Decentralized Control of Multi-AGV Navigation System in Autonomous Warehousing Applications

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Abstract: **Intelligence space is one among the emerging concept in today's world. The key idea is that devices like autonomous systems need not own all necessary sensors to stay connected. This paper examines the possible means of interconnection using sparsely deployed radio frequency identification detector tags with sonar's. The paper brings forth real time navigation experiments with a simple vehicle and is evaluated by selection criteria.**

Keywords: intelligent space, RFID tags, a fuzzy cognitive map, sensors.

I. INTRODUCTION

Computer-controlled and wheel-based, automatic guided vehicles (AGV) are load carriers that travel along the floor of a facility without an onboard operator or driver. Their movement is directed by a combination of software and sensor-based guidance systems. Because they move on a predictable path with precisely controlled acceleration and deceleration, and include automatic obstacle detection bumpers, AGVs provide safe movement of loads. Typical AGV applications include transportation of raw materials, work-in-process, and finished goods in support of manufacturing production lines, and storage/retrieval or other movements in support of picking in warehousing and distribution applications. It helps to reduce time consumption of moving the products form a place to another.

In previously RFID is the main and often the only navigation means with various improvements of RFID technology as special types of antennas and using ultrahigh frequencies or it is fused with other sensing types like sonar, compass or GPS heading to a general concept of the so-called wireless sensor network.

II. PROPOSED SYSTEM

In this paper we described about fuzzy logic is used for tag localization as well as for designing a fuzzy model of the RFID antenna. A neural network helps with classification of tag signals based on RSSI measurements. Evolutionary approaches as optimizing methods try to minimize the localization error. In correspondence with IS our approach tries to utilize a combination of IS as well as further robotic means to find a proper balance between sensors of these two groups. In future, one of the most significant criteria will be economical effectiveness of solutions, too. Our approach enables navigation also for simple devices not owning complex sensors. This work comes from our earlier papers dealing with object identification using the so-called smart floors and navigation with help of a fuzzy cognitive map (FCM). Its basic idea is based on a combination of a grid comprised of passive RFID tags for robot (vehicle) localization and sonar's for obstacle avoidance. Further, we will deal with the use of a sparse tag grid supplemented by odometer for overcoming distances between RFID tags.

III. BLOCK DIAGRAM

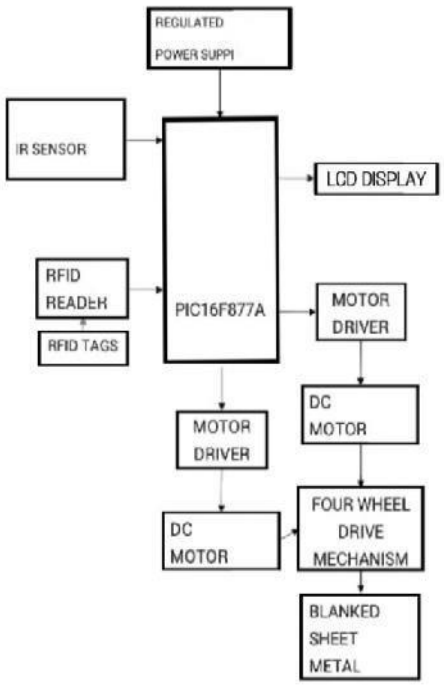

Fig-3.1

IV. MAJOR COMPONENTS

Dc Motor

The specific type of motor we are addressing is the permanent magnet brushed DC motor (PMDC). These motors have two terminals. Applying a voltage across the terminals results in a proportional speed of the output shaft in a steady state.

There are two pieces to the motor: 1. stator and 2. rotor. The stator includes the housing, permanent magnets, and brushes. The rotor consists of the output shaft, windings and commentator.

PIC Controller

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.

The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

RFID Tags and Reader

Shown is a RFID transceiver that communicates with a passive Tag. Passive tags have no power source of their own and instead derive power from the incident electromagnetic field. Commonly the heart of each tag is a microchip. When the Tag enters the generated

RF field it is able to draw enough power from the field to access its internal memory and transmit its stored information. When the transponder Tag draws power in this way the resultant interaction of the RF fields causes the voltage at the transceiver antenna to drop in value. This effect is utilized by the Tag to communicate its information to the reader. The Tag is able to control the amount of power drawn from the field and by doing so it can modulate the voltage sensed at the Transceiver according to the bit pattern it wishes to transmit.

Shown below is a typical RFID system. In every RFID system the transponder Tags contain information. This information can be as little as a single binary bit, or be a large array of bits representing such things as an identity code, personal medical information, or literally any type of information that can be stored in digital binary format.

An RFID tag is comprised of a microchip containing identifying information and an antenna that transmits this data wirelessly to a reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item, similar to the way many bar codes are used today. A key difference, however is that RFID tags have a higher data capacity than their bar code counterparts. This increases the options for the type of information that can be encoded on the tag, including the manufacturer, batch or lot number, weight, ownership, destination and history (such as the temperature range to which an item has been exposed). In fact, an unlimited list of other types of information can be stored on RFID tags, depending on application needs. An RFID tag can be placed on individual items, cases or pallets for identification purposes, as well as on fixed assets such as trailers, containers, totes, etc.

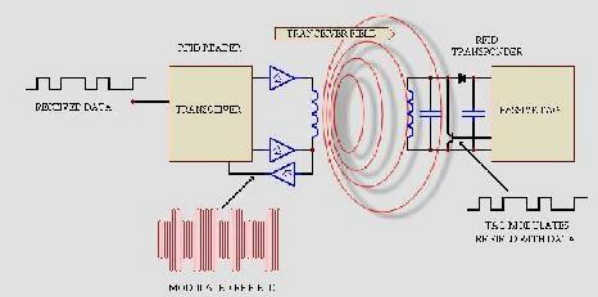

Fig-4.1

Robot Chassis

A chassis or the body of the Robot is the main and the most important part of the Robot. It is the thing which carry the whole mechanism, parts and almost everything that a Robot contains and that is the reason why it has to be designed with a good care.

V. LITERATURE REVIEW

History of Automated Guided Vehicles

Automated guided vehicles are unmanned vehicles used to transport unit loads, large or small, from one location on the factory floor to another. These vehicles are operated with or without wire guidance and are controlled by a computer. A system controller is responsible for the regulation of traffic when more than one vehicle is in the system. Automated guided vehicle systems (AGVS) are computer controlled material-handling systems typically used for repetitive tasks in intermodal container terminals, distribution centres, storage and warehouses, manufacturing, and Assembly plants. An AGVS is composed of a fleet of automated guided vehicles (AGVs), a navigation network, and dispatching, routing, and traffic-management software. The vehicles are battery-powered, equipped with manual or automated pick-up and drop-off mechanisms as well as with automated obstacle-detection capability. Earlier navigation networks utilized wire or magnetic tape, but more recent technologies are optical, inertial, or laser. Unit loads AGVs represent the largest segment of the AGVS market. Automated material handling systems, though more flexible and capable than their counterpart (non-computer controlled systems), do pose more serious and challenging operational control problems. These control problems increase with the level of system automation. The manner by which these problems are resolved, determines the operating effectiveness of the total system, as typified by an Automatic Guided Vehicle (AGV) system .Among the new generation of material handling systems (MHSs),

automated guided vehicles (AGVs) are the most widely used today in flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM) environments.
AGVs are found to be flexible, modular and versatile. However, the failure of some of the installations, and the subsequent analysis of the reasons for failure, shows that careful design and operational planning of AGV-based material handling systems is required if the full potential of such a system is to be realized.

Micro Controller
It was during 1970 and 1971 when Intel was working on inventing the world's first microprocessor, that Gary Boone of Texas Instruments was working on quite a similar concept and invented the microcontroller. Boone designed a single integrated circuit chip that could hold nearly all the essential circuits to form a calculator; only the display and the keypad were not incorporated. Surprisingly, this exceptional breakthrough in the field of electronics and communication was rather given a mundane name of TMS1802NC; however, the device wasn't ordinary. It had five thousand transistors providing 3000 bits of program memory and 128 bits of access memory!! So, it was possible to program it to perform a range of function. Intel also created many significant microcontrollers besides producing the world's first ever microprocessor. The important ones produced by Intel are the 8048 and the 8051 microcontrollers. 8048 was introduced in 1976 and was the first of Intel's microcontrollers. It was used as the processor in the PC keyboard of IBM. The 8051 microcontroller was introduced in 1980 and is one of the most popular microcontrollers. It is even used now and is considered to be one of the most long-lived microcontrollers .It was during the 1990s that advanced microcontrollers with electrically erasable and programmable ROM memories such as the flash memory started flooding the electronics market. The unique feature of these microcontrollers is that they can be programmed, erased and reprogrammed with the help of just electrical signals. A lot of currently used microcontrollers such as the ones available from Atmel and Microchip use the flash memory technology. Today, in addition to the general purpose gadgets, unique microcontrollers are being created for areas like lighting, automotive, communications, and low-power driven consumer goods. The present day microcontrollers like AVR, and PIC have become smaller and sleeker yet more and more powerful.

Radio Frequency Identification
Radio Frequency Identification (RFID) is an upcoming technology which has recently attracted the interest of the research community because of the extraordinary benefits it offers over the other existing identification and data capturing technologies. This chapter is formatted to review the existing RFID literature and explore the issues in the present RFID systems since the technology is still in its acceptance phase. Since the growth of RFID technology from 1900's, apart from its stated positive aspects, the technology also bears some concerns or issues. The intended purpose of this chapter is to examine the literature related to Radio Frequency Identification further extend academic research, and providing an insight into some of the outstanding and crucial issues hindering the growth of the RFID technology. There is a strong need to address these issues in order to provide a greater visibility and an increased product velocity of the RFID technology.
Radio Frequency Identification is a growing technology that has been around since early 1900's and was used in World War II. An early research paper had explored RFID work where the author of this paper stated that "Evidently, considerable research and development work has to be done before the field of useful applications is explored". Then, the electromagnetic theory related to RFID was studied in 1960's. Apart from that, inventions like Robert Richardson's "Remotely activated radio frequency powered devices" took place in that era. By this time, the wheels of RFID development had started turning. 1960's was the start of the 36 adoption of RFID in commercial activities. A noticeable development work in this area had taken place in 1970's where vehicle tracking, factory automation etc. were the prime intentions.. The pace of developments in RFID is as well apparent in the 21st century where even the modest of item like cloth is bearing a small sticky patch of RFID and human implantation of RFID tag and that too of rice sized grain is the reality of the day.

VI. CONCLUSION

This project is clearly an advancement over the currently used systems for delivering products and goods. The RFID tags are coded with navigation commands that uses AGV to calculate the shortest route to destination. The IR sensors would prevent the vehicle from being damaged by any obstacles in the route. This project would certainly
increase the efficiency and reduce the time for the delivery of goods. This is definitely an enhancement over the current methods and technologies used and there are no limitations.

VII. REFERENCE

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