is increasing day by day even the humans are more attracted to the new technologies. The project describes the design and implementation of an intelligent robot that can detect traffic signs in real environment and perform operations accordingly. A webcam mounted on the robot captures the live images of the environment which are then processed using laptop where a simple template matching MATLAB algorithm is used for detection of the signs. Upon a successful match, an appropriate command is issued to robot. The robot is employed in this work which is modified to include sensors and computing elements

2. OBJECTIVES:

The main objective of the system is to save time.

1. It can also be implemented where we want to monitor the each and every situation.
2. It reduces the manpower.
3. It is very useful in industries for carrying loads and shows directions.
4. By placing different sensors on robot we can detect disasters.

3. METHODOLOGY:

Here in this system we are using both software and hardware mechanisms to design it. We are using electronic system also.

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In this project we have both transmitter and receiver, where the camera at transmitter side captures the live images as input and the input get processed at transmitter and sends it receiver through serial communication. The processed image is transmitted through zigbee transmitter and received at the receiver through zigbee receiver. When the receiver receives the signal the robot will move according to the captured image.

4. REQUIREMENTS OF ADVANCED USER INTERFACE VENDING MACHINE:

i. LPC2148 ARM
ii. Ultrasonic Sensor
iii. Zigbee Transmitter
iv. Power supply board
v. H-Bridge
vi. DC Motor
vii. Zigbee Receiver
viii. RS-232

LPC 2148 ARM:

An ARM processor is one of a familyof CPUs based on the RISC (reduced instruction set computer) architecture developed by Advanced RISC Machines. ARM makes 32-bit and 64-bit RISC multi core processors. RISC processors are designed to perform a smaller number of types of computer instructions so that they can operate at a higher speed, performing more millions of instructions per second (MIPS). By stripping out unneeded instructions and optimizing pathways, RISC processors provide outstanding performance at a fraction of the power demand of CISC (complex instruction set computing) devices.

Fig 1.1 LPC2148 ARM7

ULTRASONIC SENSOR:

Ultrasonic sensor are ultrasonic transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers. Many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in radar and sensory systems, which evaluate attributes of target by interpreting the echoes from radio or sound waves, respectively.

Fig 1.2 Ultrasonic Sensor

ZIGBEE TRANSMITTER:

It is a type of technology which requires ultra low power consumption with an excellent battery life ranging from moths to years. As we know that there is no. of appliances in the present era which are remote control and often these devices need large number of batteries to be provisioned. In this technology maximum data rates allowed for different frequency bands but in some cases these bands are fixed.Transmits up to 1024 I/O Values through ZigBee Wireless Link.range of freq inputs to 250kHz.

Fig 1.3 ZIGBEE

POWER SUPPLY BOARD:

The power is supplied to components which are used in the circuit and micro controller uses 5v and other modules require 12v.

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H-BRIDGE:

This device is a monolithic integrated high voltage, high current four channel driver designed to accept drive inductive load such as relays solenoid and DC and stepping motors and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate input is provided for the logic allowing operation at a lower voltage and internal clamp diodes are included. The device is suitable for use in switching applications at frequencies up to 5kHz. The L293D is assembled in a 16 lead plastic package which has four centre pins connected together and used for heatsinking.

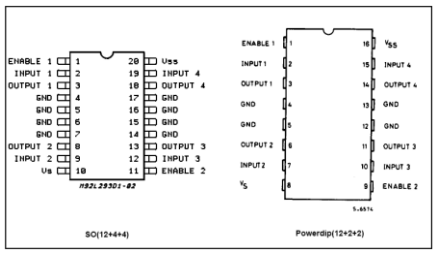

Fig 1.4 Pin Diagram of H-Bridge

Fig 1.5 L293D

DC MOTOR:

Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, Commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets[1]. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commentator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the Commutator.

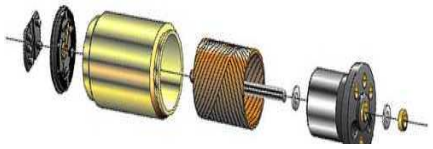

Fig 1.6 DC Motor

RS-232 OR USB:

Traditionally all PC's had a serial port in the back.However, now they are being replaced by USB ports. "Serial ports" take many forms.For example the XBee modems create a wireless serial link.Many laptops don't have a serial port – just USB ports. USB to Serial Converters or Bluetooth Connections can function as "virtual serial ports", meaning that once set up correctly MATLAB just view them as additional serial ports.

5 WORKING PRINCIPLE:

Here we have transmitter to transmit data whereas receiver receive data and the robot moves according to the received input.

TRANSMITTER:

The Transmitter side requires a Web Cam, Laptop, RS-232 for Serial Communication, and one ZigBee Transmitter for Wireless Communication. The software used at the Transmitter side is MATLAB for Image Processing. Using GUIDE a MATLAB tool used to design the GUI. GUI is created using drag and drop method and the remaining program has to be written where ever the execution is achieved. By using that program we will do image processing for image acquisition, segmentation, bound tracking, correlation and ect.

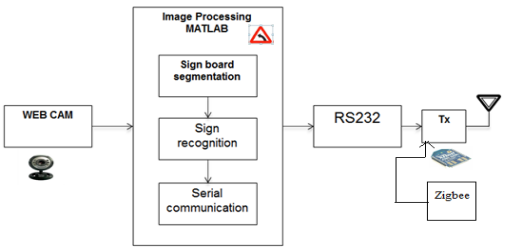

Fig1.7 Block Diagram of the Transmitter

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RECEIVER:

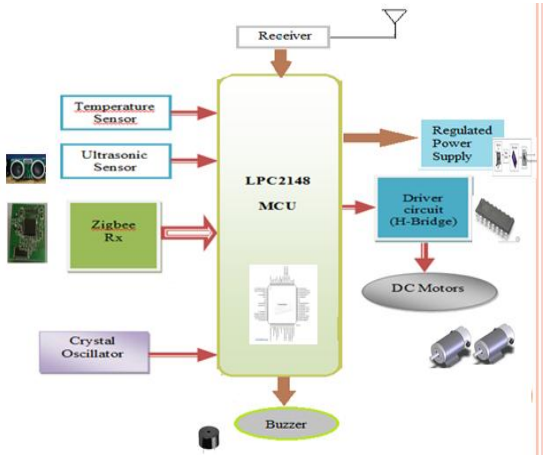
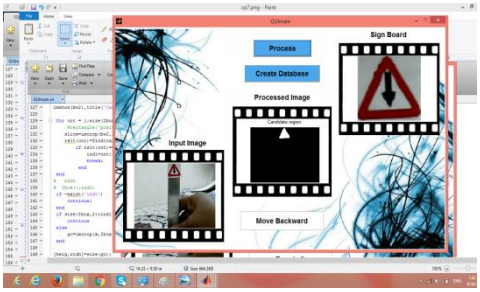


Fig1.8 Block Diagram of the Receiver

The receiver unit placed in the other section receives the commands wirelessly and sends to the microcontroller. According to the instruction which is sent wirelessly from transmitter the motors will rotate and the robot will move. To implement the commands we use MATLAB software at Transmitter side and Keil software at Receiver side. For data transfer from MATLAB programming to Control unit we use USB or RS-232 and receiving section we use Zigbee transmitter and receiver. Experimental results will be carried over motors connected using Zigbee receiver.

6 RESULTS:

Transmitter:



Receiver:

We can observe that transmitter and receiver having components such as

i. Ultrasonic Sensor
ii. Zigbee Transmitter
iii. Power supply board
iv. LPC 2148 ARM
v. DC Motor
vi. H-Bridge
vii. Zigbee Receiver
viii. Serial Port
ix. Graphical User Interface on laptop.

Here camera will capture the Traffic Signs while the robot is moving then captured sign is compared with the signs which are already stored in Data Base. At Transmitter side MATLAB Software is used for capturing the input, red colour detection, segmentation, cropping, matching and etc. When we run the program using MATLAB Software at Transmitter Side here we get GUI (Graphical User Interface) main page which is already designed using MATLAB. The image processed image is sent to Zigbee transmitter and received through Zigbee receiver and the received input is given to controller through program. According to the processed image the wheel robot will move.

7 CONCLUSIONS:

In this paper, an efficient approach for the detection and recognition of road sign have been proposed, and tested on real life video. The detection stage utilizes a robust method of colour segmentation by employing the colour space. A template matching technique has been proposed for shape classification of all possible potential road sign.

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Finally, the performance of the developed road sign recognition system has been evaluated extensively through various tests on real life- video captured with a vehicle-mounted camera. The- experimental results have shown that the proposed method is fast and accurate.

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