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Automatic Docking System For Surviellance Robots Using Wireless Image Transmission

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***Abstract*— An ordinary Petri-net (PN) based approach is proposed to design a programmable logical controller (PLC) that prevents collisions among vehicles in an automated guided vehicle (AGV) system. This implementation is the development and delineation of a surveillance robot with automatic docking and recharging potentiality for home security. In this system consists of two parts Warfield part and the monitoring part, in the former part consists of Passive IR motion detectors are usually contrived to provide an denotation to an alarm panel in response to detecting IR that is indicative of motion of the object. The alarm panel is sensitive to acknowledgement of the breach indication to cause an alarm condition to occur. When a person or intruder enters a monitored area, PIR motion detectors immediately will send a denotation to the monitoring part through wireless communication and indicated to the control room through alarm. The people can apprehended something happens in host part. At the same time CMOS camera keep on capturing images at the host place and saved into the computer. The security system in monitoring room got an indication to the host part by alarm through zigbee, view all information of the war field part images by PC and maneuver the weapons if the intruder were opponent persons. The robot can revert to the docking station for reload progress when the on-board battery is too low.**

Keywords—Automated guided vehicle; Petri nets; Programmable Logical Controller; Passive Infra Red; Complementorry Metal oxide Semiconductor

I. INTRODUCTION

Automated guided vehicle system (AGVS) is an efficient and flexible option for material handling in an automated manufacturing system (AMS). A programmable logic controller (PLC) is a typical sort of industrial control device used to control an AGVS. The overall design of a PLC program is experience-based, and its verification is typically done through experiments and simulations. For a simple AGVS, it is easy to write down its PLC program by heuristic methods. However, as the complexity of AGVS and control problems increases, it becomes more and more difficult to design controllers. Such methods can no longer ensure the safety and reliability of their resultant programs. Moreover, PLC programs usually need to be modified significantly when design specifications and route structures change, or hardware faults occur. Unfortunately, the modification, reuse and debugging of original programs are difficult, tedious and costly. The agile redevelopment of PLC programs is clearly desired to reduce loss when some hardware equipment is suddenly broken. To do so, their design based on formal methods is so crucial that many researchers are endeavoring to study how to narrow down the gap between PLC designs and formal methods.

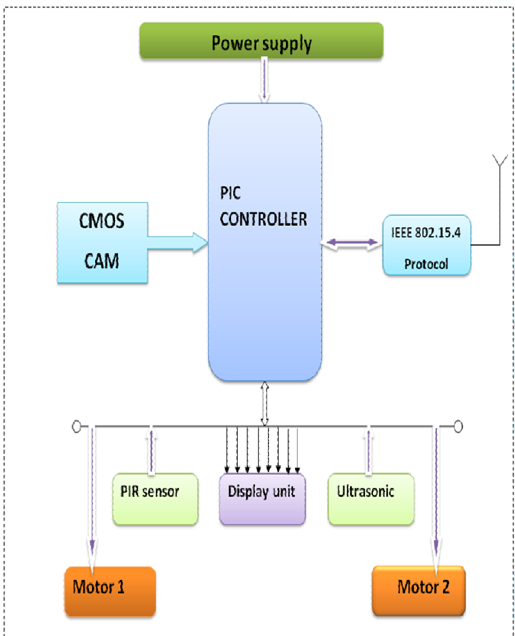
Taking into account the needs of users, home robots must exhibit some self-sustaining property. In addition to being robust in their hardware and software design, home robots must have autonomous capabilities for long duration missions. This system is designed for continuous surveillance, automatic recharging to the robot. This robotic section runs with PIC with CMOS camera with a person detection sensor and another docking section with wireless power transfer unit for recharging the robot. Communications between robot and monitoring unit are accomplished through IEEE 802.15.4.

For surveillance purpose, the path of the robot has to feed initially. This Robot will be ready to capture the image of any human who enters into robot surveillance region. This presence of human can be determined by the thermal heat radiation from the object and this interrupt will wake up the camera. In order to cover the entire room, the robot module can able to turn in various angle with manual and automatic control. Under the absence of human the processor will keep the camera in the sleep mode. The technique is followed in the project to reduce the energy consumption of robot. In this project the robotic unit can be charged using wireless power transmission method. Ultrasonic signal confirms the robot that it is in power transmission region. This paper uses the Matlab platform for the image visualization.

This work proposes a formal approach to design surveillance robots which ensures safety and reliability Moreover the programs can be changed according to the route structures or hardware faults. Also the robot can revert to the docking station for reload progress when the on-board battery is too low. In this paper, we present docking mechanisms with high error compliance, flexibility, and capability of autorecharging. The paper is structured as follows. Section II explains the mobile robot platform to which the docking system is attached. Section III describes the data flow mechanisms. The experimental investigation of the mechanism is discussed in Section IV, and the conclusions are presented in Section V.

II. SCHEMATIC DATA STRUCTURE

A. *Surviellance Section*



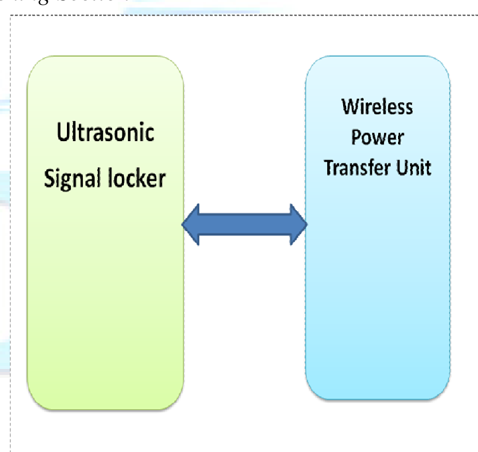
a.

Fig. 1. Surveillance Section

Here two sensors are used for sensing the objects and detecting the power consumption of the robot to the processor. An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Moving objects of similar temperature to the background but different surface characteristics may also have a different infrared emission pattern, and thus sometimes trigger the detector.

PIRs come in many configurations for a wide variety of applications. The most common models have numerous Fresnel lenses or mirror segments, an effective range of about ten meters (thirty feet), and a field of view less than 180 degrees. Models with wider fields of view, including 360 degrees, are available—typically designed to mount on a ceiling. Some larger PIRs are made with single segment mirrors and can sense changes in infrared energy over one hundred feet away from the PIR. There are also PIRs designed with reversible orientation mirrors which allow either broad coverage (110° wide) or very narrow "curtain" coverage or with individually selectable segments to "shape" the coverage.
This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications

B. *Docking Section*



b.

Fig. 2. Docking Section

A home surveillance system based on an embedded system with multiple ultrasonic sensor modules has been presented in. Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions. Signal from ultrasonic sensor is send to wireless power transmitter. Further action takes place in accordance with the signal generated.

C. Monitoring Section

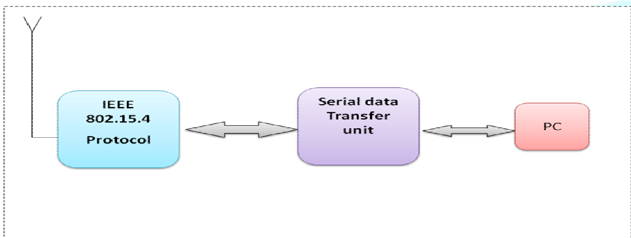


Fig. 3. Monitoring Section

IEEE standard 802.15.4 intends to offer the fundamental lower network layers of a type of wireless personal area network (WPAN) which focuses on low-cost, low-speed ubiquitous communication between devices. It can be contrasted with other approaches, such as Wi-Fi, which offer more bandwidth and require more power. The emphasis is on very low cost communication of nearby devices with little to no underlying infrastructure, intending to exploit this to lower power consumption even more.

The basic framework conceives a 10-meter communications range with a transfer rate of 250 Kbit/s. Tradeoffs are possible to favor more radically embedded devices with even lower power requirements, through the definition of not one, but several physical layers. Lower transfer rates of 20 and 40 Kbit/s were initially defined, with the 100 Kbit/s rates being added in the current revision.

Even lower rates can be considered with the resulting effect on power consumption. As already mentioned, the main identifying feature of IEEE 802.15.4 among WPANs is the importance of achieving extremely low manufacturing and operation costs and technological simplicity, without sacrificing flexibility or generality. Important features include real-time suitability by reservation of guaranteed time slots, collision avoidance through CSMA/CA and integrated support for secure communications. Devices also include power management functions such as link quality and energy detection.IEEE 802.15.4-conformant devices may use one of three possible frequency bands for operation (868/915/2450 MHz).

In telecommunications, RS-232 a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit-terminating equipment, originally defined as data communication equipment), such as a modem. The RS-232 standard is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors. The current version of the standard is TIA-232-F Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange, issued in 1997.

An RS-232 serial port was once a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterruptible power supplies, and other peripheral devices. However, RS-232 is hampered by low transmission speed, large voltage swing, and large standard connectors. In modern personal computers, USB has displaced RS-232 from most of its peripheral interface roles. Many computers do not come equipped with RS-232 ports and must use either an external USB-to-RS-232 converter or an internal expansion card with one or more serial ports to connect to RS-232 peripherals. RS-232 devices are widely used, especially in industrial machines, networking equipment and scientific instruments.

III. SOFTWARE MODULES

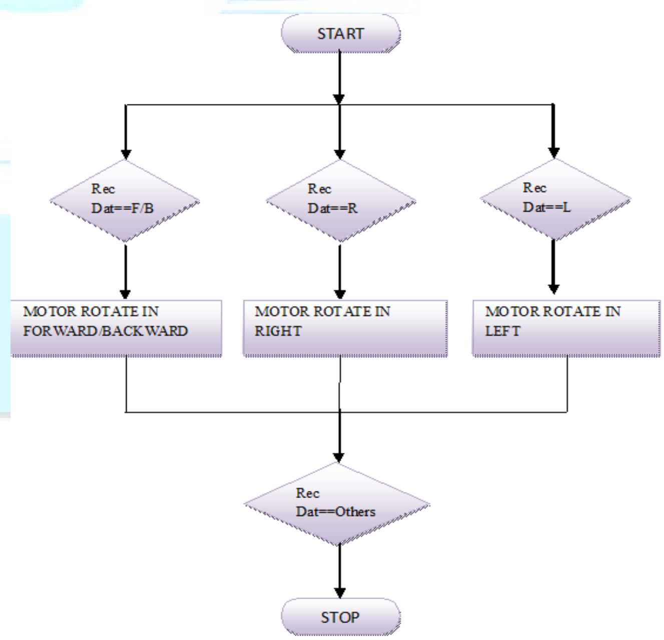


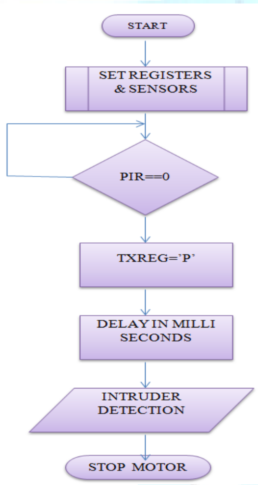
Fig. 4. Flow Diagram of Movement control

A. Movement control

d.

The movement control of the robot is controlled manually by the transmitted and received character. This work proposed for the four controlling functions, namely rotating the motor forward backward and left and right. Here the program is to control the module in forward direction by simply giving the command 'F'.The reaction would be rotation of the two wheels of the motor in forward direction. Next, the program is to control the module in backward direction by simply giving the command 'B'.The reaction would be rotation of the two wheels of the motor in backward direction.Fllowed by the program is to control the module to turn right direction by simply giving the command 'R'.The reaction would be rotation of the upper wheel of the motor turn right. Followed by the program is to control the module to turn left direction by simply giving the command 'L'.The reaction would be rotation of the lower wheel of the motor turn left.

B. Intruder Detection



e.

Fig. 5. Flow Diagram of Intruder Detection

This module shows the detection of intruder who enters into the surveillance area by the help of PIR sensors. The signals from the sensors indicates the movement of the unauthorised persons and immediately the persons image is captured in the CMOS camera also the signals is sent to the monitoring section for further action should be taken. Once the image is captured the motor stops and gets read for the further action.

C. Docking Function

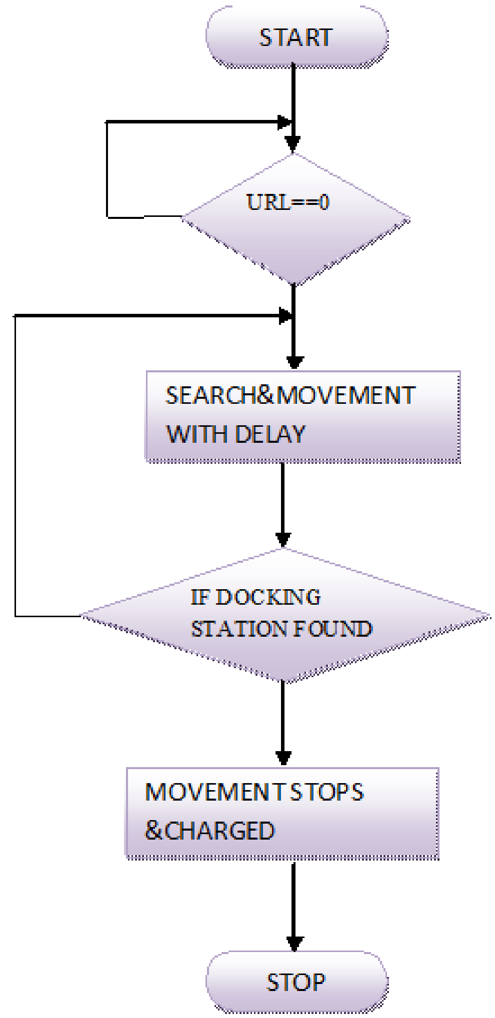


Fig. 6. Flow Diagram of Docking Function

Most important function is the automatic docking operation of the robot module. This function is performed by the sensing function of ultra sonic sensors. Once the signal is locked by the sensors automatically the robot starts searching for the docking stations by moving here and there randomly from the place where it stops. Finally it found the docking station then stops the motor and automatically gets charged and after finishing it's charging the robot module enters into the surveillance operation without any suspension.

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IV. EXPERIMENTAL RESULT

A. Movement Control

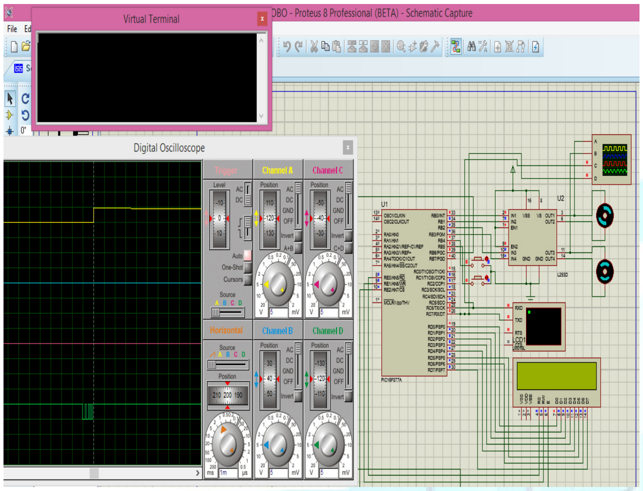

Fig. 7. Output of Robots Movements

B. Intruder Detection

f.

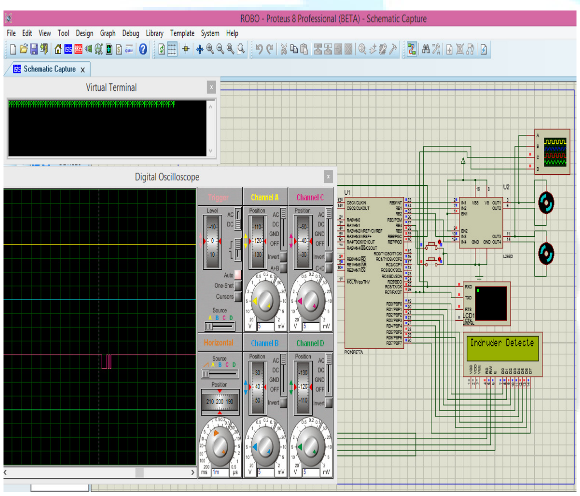

Fig. 8. Output of Intruder Detection

C. Finding Docking Station

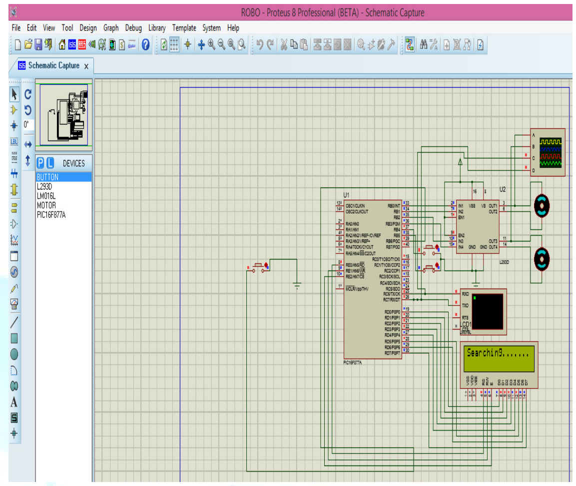

Fig. 9. Output of Searching of Docking Station

D. Charging Function

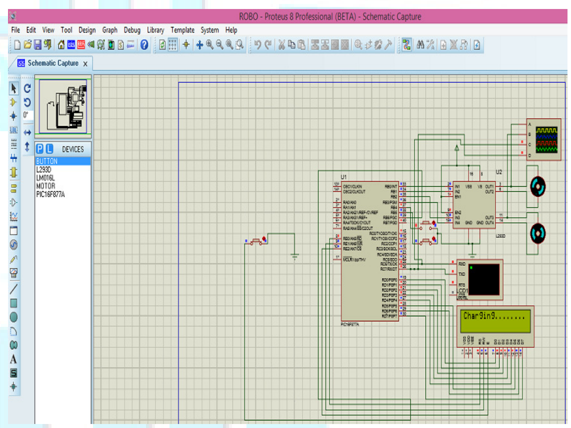

Fig. 10. Output of Charging

TABLE I. COMPARISION PLC AND EMBEDDED SYSTEM

Sl.no.	PLC	Embedded Systems
1.	Difficult to design controllers	Simple to users
2.	Modification in programs are difficult and tedious	Modification at ease
3.	Various Algorithms used	Algorithms are less
4.	In Control Hardware PN algorithm modules for sensors ,wiring loops and counters are designed in 17 steps.	All functions are in built with the registers

TABLE II. DRAW BACKS OF VARIOUS ALGORITHMS

Sl.no.	ALGORITHM	DRAW BACK
1	Control Hardware PN algorithm	Modules for sensors, wiring loops and counters are designed in 17 steps.
2.	Control Structure design algorithm1	Line alignment functions only with this algorithm
3.	Control Structure design algorithm2	Divide alignment functions only with this algorithm
4.	Control Structure design algorithm3	Merge alignment functions only with this algorithm
5.	Control Structure design algorithm4	Intersection alignment functions only with this algorithm

V. CONCLUSION

This paper presented the design and implementation of a surveillance robot with automatic docking and recharging capabilities for home security. A docking method based on the self-localization of the robot and the infrared detectors of the docking station is proposed. The robot can navigate back to the docking station for recharging operations when the on-board battery is too low. The prototype robot achieved a success rate of 90% after 60 different docking attempts. Future work will focus on improving the current prototype robot to enable more functions. The future work proposed to address several technical challenges such as visual navigation, adding more docking stations, and the automatic battery replacement mechanism.

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