VACANT PARKING SLOT DETECTION AND TRACKING USING ZIGBEE

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Abstract- *This paper introduces an intelligent parking slot detection and tracking with ARM7-LPC2148 microcontroller. The parking problem in big cities, especially the mega-cities, has become one of the key causes of the city traffic congestion. The Vacant Parking slot detection and tracking is considered to be an effective way to improve parking situation. The parking slot occupancy classification stage identifies vacancies of detected parking slots using ultrasonic sensor data. Parking slot occupancy is probabilistically calculated by treating each parking slot region as a single cell of the occupancy grid. The parking slot marking tracking stage continuously estimates the position of the selected parking slot while the ego-vehicle is moving into it. In the experiments, it is shown that the proposed method can recognize the positions and occupancies of various types of parking slot markings and stably track them under practical situations in a real-time manner. The proposed system is expected to help drivers conveniently select one of the available parking slots and support the parking control system by continuously updating the designated target positions.*

Keywords*: LPC2148, ZIGBEE, RFID READER, REFLECTION SENSORS, WIFI.*

I. INTRODUCTION

Due to the rapidly growing interest in parking aid products, automatic parking systems have been extensively researched. Target position designation is one of the primary components of automatic parking systems. This has been explored in a variety of ways that can be categorized into four types: user interface-based, free space-based, parking slot marking based, and infrastructure-based approaches. Most of the (semi-) automatic parking system products on the market designate target positions by utilizing a user interface-based approach via a touch screen or a free space-based approach via ultrasonic sensors (usually mounted on both sides of the front bumper). Once the target position is designated, the system generates a path from the initial position to the target position and autonomously controls the steering to follow the path. For this purpose, it continuously estimates the ego-vehicle position using in vehicle motion sensor-based odometry. Meanwhile, an Around View Monitor (AVM) system has become popular as a parking aid product, and most car makers have started to produce vehicles equipped with this system. An AVM system produces a bird's-eye view image for the 360◦ surroundings of the vehicle by stitching together a number of images acquired by three or four cameras. Displaying AVM images helps drivers easily recognize parking slot markings and obstacles around the vehicle during the parking maneuver. This paper proposes a vacant parking slot detection and tracking system that fuses the sensors of an AVM system and an ultrasonic sensor-based automatic parking system. The flowchart of the proposed system is presented in Fig. 1. Once a driver starts parking, the system continuously detects parking slot markings and classifies their occupancies. Simultaneously, it presents the detection and classification results on AVM images to help the driver identify available parking slots. If a driver selects a desirable parking slot using the touch screen interface, this system tracks the position of the selected parking slot while the ego-vehicle is moving into it. Finally, the parking maneuver is finished when the vehicle is located at the target position. This paper excludes path planning and steering control because they are beyond its scope.

II. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

The proposed system consists of three stages:

(1) Parking slot marking detection

(2) Parking slot occupancy classification

(3) Parking slot marking tracking.

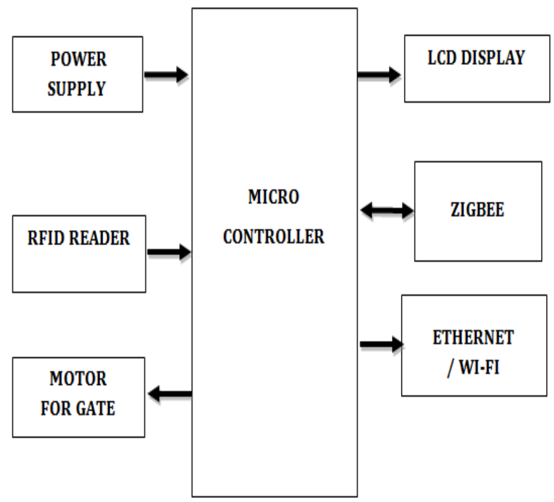

Fig 1: Security Section Block Diagram

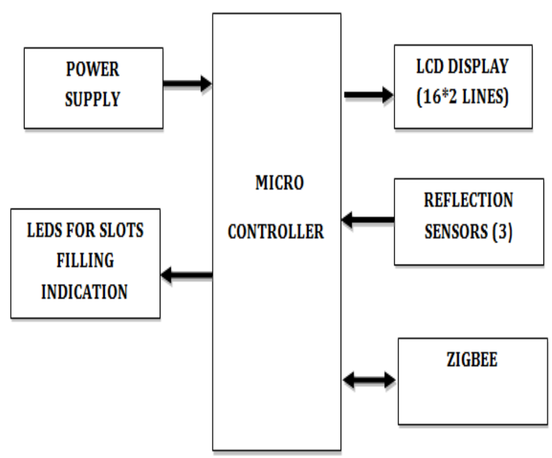

Fig 2: Parking Section Block Diagram

The parking slot marking detection stage recognizes various types of parking slot markings using AVM image sequences means It detects parking slots. The parking slot occupancy classification stage identifies vacancies of detected parking slots using ultrasonic sensor data. Parking slot occupancy is probabilistically calculated by treating each parking slot region as a single cell of the occupancy grid. The parking slot marking tracking stage continuously estimates the position of the selected parking slot while the ego-vehicle is moving into it.. After analyzing and processing the data, the information and Management center would distribute the parking information by LCD screen and displays for the drivers. And the results of the experiment show that the performance of the system can satisfy the requirements of parking guidance.

III. METHODOLOGY

RFID:

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes active and passive.

Fig 3: types of RFID Tags

Active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade. Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID(the tag's chip coordinates this process). The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.

Motor:

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings, solenoids, springs. Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

Fig 4: DC Motor

ZIGBEE Technology:

ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. 802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks.

Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. This technology allows users to set up a network quickly, and allows them to set up networks where it is impossible or inconvenient to wire cables. Wireless networks are more cost-efficient than wired networks in general. Bluetooth (802.15.1) was the first well-known wireless standard facing low data rate applications. The effort of Bluetooth to cover more applications and provide quality of service has led to its deviation from the design goal of simplicity, which makes it expensive and inappropriate for some simple applications requiring low cost and low power consumption. These are the kind of applications this new standard is focused on. It's relevant to compare here Bluetooth and ZIGBEE, as they are sometimes seen as competitors, to show their differences and to clarify for which applications suits each of them. The data transfer capabilities are much higher in Bluetooth, which is capable of transmitting audio, graphics and pictures over small networks, and also appropriate for file transfers. ZIGBEE, on the other hand, is better suited for transmitting smaller packets over large networks; mostly static networks with many, infrequently used devices, like home automation, toys, remote controls, etc. While the performance of a Bluetooth network drops when more than 8 devices are present, ZIGBEE networks can handle 65000+ devices.

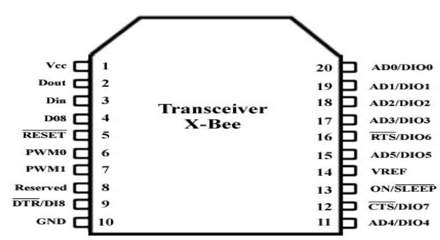

Fig 5: Pin diagram of X-Bee Transceiver

Reflection sensor:

Transmitter and receiver are incorporated in a single housing. The modulated infrared light of the transmitter strikes the object to be detected and is reflected in a diffuse way. Part of the reflected light strikes the receiver and starts the switching operation. The two states – i.e. reflection received or no reflection – are used to determine the presence or absence of an object in the sensing range.

This system safely detects all objects that have sufficient reflection. For objects with a very bad degree of reflection (matt black rough surfaces) the use of diffuse reflection sensors for short ranges or with background suppression is recommended.

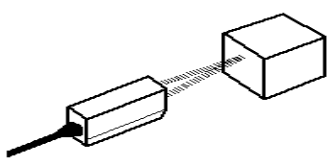

Fig 6: Reflection sensor

WIFI:

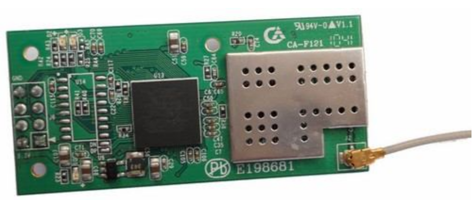

Fig 7: WIFI Module

VSD03 is the new third-generation embedded Uart Wifi modules studied by VSDTECH. Uart-Wif is an embedded module based on the Uart serial, according with the WiFi wireless WLAN standards, It accords with IEEE802.11 protocol stack and TCP / IP protocol stack and it enables the data conversion between the user serial and the wireless network module. Through the Uart-Wifi module, the traditional serial devices can easily access to the wireless network. The module supports quick networking by specifying channel number. In the usual course of wireless networking, devices would first scan automatically on the current channel, in order to search for the network (or Ad hoc) built by the target AP. This module provides working channel configuration, when the channel of the target network is known, users can specify the working channel directly, the networking time will be reduced from 2seconds to about 300 milliseconds, then quick networking is achieved.

IV. CONCLUSION

This paper has proposed vacant parking slot detection and tracking system that fuses the sensors of an AVM system and an ultrasonic sensor-based automatic parking system. This paper has presented that 1) parking slot markings can be successfully detected and tracked by fusing two off-the-shelf parking aid systems, 2) parking slot markings can be reliably detected in AVM image sequences by combining sequential detection results, 3) occupancy of parking slot can be efficiently classified by treating each parking slot region as a cell of an occupancy grid, and 4) parking slot markings can be tracked robust against severe occlusions by fusing an AVM image.

V. REFERENCES

[1] H. G. Jung, Y. H. Cho, P. J. Yoon, and J. Kim, “Scanning laser radarbased target position designation for parking aid system,” IEEE Trans.Intell. Transp. Syst., vol. 9, no. 3, pp. 406–424, Sep. 2008.

[2] J. Zhou, L. E. Navarro-Serment, and M. Hebert, “Detection of parkingspots using 2D range data,” in

Proc. 15th Int. IEEE Conf. Intell. Transp.Syst., Sep. 2012, pp. 1280–1287.

[3] S. Görner and H. Rohling, “Parking lot detection with 24 GHz radar sensor,” in Proc. 3rd Int. Workshop Intell. Transp., Mar. 2006, pp. 1–6.
[4]M.R.Schmid,S.Ates,J.Dickmann,F. undelshausen, andH. J. Wuensche, “Parking space detection with hierarchical dynamicoccupancy grids,” in Proc. IEEE Intell. Veh. Symp.,Jun. 2011,pp. 254–259.

[5] U. Scheunert, B. Fardi, N. Mattern, G. Wanielik, and N. Keppeler, “Free space determination for parking slots using a 3D PMD sensor,” in Proc. IEEE Intell. Veh. Symp., Jun. 2007, pp. 154–159.

[6] H. G. Jung, D. S. Kim, P. J. Yoon, and J. Kim, “Structure analysis basedparking slot marking recognition for semi-automatic parking system,” in Proc. Lect. Notes Comput. Sci., Aug. 2006, vol. 4109, pp. 384–393.

[7] H. G. Jung, Y. H. Lee, and J. Kim, “Uniform user interface for semiautomatic parking slot marking recognition,” IEEE Trans. Veh. Technol., vol. 59, no. 2, pp. 616–626, Feb. 2010.

[8] J. Xu, G. Chen, and M. Xie, “Vision-guided automatic parking for smartcar,” in Proc. IEEE Intell. Veh. Symp., Oct. 2000, pp. 725–730.

[9] H. G. Jung, D. S. Kim, P. J. Yoon, and J. Kim, “Parking slot markingsrecognition for automatic parking assist system,” in Proc. IEEE Intell.Veh. Symp., Jun. 2006, pp. 106–113.

[10] Y. Tanaka, M. Saiki, M. Katoh, and T. Endo, “Development of imagerecognition for a parking assist system,” in Proc. 14th World Congr. Intell.Transp. Syst. Serv., Oct. 2006, pp. 1–7.

[11] J. K. Suhr and H. G. Jung, “Full-automatic recognition of various parking slot markings using a hierarchical tree structure,” Opt. Eng., vol. 52, no. 3, pp. 037203-1–037203-14, Mar. 2013.

[12] M. Y. I. Idris, Y. Y. Leng, E. M. Tamil, N. M. Noor, and Z. Razk, “Car park system: A review of smart parking system and its technology,” Inf.Technol. J., vol. 8, no. 2, pp. 101–113, 2009.

[13] G. Yan, W. Yang, D. B. Rawat, and S. Olariu, “SmartParking: A secure and intelligent parking system,” IEEE Trans. Intell. Transp. Syst. Mag., vol. 3, no. 1, pp. 18–30, Spring 2011.

[14] Y. Suzuki, M. Koyamaishi, T. Yendo, T. Fujii, and M. Tanimoto, “Parking assistance using multi-camera infrastructure,” in Proc. IEEE Intell. Veh.Symp., Jun. 2005, pp. 106–111.

[15] M. Wada, K. S. Yoon, and H. Hashimoto, “Development of advanced parking assistance system,” IEEE Trans. Ind. Electron., vol. 50, no. 1,pp. 4–17, Feb. 2003.

[16] M. Wada, X. Mao, H. Hashimoto, M. Mizutani, and M. Saito, “iCAN: Pursuing technology for near-future ITS,” IEEE Intell. Syst., vol. 19, no. 1,pp. 18–23, Jan./Feb. 2004.

[17] K. An, J. Choi, and D. Kwak, "Automatic valet parking system Incorporating a Nomadic device and parking servers," in Proc. IEEE Int. Conf.Consum. Electron., Jan. 2011, pp. 111–112.

[18] K. Sung, J. Choi, and D. Kwak, "Vehicle control system for automatic valet parking with infrastructure sensors," in Proc. IEEE Int. Conf. Consum. Electron., Jan. 2011, pp. 567–568.

[19] V-Charge: Autonomous Valet Parking and Charging for e-Mobility. [Accessed: Mar. 2013]. [Online]. Available: http://www.v-charge.eu/

[20] Nissan-Around View Monitor System. [Accessed: Mar. 2013]. [Online]. Available: http://www.nissan-global.com/EN/TECHNOLOGY/OVERVIEW/avm.html

[21] Honda-Multi-View Camera System. [Accessed: Mar.2013].[Online].Available:http://world.honda.com/news/2008/4080918Multi-View-Camera-System

[22] BMW-Surround View System. [Accessed: Mar. 2013].[Online].Available:http://www.bmw.com/com/en/insights/technology/connecteddrive/2010/convenience/parking/surround_view_information.html

[23] Hyundai Mobis- Around View Monitoring System. [Accessed: Mar.2013]. [Online]. Available: http://www.mobis.co.kr/Eng/PR/News/View.aspx?idx=219