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DESIGN AND ANALYSIS OF AN EMBEDDED ACCELEROMETER COUPLED OBSTACLE DETECTION SENSOR

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Abstract:

This paper presents a robot is designed which is made to move all the time. Apart from this, the system also embedded with ultrasonic detectors used to detect the obstacle during which the direction of the robot is changed by using MEMS. All the devices such as ultrasonic detectors, MEMS, motor by which robot is made to move are being interfaced to microcontroller which forms the control unit of the project. Now the micro controller changes the direction of the robot by driving the motors in a respective direction. And also in this adding MEMS sensors to change the direction of the robot manually. An automatic obstacle avoidance and distance measurement algorithm is developed to identify obstacles in howmuch distance they appeared from the robot and if the distance is less than pre-defined value robot automatically direction changes.It is conclude that obstacle avoidance system, a reactive control system for real time obstacle avoidance is presented. It is capable to avoid any kind of static obstacles.

Keywords: Arm7,Micro-Electro-Mechanical System (MEMS),Accelerometer, Ultrasonic, L293d, Power Supply.

I. Introduction

Many applications of robotics involve robot motion. In particular, an emphasis should be put on obstacle avoidance. Obstacles may as well be expected or not, a natural approach may be to make robots to navigate and avoid obstacles using reactive behavior [1]. The ability to detect and avoid obstacles in real time is an important design requirement for any practical application of robot vehicle.

Therefore, a significant number of solutions have been proposed for this problem. Unfortunately, most of these solutions demand a heavy computational load, which makes them difficult, if not impossible, to implement on low cost, microcontroller based, control structures. So, this paper proposes the reactive robotic system for obstacle avoidance relying on low cost ultrasonic sensor, MEMS sensor, and involving a reasonable level of calculations, so that it can be easily used in real time control applications with microcontroller.The increase in human-machine interactions in our daily life's has made user interface technology progressively more important. Physical gestures as intuitive expressions will greatly ease the interaction process and enable humans to more naturally command computers or machines. For example, in Telerobotics, slave robots have been demonstrated to follow the master'shand motions remotely.We are intended to make this monitoring using ARM7 hardware platform ported with real time operating system µc/OS-II.

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.

II. DesignOfHardware System:

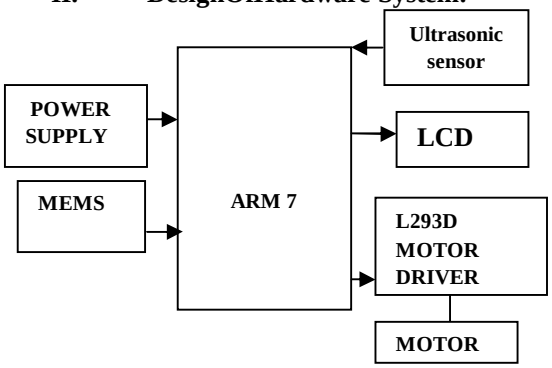

Fig.1.Block diagram

The interaction between human and sensor-enabled home robots in a smart home environment is important in the field of pervasive computing. While home robots have become available, most robots are custom-made for specific operations without the capability to meet the needs of different users. As many everyday tasks (such as cleaning, cooking, moving objects) require specific gestures and movements that vary with users and usage scenarios, it is important to design a system that allows users to train and control the robot the way they want. Here we have designed a system which is controlled using MEMS sensors.In this project we have two sections ie transmitter and receiver sections. In transmitter section it operates two modes. They are robot mode and robotic arm mode. To select these modes we are using slide switch. By changing the switch positions and with the help of mems we are sending thecommands to the receiver section with the help of ZIGBEE transceiver. In the receiver section ZIGBEE transceiver receives the directions like front, back, left and right robot is moved. The information about the robot direction is displayed on LCD.

I. Board Hardware Resources Features

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, microengines, locks, inertial sensors, micro transmissions, micromirrors, 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 advantagesof the miniaturization, multiple components andmicroelectronics 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.

L293D:

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo- Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications. On the L293, external high-speed output clamp diodes should be used for inductive transient suppression.

Ultrasonic Sensor:

The sensor is primarily intended to be used in security systems for detection of moving objects Modern security systems utilizes various types of sensors to detect unauthorized object access attempts. The sensor collection includes infrared, microwave and ultrasound devices, which are intended to detect moving objects each type of sensor is characterized by its own advantages and drawbacks. Ultrasound motion detection sensors are characterized by small power consumption, suitable cost and high sensitivity.

That's why this kind of sensor is commonly used in home, office and car security systems. Existing ultrasound sensors consist of multiple passive and active components and are relatively complicated for production and testing. Sensors often times require a laborious tuning process. The ultrasound transmitter TX is emitting ultrasound waves into sensor ambient space continuously. These waves are reflecting from various objects and are reaching ultrasound receiver RX. There is a constant interference figure if no moving objects are in the placement.

MOTORS:

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 variables andtorque .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,spring.

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 motorsinduction, 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.In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

III. Experimental kit

I. CONCLUSION

This paper a walking robot that achieved the stated objectives had been developed. This robot is able to produce the basic walking movements using two DC motors. We developed the robot with a very good intelligence which is easily capable to sense the obstacle and by processing the signal coming from the sensor it is perfectly avoiding the obstacle coming in between the path .Robot take the left or right or the forward movement in according to the signal recevied from the MEMS sensor with the help of the two DC motor which makes the movement of the robot smooth .In future, the sensing range can be increased by increasing the sensor quality with the help of ultrasonic sensor or the IR signal spread all over theprovide area and also we are adding one of the recognisation future to detect the accident occurrence.

VI. REFERENCES

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