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Design Of Wheel Chair for Portable Indoor Localization For Visually Impaired

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Abstract:
Physical disability becomes a major obstacle in the lives of physically challenged people and they are deprived of performing even their day-to-day activities without anybody's aid. One of the common problems they face is navigating their own home. So we proposed a system which aids such people to navigate their home or any indoor environment with all ease. Using this system not only can they reach any desired room in their home, they could also reach to the commonly used places inside a room such as sofa, television, refrigerator or any such commonly used places using voice commands. This can be done using the indoor positioning technique. The given area of the house is mapped into the system. The user's location is triangulated by applying lateration techniques such as time difference of arrival and angle of arrival.
Keywords: Microcontroller, Rfid, Motor, Obstacle Detection (Sensor), Voice ic

I. Introduction

Mobility impairment is one of the common types of physical disability which a wide range of world population suffers from. Mobility impairment may be due to various reasons such as Rheumatoid Arthritis, Osteoarthritis, Cerebral Palsy, Multiple Sclerosis, Muscular Dystrophy, Paralysis, Parkinson's disease, stroke, etc. And the most common form of assistive device used is the wheelchair. Mobility limitations are the leading cause of functional limitations among adults, with an estimated prevalence of 40 per 1,000 persons age 18 to 44 and 188 per 1,000 at age 85 and older .Though various technologies have been implemented in wheelchair to aid various groups of affected people there is always a need for a better technology in aiding such people. Some sect of mobility impairments cannot access the joystick provided with wheelchairs. In such cases we use the voice assistive technology to aid such people in indoor navigation and such a navigation system will provide a better use if they can access commonly used places in their homes. This technology could be of great use even to the elderly people too.

II. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

MEMS:

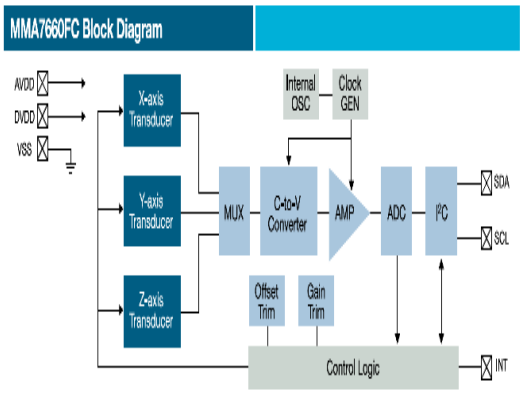
Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements

such as beams, gears, diaphragms, and springs to devices.

Examples of MEMS device applications include inkjet-printer cartridges, accelerometers, miniature robots, micro engines, locks, inertial sensors, micro transmissions, micro mirrors, micro actuators, optical scanners, fluid pumps, transducers and chemical, pressure and flow sensors. Many new applications are emerging as the existing technology is applied to the miniaturization and integration of conventional devices.

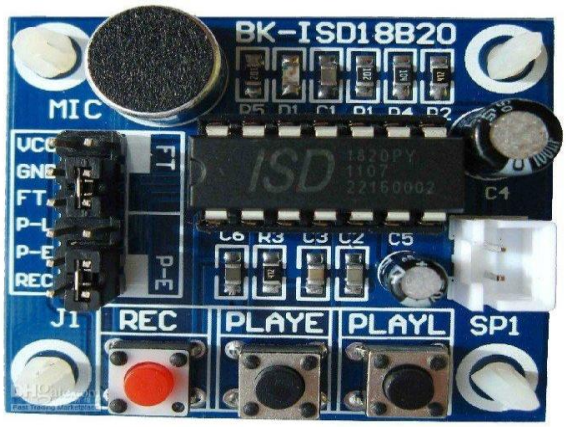
These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

MEMS are not about any one application or device, or they are not defined by a single fabrication process or limited to a few materials. They are a fabrication approach that conveys the advantages of miniaturization, multiple components and microelectronics to the design and construction of integrated electromechanical systems. MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems.



VOICE IC:

A **voice IC** (or) **sound chip** is an integrated circuit (i.e. "chip") designed to produce sound. It might be doing this through digital, analog or mixed-mode electronics. Sound chips normally contain things like oscillators, envelope controllers, samplers, filters and amplifiers. During the late 20th century, sound chips were widely used in arcade game system boards, video game consoles, home computers, and PC sound cards.



III. Design of Proposed Hardware System

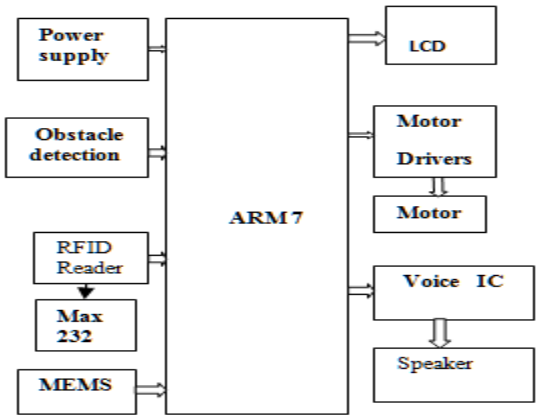


Fig.1.Block diagram

One of the most common problems faced by physically challenged and disabled people is their day to day activities without any body's help. They even face the problem to navigate their own house when no one is available in home. Here we are going to develop a navigation system for such people who are really in need of it. Our system consists of obstacle detection, thus when the obstacle is detected, it sends an interrupt to the microcontroller and a voice command is given out about the obstacle detected. A RFID reader reads the particular tag shown by the person and sends the message to the voice ic through micro controller, then a voice command comes out regarding that particular tag (example if a tag containing information regarding a drawing room or kitchen, a voice command is given out as kitchen room). In this system some keys are also used to select the options if needed and go forward, i.e. if a disabled person shows a tag and gets a voice command as kitchen but he wants to go to some other room, in that case he can select a key and stop the command and chose another tag. This module will be placed in the wheel chair. This module works on the

feedback received from obstacle detection module or by the commands received from Voice recognition. With the help of motors the wheel chair moves.

IV. Board Hardware Resources Features

Rfid

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes **active** and **passive**.

Active Tag Passive Tag

Active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade. Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID(the tag's chip coordinates this process). The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.

Obstacle detection sensor

The robot requires means of detecting an obstacle (or another robot) without making physical contact. This allows the robot to decide whether to avoid or to confront and investigate the obstacle depending on its programming. Ultrasonic transducers were chosen for this because they are more reliable and have a greater range than IR sensors (effectiveness of IR sensors varies with ambient light level).

Motor

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings, solenoids, springs.
Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

V. Conclusion

In this paper we have discussed about an automated voice based indoor navigation system which is of great use to the mobility impaired people. This low cost setup mainly using UWB will be very helpful for the physically challenged people as they could not only move to any room but to any commonly places used in the room. As it is controlled using voices, it can be of great ease and can be regarded as a very user-friendly system and also without needing any external aid. It uses the obstacle avoidance technique which again makes this proposed system a more reliable one

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