Vehicle Navigation and Obstacle Detection System Using Rfid and Ultrasonic Sensors

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Abstract: Due to large number of vehicles running on the roads it is the need of the time to develop a system to track these vehicles by some means and make the database of the system. Keeping this in mind the system is developed using micro controller. It also uses Ultrasonic sensor, RFID cards and RFID reader for detecting the vehicle. RFID means Radio Frequency Identification. These cards will be placed on the place. When vehicle passes through the system the RFID reader connected to the System will read the code of the card. This paper concentrates on the vehicle navigation and obstacle detection. Vehicle navigation is carried out using Radio Frequency Identification (RFID) technology. It is used to navigate the vehicle from source to destination. The robot automatically moves along hallways using the scanned range data until a tag is found. Our proposed technique would be useful for real-world robotic applications such as intelligent navigation for motorized wheelchairs, surveillance and security purposes and in Nuclear power plants where humans are prone to harmful radiations.

Keywords - RFID, Ultrasonic sensors, Robot Navigation System, Mobile platform Indoor mobile robots.

I. INTRODUCTION

Nowadays for transportation of goods or materials in industries face many problems. To find such destinations an RFID based solution can be used. Using wireless and sensor technology automation can be made for transportation. The operator can stay static and navigate his vehicle from remote location. RFID is rated as one of the most promising and significant RTLS (RFID Transportation Location System) in industries and other applied areas. It can be deployed in different applications and in various functionalities. RFID is a non-contact Automatic identification technique, by which radio frequency can identify the object and obtain relevant data without human involvement. So due to advancement in the technology, every system is becoming simple and with less cost. So in order to achieve the operation we are designing the system using the new technology RFID which is very cheap and effective. The car navigation and obstacle detection system include two modules; RFID based navigation module, Obstacle detection module.

RFID technology is used for automatic navigation of the car from source to destination. Ultrasonic sensor used in this system helps in obstacle detection and the wireless technology is used for making communication with the base station.

II. OVER VIEW OF SYSTEM FRAMEWORK

RFID systems play a key role in managing of stocks, transportation and parcel tracking. The key component of an RFID system is the tag and the reader. The functional characteristics of the tags are divided into active and passive classes. Passive tags are much cheaper than the active tags because in active tag the external source is to be given. Passive tags are used as it is cheaper because there is no need of external source. In industries, to convey the goods from one section to another section autonomous car is used. RFID is the component, to work in the autonomous car. The RFID reader is placed in autonomous vehicle and RFID tag is placed in each post. The ultrasonic sensor is used to detect the obstacles if any in the path. While transferring the goods, if any obstacles are found, the ultrasonic sensor will detect and vehicle will stop.

III. BLOCK DIAGRAM

[Diagram of RFID and Ultrasonic Sensor System]

Figure 1. Transmitter
a. Power Supply
The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

b. RFID Tags
The RFID tags will consist of a unique number for each and every tag. Whenever the tag reaches the RFID reader section. Due to the electromagnetic waves, the data from the tag will be passed to the RFID reader that will further given to the arm controller for further Processing.

c. Ultrasonic sensor
The purpose of ultrasonic sensor is used to identify any obstacle in the path. Compared to passive infrared sensor, the ultrasonic sensor will have high range, so it will easily identify the obstacles in the path. Ultrasonic sensor operating at 40 kHz frequency is used in this system and the estimated range is 4.5 feet. Long range ultrasonic sensors are also available and can be used as per the application needs. Ultrasonic sensors are very effective and easily available.

d. PIC Microcontroller
The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory.

By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

e. Mechanical Unit
The robot used here is two-axis Robot. The wheels of the robot is designed such that it can make the robot to move in forward, backward, turn left or turn right. The robot has a flat metal body mounted with 12V DC motors. The rotation of the DC motor will make the wheel to rotate.

f. Software Unit
Software is used to compile the coding of the desired application for the corresponding embedded system.

g. Keil Uvision 3
This is the embedded C compiler which is compatible for the 8051 microcontroller to compile the code. Keil Software makes C compilers macro assemblers, real-time kernels, debuggers, simulators, integrated environments and evaluation boards for the microcontroller families.

IV. RESULTS AND EXPERIMENTS
Fig. 3 shows the prototype of car navigation and obstacle detection using RFID and ultrasonic sensor. This process is used in industries to carry the goods from one section to another section. It is an autonomous vehicle. In this prototype the RFID tag, RFID reader and ultrasonic sensor are used. Fig. 4 shows the Reading of a tag. Each RFID tag has EPIC code. The EPIC code has unified identify code. From that RFID tag, the vehicle moves forward, backward, left or right. These results show that the autonomous vehicle start to move and it will read the tag. The RFID reader placed in the vehicle and tag placed in lamp post. Fig. 5 shows that the vehicle moves in the forward direction based on the information in the RFID tag. Tags unified code will be predefined in the microcontroller. In the unified code, there is a predefined set that indicates whether the vehicle moves forward, backward, left or right. The prototype shows the vehicle moving in the forwarded direction.
V. APPLICATIONS

a. Industrial Transportation:
Transportation goods or raw materials, visitors etc.

b. In Nuclear Power Plants:
They can also be used in nuclear power plant where there is always a risk for humans for getting exposed to harmful radiations.

c. In Automotive companies:
Automotive companies employing RF for wireless remote control, remote keyless entry and safety applications.

d. Security and Surveillance:
These types of robots are very much useful in the security and surveillance purpose where there is a need for the robot to move according the direction specified by the user.

e. Other Applications:
Consumer products including electronic toys, home security, gate and garage door openers, fire and safety systems.

VI. FUTURE SCOPE

Here we are demonstrating the project by using a prototype with limited actions and performance. If we want to implement in the real world we can do it by using the advanced technology such as GPS, GSM and advanced sensors and by better designing, we can achieve it.
VII. CONCLUSION

This work solves the issues in autonomous vehicle used in industries to transfer the goods from one section to another section. The experimentation results are very successful and can be easily implemented in real time. An automatic robot inside the building can complete many tasks efficiently. We proposed a robot system which makes the robot able to navigate around the building. The core part of the system is the RFID system and the ultrasonic sensors, which enable the robot to locate itself and move without mistakes. On the whole, this system proves to be very effective in unmanned transportation for industrial applications.

REFERENCES