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SELF PARKING CHAIR

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Abstract - *This project describes a system or a product which will reduce the human efforts and save time through the use of Anisotropic Magnetoresistive (AMR) technology that provides advantages over other maganetic sensor technologies . It is an system equipped with an magnetometer for navigation and a combination of ultrasonic for obstacle detection and avoidance during navigation. To increase the accuracy of the system we have to go with high precision sensors which will help it to navigate itself and correctly calculate its co-ordinate and identifying direction towards the destination. There are different methods to complete this product but this proposed method is very much efficient as the 3-Axis digital compass is used in it.*

Keywords- *magnetometer, ultrasonic sensor, motor driver, high torque DC motor, Arduino UNO, At mega328 etc.*

I. INTRODUCTION

Nowadays we observe in the main buildings like offices , labs and many facilities after completing the meeting people does not arrange their chair to the respected places , so an employee has to arrange each and every chair to their respected places which consumes more time and human effort is also wasted , to overcome this problem or we can say to reduce the human effort and save time we will develop a chair which will work on the basis of self parking or we can say intelligent parking. This self parking chair will be the unique solution to the problem of arranging the chair again and again.

It will locate it's respected place by it's self and will reach to it by responding to the signal given to it.

II. DESIGN IMPLIMENTAION

2.1. Embedded System

The embedded system of the intelligent parking chair has been classified into input module and output module as in Fig. 2. The input module consists of the localization device, the obstacle detection sensors, and the user input device. Both these modules are interfaced using an embedded microcontroller that serves as the central command module, and provides information regarding the current location. Localization is performed using a anisotropic magneto-resistive sensor system [4], and obstacle avoidance navigation is performed using ultrasonic range finders [7]. All other hardware is enclosed inside the circular frame affixed to bottom of the chair. Once the destination

coordinates are input to the system through the clap sensor, the microcontroller [9] will initiate its routine. At the same time, the magnetometer communicates with the microcontroller to read initial and final co-ordinates . When it determines that the robot is present at a point of interest, it will send an appropriate signal to the microcontroller.

Accordingly, the microcontroller will initiate the motor to move the chair in decided direction . The ultrasonic sensor integrated to the input ports of the Arduino uno AT mega328 microcontroller, which constantly.0 sends appropriate signals when an obstacle is detected. These signals are then analyzed to determine the location of an obstacle, and initiate the obstacle avoidance routine accordingly.

III. SUB-SYSTEM OPERATION

3.1. Localization

The HMC588L magnetoresistive sensor circuit is a trio of sensors and application specific support circuit to measure magenetic fields. With power supply applied, the sensor converts any incident magnetic field in the sensitive axis directions to a differential voltage output. The magnetoresistive sensor are made of a nickel-iron (permalloy) thin-film and patterned as a resistive strip element. In the presence of a magnetic filed, a change in the bridge resistive elements causes a corresponding change in voltage across the bridge outputs.

These resistive elements are aligned together to have a common sensitive axis (indicated by arrows in the pinout diagram) that will provide positive voltage change with magnetic fields increasing in the sensitive direction. Because the output is only proportional to the magnetic field component field in any orientation.

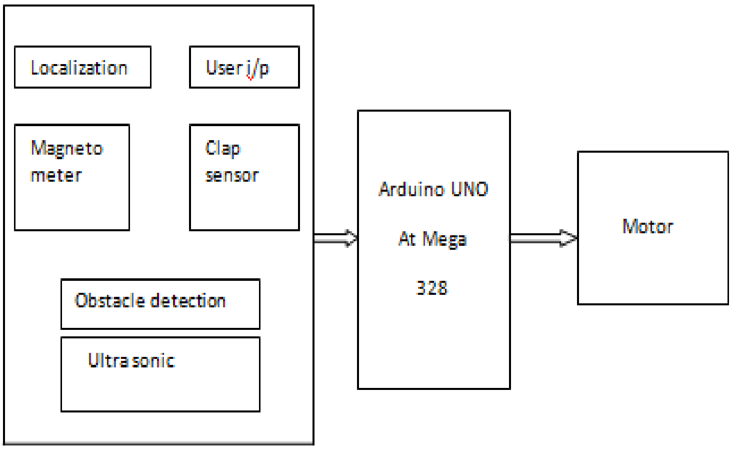


Fig 1: Embedded System with Input and Output Modules

3.2. Self test

To check the HMC5883L for proper operation, a self test feature in incorporated in which the sensor is internally excited with a nominal magnetic field (in either positive or negative bias configuration). This field is then measured and reported. This function is enabled and the polarity is set by bits MS[n] in the configuration register A. An internal current source generates DC current (about 10 mA) from the VDD supply. This DC current is applied to the offset straps of the magnetoresistive sensor, which creates an artificial magnetic field bias on the sensor. The difference of this measurement and the measurement of the ambient field will be put in the data output register for each of the three axes. By using this built-in function, the manufacturer can quickly verify the sensor's full functionality after the assembly without additional test setup. The self test results can also be used to estimate/compensate the sensor's sensitivity drift due to temperature. For each "self test measurement", the ASIC: 1. Sends a "Set" pulse 2. Takes one measurement (M1) 3. Sends the (~10 mA) offset current to generate the (~1.1 Gauss) offset field and takes another measurement (M2) 4. Puts the difference of the two measurements in sensor's data output register:

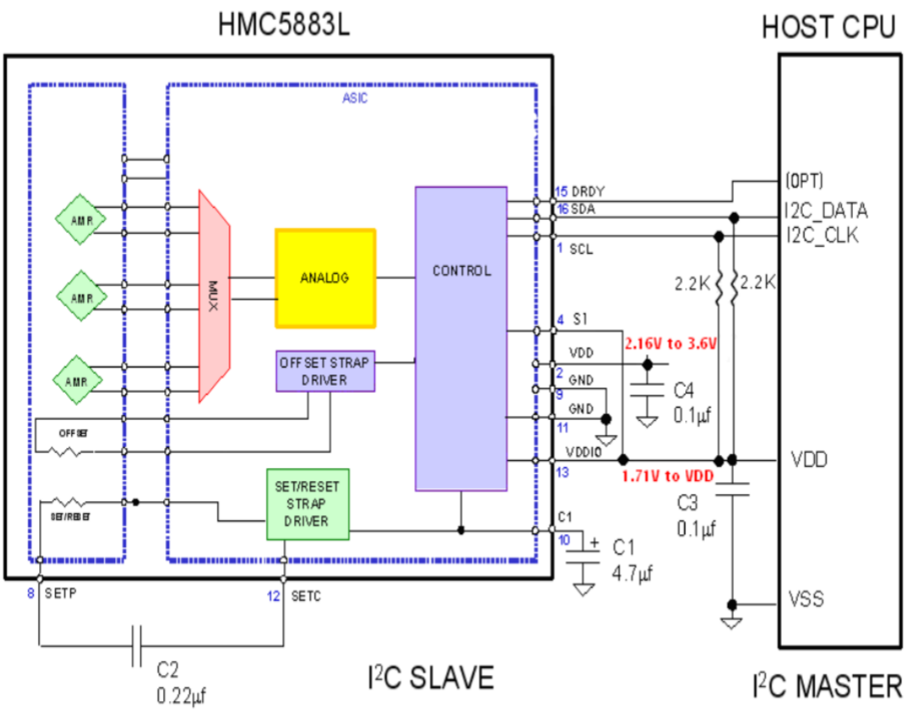


Fig 2: INTERNAL SCHEMATIC DIAGRAM

For each "self test measurement", the ASIC

1. Sends a "Set"
2. Takes one measurement (M1)
3. Sends the (~10 mA) offset current to generate the (~1.1 Gauss) offset field and takes another measurement (M2)
4. Puts the difference of the two measurements in sensor's data output register:

Output = [M2 – M1] (i.e. output = offset field only)

IV. MODES OF OPERATION

This device has several operating modes whose primary purpose is power management and is controlled by the Mode Register. This section describes these modes.

4.1. Continuous-Measurement Mode

During continuous-measurement mode, the device continuously makes measurements, at user selectable rate, and places measured data in data output registers. Data can be re-read from the data output registers if necessary; however, if the master does not ensure that the data register is accessed before the completion of the next measurement, the data output registers are updated with the new measurement. To conserve current between measurements, the device is placed in a state similar to idle mode, but the Mode Register is not changed to Idle Mode. That is, MD[n] bits are unchanged. Settings in the Configuration Register A affect the data output rate (bits DO[n]), the measurement configuration (bits MS[n]), when in continuous-measurement mode. All registers maintain values while in continuous-measurement mode. The I2C bus is enabled for use by other devices on the network in while continuous-measurement mode.

4.2. Single-Measurement Mode

This is the default power-up mode. During single-measurement mode, the device makes a single measurement and places the measured data in data output registers. After the measurement is complete and output data registers are updated, the device is placed in idle mode, and the Mode Register is changed to idle mode by setting MD[n] bits. Settings in the configuration register affect the measurement configuration (bits MS[n])when in single-measurement mode. All registers maintain values while in single-measurement mode. The I2C bus is enabled for use by other devices on the network while in single-measurement mode.

4.3. Idle Mode

During this mode the device is accessible through the I2C bus, but major sources of power consumption are disabled, such as, but not limited to, the ADC, the amplifier, and the sensor bias current. All registers maintain values while in idle mode. The I2C bus is enabled for use by other devices on the network while in idle m

V. OBSTACLE AVOIDANCE

The Magnetometer Positioning Robot comprises ultrasonic sensors and magnetometer integrated into the system as in Fig. 3. The ultrasonic sensor will be configured on the front of the robot . When activated, the microcontroller continuously reads information from the sensor, detects any obstacle present, and determines where the obstacle is located. The ultrasonic sensors on the front of the robot are used to scan for potential objects within range of the robot. There are one regions of ultrasonic in which the object could be located, and the integrated ultrasonic system can identify in which of these regions is the obstacle present. Once this information is obtained, it considers the angle and distance of the obstacle with respect to the robot, and maneuvers the robot to go around the obstacle. As the ultrasonic sensors determine the potential location of an obstacle with respect to the current location of the robot, it will determine the direction to turn in avoiding the obstacle. As presented in Fig. 3, if the obstacle was determined to be on the front right/left side, the robot will turn 90O to the left/right, and move forward and repeat the process until the obstacle avoidance, and track the distance travelled 'x'. At this point, the robot will turn right/left by 90O and moves forward . Later, the robot turns right/left by 90O and moves forward by distance 'x,' and turns left/right by 90O. Once the robot returns to its original path, it will recalculate its position and correct for any error encountered to continue moving towards its final destination.

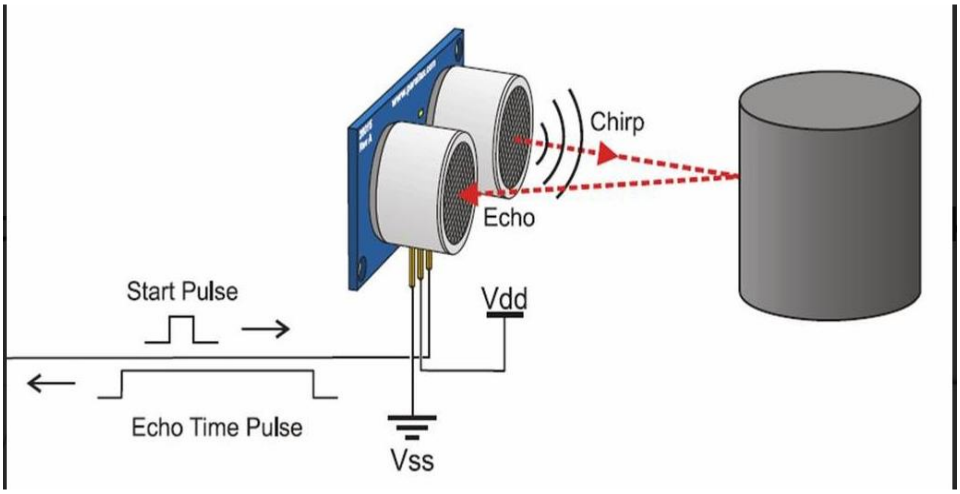
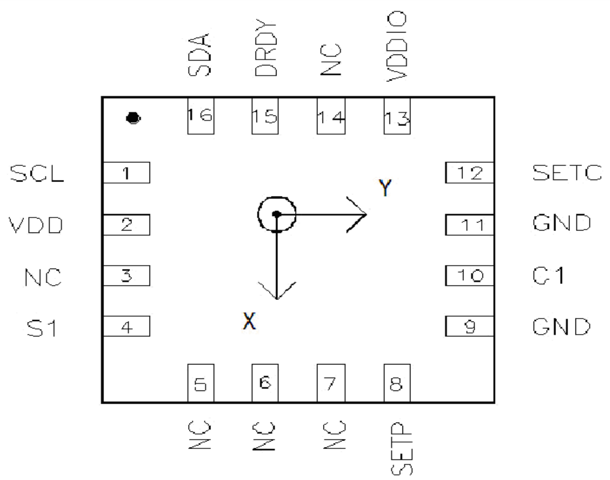


Fig. 3: Obstacle Detection Sensor Configuration

5.1. NAVIGATION

Anisotropic Magnetoresistive (AMR) technology that provides advantages over other magnetic sensor technologies. These anisotropic, directional sensor feature precision in- ais sensitivity and linearity. These sensor' solid-state construction with very low cross-axis sensitivity is designed to measure both the direction and the magnitude of earth's magnetic fields, from milli-gauss to 8 gauss.



Arrow indicates direction of magnetometer field that generates a positive output reading in normal measurement configurtion.

VI. PREIMENARY TESTING

The Anisotropic Magnetoresistive positioning robot is a work –in –progress and preliminary testing has been completed. To test the ability in addressing the project requirement, the design team has created appropriate experiments under a controlled environment. Data was collected and analyzed to validate the reliability of our system. Different experiments focused on testing each sub-system including :1) chair movement accuracy; 2) obstacle detection range; and 3) magnetometer localization.

The robot accuracy was tested to determine the error while traveling in a straight path. This data included change in the 'x' and 'y' coordinates as well as the orientation of the robot . Accordingly, it was found that the localization algorithm must account for any error encountered by the robot.

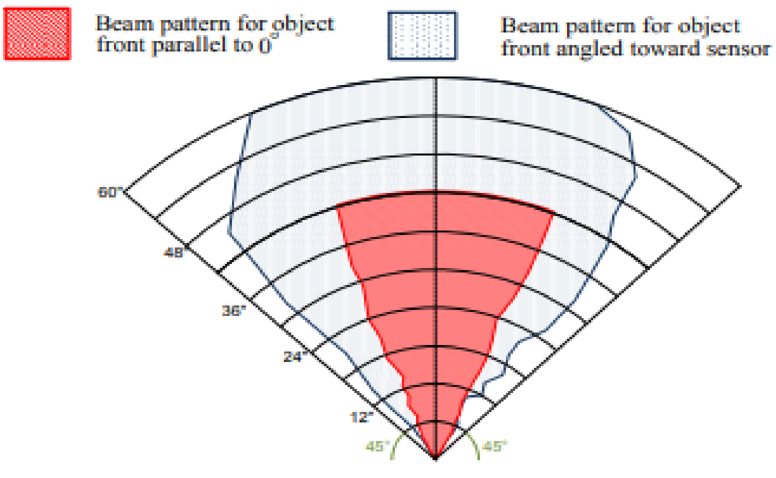


Fig. 4: Ultrasonic Sensor Beam Pattern

To accurately detect the location of an impending object, ultrasonic sensor testing was completed. The testing of the ultrasonic Sensor provided the beam pattern for our SRF04 to utilize the scanning area. Fig. 4 represents the beam pattern measured for the ultrasonic sensor.

VII. CONCLUSION

Using this system we can reduce the human effort. It is a self parking system because of this there is no manual operation required. Due to this we can easily arrange the chairs in their respective places just by giving the interrupt to the chair.

The concept of utilizing Anisotropic magnetoresistive for indoor localization has been shown to be both technically and economically feasible. The magnetoresistive positioning robot was successfully designed to provide autonomous navigation for indoor applications. In the near future, we plan to improve the localization and navigation algorithm to improve accuracy. Further analysis will be performed to accurately identify a specified location by placing advanced magnetic field detecting sensors at different orientations.

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