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Traffic Sign Recognition Robot Using Matlab

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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 rotation of the robot for automatic target detecting is achieved by using image processing.

The experimental results showed that the robot could successfully detect forward sign and response properly. Simply redistributing the recognizable signs by the robot, a new path for robot is constructed. The robot will take different signs like left, right, forward, back ward & stop according to an image. Therefore, it has great flexibility for applications.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 towards it. Similarly for remaining signs also the image process program compares with the webcam inputs and the controller will move the robot in different directions (like left, right, backward, stop) based on image. When an obstacle is detected by the IR sensors, image motion control program will launch a bypass process that means automatically the robot will take either left or right.

The robot is drived with the processor ARM7 , where all the instructions are given through c coding and emulating in the processor.Zigbee is used as wireless communication device for the robot to act for the instructions given. A voice module is interfaced to have the voice announcement for the direction when the image get matched.

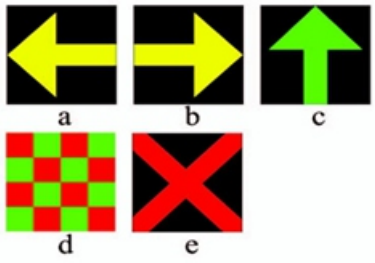
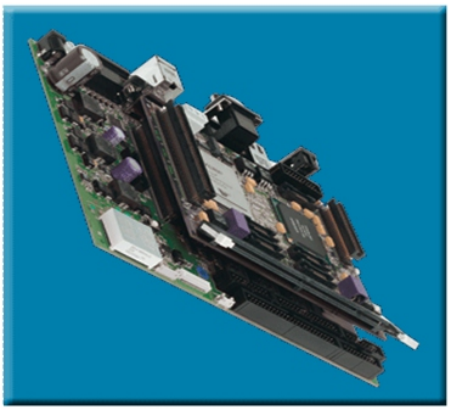


Fig. 2. Traffic lights. a) turn left, b) parking, c) follow straight ahead, d) end of trial, and e) STOP.

ARM PROCESSOR:



ARM7TDMI Processor Core:

•Current low-end ARM core for applications like digital mobile phones
•TDMI
oT: Thumb, 16-bit compressed instruction set
oD: on-chip Debug support, enabling the processor to halt in response to a debug request
oM: enhanced Multiplier, yield a full 64-bit result, high performance
oI: Embedded ICE hardware
•Von Neumann architecture

The LPC2148 are based on a 16/32 bit ARM7TDMI-S™ 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.

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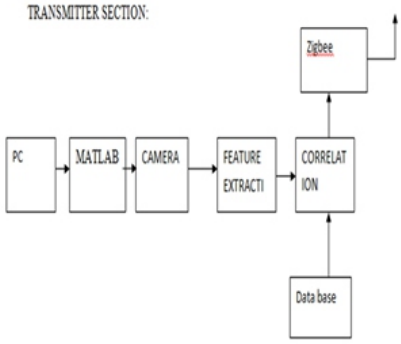
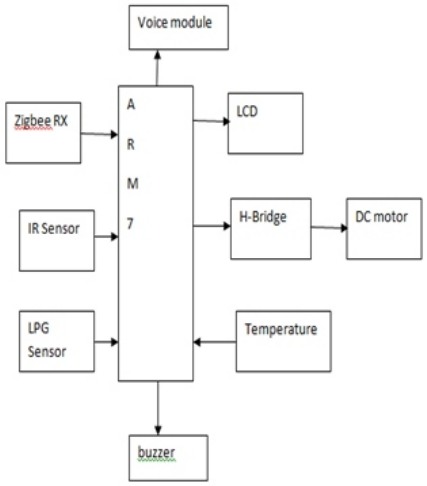
For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB The LPC2148 are based on a 16/32 bit ARM7TDMI-S™ CPU with 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.

BLOCK DIAGRAM

TRANSMITTER SECTION:

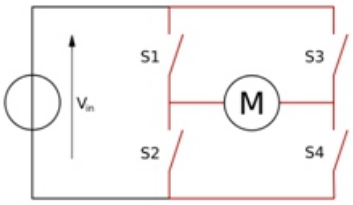


RECEIVER SECTION



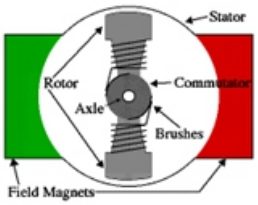
DC MOTOR:

An electric motor is a machine which converts electrical energy into mechanical energy.



Principles of operation:

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field.



As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

ZIGBEE TECHNOLOGY

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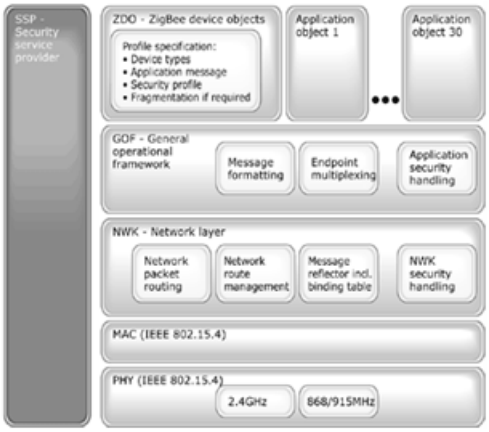
ZigBee module. The €1 coin, shown for size reference, is about 23 mm (0.9 inch) in diameter. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. The ZigBee Alliance is a group of companies that maintain and publish the ZigBee standard.

ARCHITECTURE:



ZigBee is a home-area network designed specifically to replace the proliferation of individual remote controls. ZigBee was created to satisfy the market's need for a cost-effective, standards-based wireless network that supports low data rates, low power consumption, security, and reliability. It may be helpful to think of IEEE 802.15.4 as the physical radio and ZigBee as the logical network and application software. Following the standard Open Systems Interconnection (OSI) reference model, ZigBee's protocol stack is structured in layers. The first two layers, physical (PHY) and media access (MAC), are defined by the IEEE 802.15.4 standard. The layers above them are defined by the ZigBee Alliance. The IEEE working group passed the first draft of PHY and MAC in 2003.

Applications of Zigbee:

Software consisting of MATLAB routines isdeveloped to process images from webcam for the detectionof traffic signs and communicating with microcontroller.This section describes the program modules in detail.

A. Sign Templates:

Red colored traffic signs are stored as templates in binaryform. The template database used in this study consists offour signs namely Left, Right, Slow and Stop. Captured images are processed to detect the presenceof each of these signs through the process of correlation.

B. Image Acquisition:

MATLAB image acquisition toolbox functions na mely'videoinput(adaptorname,deviceID,format)' and'FrameGrabInterval' are used to capture continuousse-quence of live images from webcam with a fixedresolution and frame grab interval. Following this,'getsnapshot(vid)' function is employed to get video framesfor further processing.

C. Image Processing:

The captured frame is an RGB image. Since the signs arered in color, the camera image is subtracted from a red-image of the same resolution for the detection of signs. Thisstep is performed using 'imsubtract' function. The resultingimage is converted into binary form using 'im2-bw' functionwhich fills the red spots in the image by ones while all othercolors are marked with zeros.A filtering operation is thenperformedto remove objects containing less number ofconnected pixels using 'bwareaopen' function. Theremaining objects in the image are labeled using 'bwlabel'function.

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D. Correlation:

The pre-processed image in above step is correlated withthe sample objects in the database. For the purpose of thecorrelation, the objects in the pre-processed image arerescaled using 'imresize' function. MATLAB function'corr2(A,B)' is then used to find similarity between thetemplates and the objects in the pre-processed image. Theimage is decalred to contain the template object if the levelof similarity returned by the function exceeds 70%.

E. Serial Communication:

A value corresponding to the detected sign is sent to the microcontroller via serial link. Serial communicationbetween the laptop and microcontroller takes place at a rateof 9600bps. A control algorithm running inside themicrocontrollers makes sure of performing the desired actioncorresponding to the received value. Figure 4 shows thesample program's flow chart.

RECOGNITION METHODS IN IMAGE PROCESSING:

Image recognition is the process of identifying and detecting an object or a feature in a digital image or video. This concept is used in many applications like systems for factory automation, toll booth monitoring, and security surveillance.

CONCLUSION:

Traffic sign detection based on color and shape is presented in this work.Color space is used for color segmentation to overcome the illumination sensitive characteristic of RGB space. The recognition rate can be improved further by increasing training data. This pre classification improves recognition rate.Hence recognition phase is easier, faster and much more efficient than training a single network for the whole set of traffic sign.

Typical image recognition algorithms include:

•Optical character recognition
•Pattern and gradient matching
•Face recognition
•License plate matching
•Scene change detection

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