

A Surveillance Robot for Home Security with Docking System

P.Vanitha Sri, S.Sharmila, K.Karthik

Abstract— This paper presents a surveillance robot with automatic docking and recharging for the purpose of home security. The proposed system has a separate robotic section and docking section. The surveillance robot is a palm sized triangular shaped with three wheels and a CMOS camera. The communication between the surveillance robot and PC is through ZigBee. The image of the person is captured using CMOS camera and stored in the database as a backup. This image is compared with existing images so that the person authentication can be done. If a person arrives at the doorstep is indicated by means of using PIR sensor. This robotic system can be operated in normal as well as security mode. In normal mode the robotic system is navigated by the user, but in secure mode the robotic system is navigated automatically. The docking system is a trapezoidal structure with an arc shaped interface. This is used for automatic recharging when the battery is too low. This process is successfully done by using MATLAB software which produced accurate results.

Index Terms— CMOS camera, docking system, PIR sensor, Surveillance robot, ZigBee.

I. INTRODUCTION

Nowadays, mobile robots are used in many fields such as home security, industrial surveillance, hospitals and in many other fields. The main reason for this evolution is that the cost of producing and designing the robot is reduced to a great extent. The robots that are designed and produced reduces the human burden in many ways. Among these the home surveillance robot is widely used. This is because of lack security in the society. Each and every surveillance robot has its own working principles and methodologies.

II. LITERATURE REVIEW

From this paper a surveillance robot using ultrasonic sensor was studied. These ultrasonic sensor was used both as receiver and transmitter sides. Whenever a human interrupts or comes near to the sensing area the transmission of ultrasonic waves is interrupted. This is checked by using majority voting mechanism [1]. Home automation makes the

Interaction between the devices perfectly. This has enabled drastic changes in the interaction between devices and the usage of devices by an uneducated person easily [2]. A recharging system for robot has been implemented using a multi level multi sensor. In this an RS 232 protocol was used to determine when to charge by connecting to the recharging station and when to disconnect from it [3]. A home monitoring system using hybrid sensors was designed using web access. This hybrid node was stable and provides a forever home monitoring of home appliances [4]. A speech recognizing robot was developed for home monitoring. In this the person speech is recorded and then it is compared with the existing voice notes. If the voice notes are matched, then the person is allowed inside, otherwise they are not allowed [5]. A call and come robot was designed for home monitoring. In this the robot moves to the person correctly when the name is called. The name is registered by using tri-phone model. The drawback in this method was the word error rate [6]. A docking system using an autonomous underwater vehicle was designed. This was used in aquariums for charging the robot which was used for cleaning purpose [7]. A hopping robot to climb stairs when used in home monitoring was designed. This can also roll over the floor and hop when there is any obstacle[8]. A neural network and multilayer perceptron for the purpose of home monitoring. In this the robot is trained to certain words and then the processing is done [9]. A home monitoring robot with PIR sensor and camera on the door is designed. This ensnares the image when a person arrives near the door [10]. A video surveillance robot was designed. This was a safer monitoring system because the video of the person was caught by means of video camera[11].

III. PROPOSED SYSTEM

The proposed system was to depict and implement a home surveillance robotic system using PIR sensor and CMOS camera. The communication is established by using ZigBee. Whenever a person comes near the door the PIR sensor is activated and the image is nabbed. The robot can be manipulated in two modes. One is normal mode and another is security mode. The normal mode is the mode in which the person is inside the home and navigates the robot. The navigation includes right, left, up, down, clockwise and anticlockwise movements. The navigation is done through

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certain keys on the keyboard of the device that is attached to the robot. Security mode is used when the user or the person is not at home. In this mode the robot moves automatically towards the door and captures the image of the intruder and automatically saves the image in the database for further uses. When the person arrives home the database can be checked to see who came home on that particular day. Another peculiarity of this system is the automatic charging system. Automatic charging is made possible by using docking system. The charging is enabled when the charge is reduced. The robot module moves automatically by using the docking section.

IV. BLOCK DIAGRAM

In the proposed system LPC2148 ARM processor is used. The ARM processor is connected to a power supply to provide supply to the processor. This connects the PIR sensor, ZigBee, CMOS camera, LCD display, and motors. All these have separate working principles. Whenever the ARM processor is powered up the surveillance section is powered and the surveillance process is geared up. Whenever a person hinders the doorstep the PIR sensor automatically senses the intruder and communicates to the processor through ZigBee. Once the processor receives the signal the surveillance section moves towards the door and nabs the image of the intruder. This intruder image is checked with the existing database. If the database matches, then the person is authorized person and he is allowed inside the home, otherwise the person is considered as unauthorized and the person is restricted to enter the home.

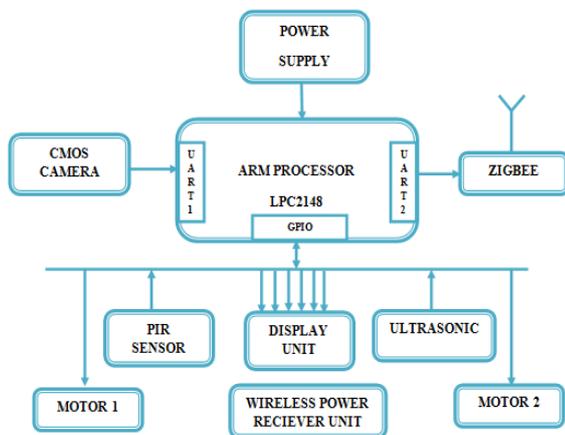


Fig.1.Block diagram

The docking section is used for automatic recharging of the robotic module. When the charge of the robotic module is reduced to a greater extent, then the robot is hooked up to the charging unit which is indicated by means of LED blinking. After sufficient charging is done the robotic module is detached from the charging unit.

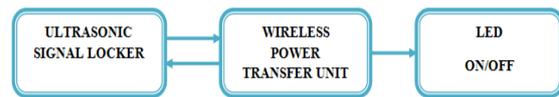
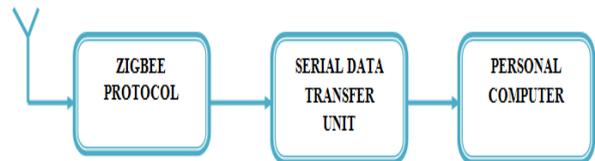


Fig.2.Docking section



The monitoring section is for the purpose of monitoring, capturing the image, checking for authorization and storing the image. The monitoring section operates differently in different modes. In normal mode only authorization is done but, in surveillance mode the storing of image in the database is done.

Fig.3.Monitoring section

V. SOFTWARE USED

The proposed system uses MATLAB as simulation software. The MATLAB software runs the code that is coded for the software part of the proposed system. This generates the output for selecting the mode of operation, navigation of robot module and to capture and store the image. Another part of the software coding is the checking if the person is authorized or unauthorized person by comparing the image nabbed and the existing images.

VI. RESULT AND DISCUSSION

The software output is as follows. The fig.4 shows the robot module mode selection, navigation of the robot in corresponding direction, port connection and capturing the image. Fig.5 shows the process of getting the input image. The input image is captured using the CMOS camera.

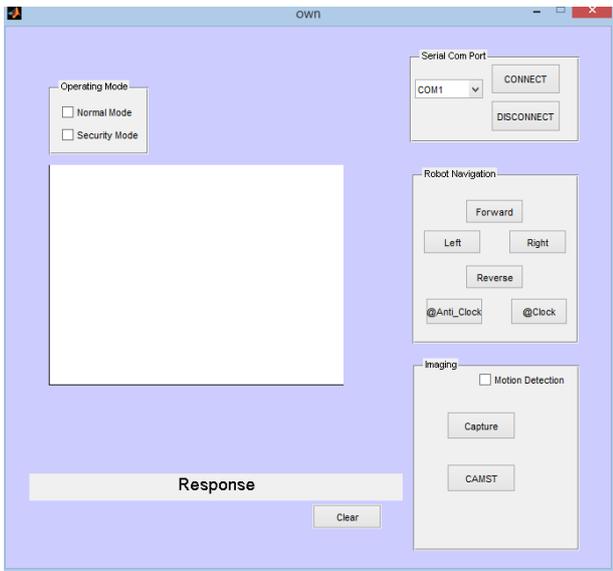


Fig.4.Screenshot of the robot module output

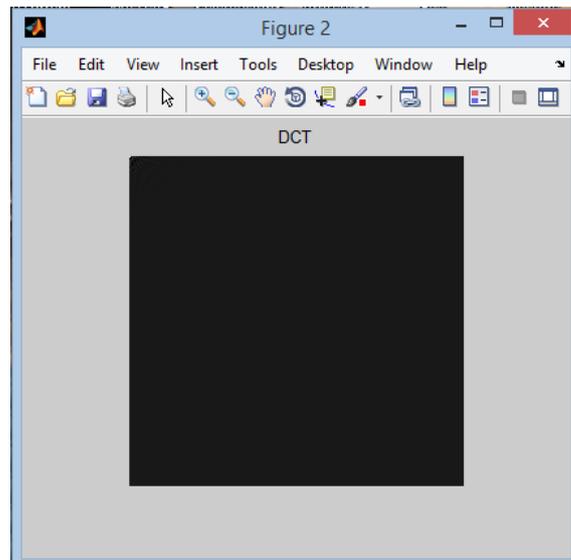


Fig.6.DCT of the input image

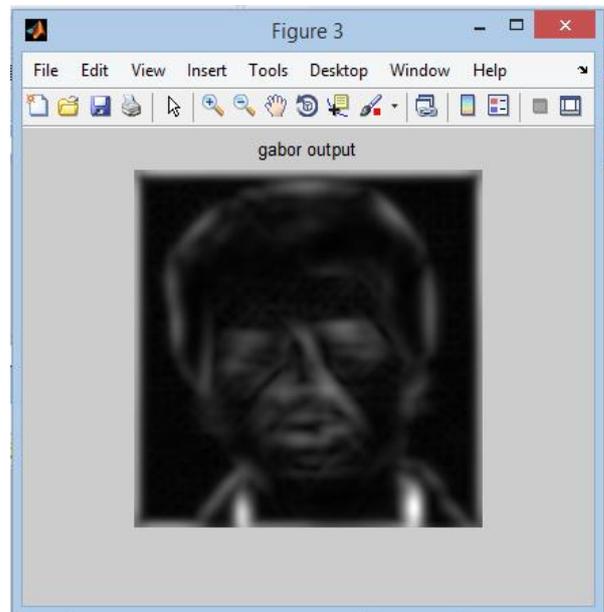


Fig.7.Gabor filter output

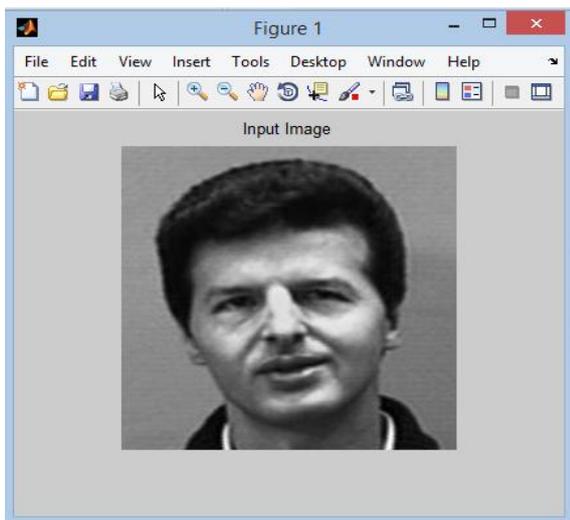


Fig.5.Input image

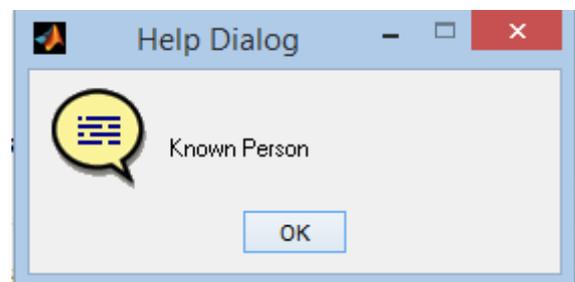


Fig.8 Dialog box for user authentication

Fig.6 is the DCT output of the input image process is carried. This is done to compress the input image because the image occupies lot of memory space. Fig.7 is the Gabor filter output. The Gabor filter is used for edge detection. This produces output which co insides the human visual system and this is peculiar for texture representation and discrimination.Fig.8 is to intimate if the person entering is authorized or unauthorized person

VII. CONCLUSION

This project produces result in such a way that it can be used for navigating the robot or else it automatically navigates in different modes. Along with this the authentication of the person entering the home is done by nabbing the image of the

person. The future scope of this project is to implement a further security by sending SMS to the user when an intruder arrives.

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REFERENCES

- [1] Design and Implementation of an Embedded Surveillance System by Use of Multiple Ultrasonic Sensors, Ying-Wen Bai, Li-Sih Shen and Zong-Han Li, vol 11
- [2] Editorial Home Automation as a Means of Independent Living, IEEE transactions on automation science and engineering January 2008, vol.5, No.1.
- [3] Multilevel Multisensor-Based Intelligent Recharging System for Mobile Robot, Ren C. Luo, Fellow IEEE, and Kuo L. Su IEEE transactions on industrial electronics, VOL. 55, NO. 1, January 2008.
- [4] A Hybrid Sensor Network System for Home Monitoring Applications Guangming Song, Member, IEEE, Zhigang Wei, Weijuan Zhang and Aiguo Song, Member, IEEE IEEE Transactions on Consumer Electronics, Vol. 53, No. 4, NOVEMBER 2007.
- [5] Text-Independent Speaker Identification using Soft Channel Selection in Home Robot Environments Mikyong Ji, Sungtak Kim, Hoirin Kim, Member, IEEE, and Ho-Sub Yoon IEEE Transaction on consumer Electronics, Vol.54, No.1, FEBRUARY 2008.
- [6] A Name Recognition Based Call-and-Come Service for Home Robots Yoo Rhee Oh, Jae Sam Yoon, Ji Hun Park, Mina Kim, and Hong Kook Kim, Senior Member, IEEE.
- [7] Docking Control System for a 54-cm-Diameter (21-in) AUV Robert S. McEwen, Member, IEEE, Brett W. Hobson, Member, IEEE, Lance McBride, Member, IEEE, and James G. Bellingham, IEEE journal of oceanic engineering, vol. 33, no. 4, October 2008.
- [8] A Surveillance Robot with Hopping Capabilities for Home Security Guangming Song, Member, IEEE, Kaijian Yin, Yaoxin Zhou and Xiuzhen Cheng, Member, IEEE, IEEE Transactions on Consumer Electronics, Vol. 55, No. 4, NOVEMBER 2009.
- [9] A Deconvolutive Neural Network for Speech Classification With Applications to Home Service Robot Donglin Wang, Student Member, IEEE, Henry Leung, Ajeesh P. Kurian, Hye-Jin Kim, and Hosub Yoon, IEEE transactions on instrumentation and measurement, vol. 59, NO. 12, December 2010
- [10] Autonomous Network Repairing of a Home Security System Using Modular Self-Reconfigurable Robots Guifang Qiao, Student Member, IEEE, Guangming Song, Senior Member, IEEE, Yali Wang, Jun Zhang, Student Member, IEEE, and Weiguo Wang, IEEE Transactions on Consumer Electronics, Vol. 59, No.3, August, 2013
- [11] Automatic Video-Based Human Motion Analyzer for Consumer Surveillance System Weilun Lao, Jungong Han, and Peter H.N. de With, Fellow, IEEE

BIBLIOGRAPHY



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