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RFID Positioning Robot: An Indoor Navigation System

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Abstract: *Radio Frequency Identification (RFID) system is looked upon as one of the top ten important technologies in the 20th century. Radio-frequency identification (RFID) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. An RFID system is composed of a set of transponders (i.e., tags) provided with integrated circuits storing an identification code and a detector (i.e., reader) that is able to retrieve the tag's identity data (ID) by means of a wireless link. RFID tags can then be used as artificial landmarks in the environment and each landmark can be univocally identified by the reader installed on the robot.*

Keywords: *RFID, Robot.*

1. INTRODUCTION

A **Robot** is a virtual or mechanical artificial agent in practice, it is usually an electro-mechanical machine which is guided by computer or electronic programming, and is thus able to do tasks on its own. Another common characteristic is that by its appearance or movements, a robot often conveys a sense that it has intent or agency of its own. The Robotic Industries Association defines *robot* as follows: "A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks." However, the industry's current working definition of a robot has come to be understood as any piece of equipment that has three or more degrees of movement or freedom.

Robotics is an increasingly visible and important component of modern business, especially in certain industries. Robotics-oriented production processes are most obvious in factories and manufacturing facilities; in fact, approximately 90 percent of all robots in operation today can be found in such facilities. These robots, termed "industrial robots," were found almost exclusively in automobile manufacturing plants as little as 15 to 20 years ago. But industrial robots are now being used in laboratories, research and development facilities, warehouses, hospitals, energy-oriented industries (petroleum, nuclear power, etc.), and other areas.

2. PROPOSED SYSTEM

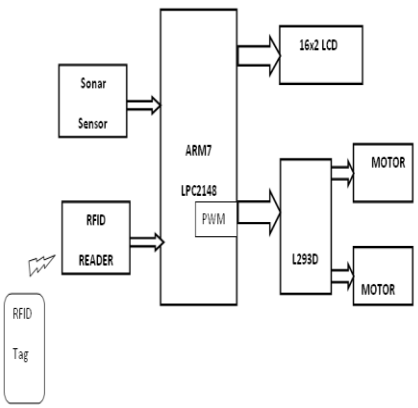

Fig1. *Block Diagram*

The aim of this paper is to control the robot direction from remote areas, so wireless communication is required to fulfill our application. There are different wirelesses communications exist. For this application we prefer RFID Module.

The purpose of an RFID system is to enable data to be transmitted by a portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc. RFID technology has been used by thousands of companies for a decade or more.

RFID quickly gained attention because of its ability to track moving objects. As the technology is refined, more pervasive - and invasive - uses for RFID tags are in the works.

3. HARDWARE IMPLEMENTATION

3.1. ARM

ARM stands for Advanced RISC machine. The first processor in ARM family was developed at Acorn Computers Ltd between October 1983 and April 1985. Acorn Computers was a British computer company established in Cambridge, England, in 1978. The company worked for Reduced Instruction Set Computer (RISC) processor design. The company produced a variety of computers which were very popular in United Kingdom. These included the Acorn Electron, the BBC Micro and the Acorn Archimedes. Particularly BBC Micro computer dominated the UK educational computer market during the 1980s and early 1990s. The ARM7TDMI core is a 32-bit embedded RISC processor delivered as a hard macro cell optimized to provide the best combination of performance, power and area characteristics.

3.2. ARM7TDMI Features

- 32-bit ARM instruction set for maximum performance and flexibility
- 16-bit Thumb instruction set for increased code density
- Unified bus interface, 32-bit data bus carries both instructions and data
- Three-stage pipeline
- 32-bit ALU
- Very small die size and low power consumption
- Fully static operation
- Coprocessor interface

3.3. LPC2148 Microcontroller

LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with embedded high speed flash memory of 512kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30% with minimal performance penalty.

- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 to 40 kb of on-chip static RAM and 32 to 512 kb of on-chip flash program memory.
- 128 bit wide interface/accelerator enables high speed 60 MHz operation.

3.4. Liquid Crystal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

3.5. Sonar Sensor

Users of ultrasonic rangefinders have found that the beam widths of low cost ultrasonic sensors do not always match their application. Wider beam width (and more sensitivity) is better suited for obstacle detection, people detection, collision avoidance, detecting small objects, and more robust detection in the central beam area. Narrower beam width (and less sensitivity) is useful for clutter rejection, high acoustic noise environments, directional ranging, room mapping, or using an ultrasonic sensor to locate an opening such as a door. Some users require very long detection and ranging, while others only care about performance only out to one meter. In addition, users of ultrasonic sensors, even sensors that have a narrow beam width, still desire detection of small objects within the central beam, stable range measurements (even when ranging moving objects), small size, low power, and the sensor must be easy to use. Both narrow or wide beam sensors can be useful for all of the mentioned uses but in general a specific beam width will perform better, than another, for a given user application. The beam width of the LV-Max Sonar sensor line up is factory calibrated and precisely controlled.

3.6. RFID Reader

RFID is a generic term for technologies that use radio waves to automatically identify people or objects. Unlike bar codes, no clear line of sight is required to obtain an accurate read. The basic RFID system comprises a transponder, a reader and an antenna. Data is stored in a transponder device called a tag. Current tags, depending on application, can hold up to 2 kbits of data. Tags can be read-only or read/write. Illumination field strength (transmitter power) generated by the reader. Antenna-to-tag orientation issues are impacted by the antenna polarization method used (circular vs. linear). Antenna sizes are mostly a function of the operating frequency used.

A radio frequency signal is transmitted from the reader to a transponder that passes within range of the reader's antenna. The signal triggers RF emissions from the tag. The transponder holds bits of data, which is either reflected or sent back to the reader, depending on whether the tag is passive or active. Transponder data includes information such as the transaction record type, the unique transponder ID number, the reader ID number, the transaction status code, and the error detection code. Customer data can be specified as well.

4. HARDWARE RESULTS

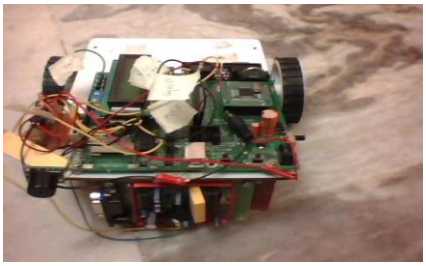

Fig2. *Robot*

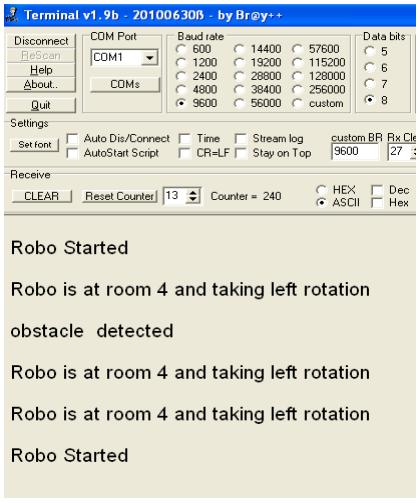

Fig3. *Remote Node*

5. CONCLUSION

The design and development of RFID based robot have been successfully designed, fabricated and tested. With the implementation of low cost and flexibility in design, this kit can reduce human inter version. This paper demonstrates how RFID signal along with embedded system. There are plenty of such examples showing how embedded system makes our life simpler and tension free. Our paper concept has robot that can be controlled by RFID tags, each and every tag is indicate such a direction. Its use is not limited to industries, with suitable modification the system can be used to serve other purposes like providing defense, coal mines and military applications etc.

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