

salaUno: Eliminating Needless Blindness in Mexico

DOMAIN

- Biomedical field
- Assisting the visually challenged.
- A directional system facilitating navigation.

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List of Issues

- Restricted Sensing environment.
- Low-cost, robust, sturdy and portable system not available in the market.
- Confusion of sounds.
- Lengthy training period is required for familiarity.
- Detecting inclined slopes and stairs.

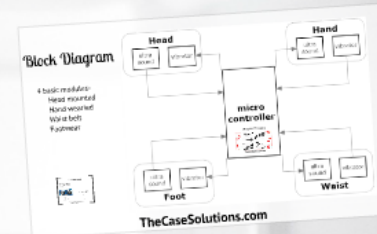
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Problem Statement

This project aims at the design and development of a wearable unit which is robust, low cost and user friendly to concede obstacle detection in spatial navigation, operated using ultrasound sensors for detection and a vibrator interface for feedback.

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Proposed Work

- The system developed employs a device that the user wears on the head, which measures the distance to the obstacles around, with the use of ultrasound.
- We plan to share the same operation principle of scanning the environment and presenting the information to the user via vibrators.
- The ultrasonic sensors are mounted on the individual's Head, Waist, Foot and Hand. The data is then analyzed, distance is calculated and it offers haptic feedback to the user in accordance with the position of the obstacle.

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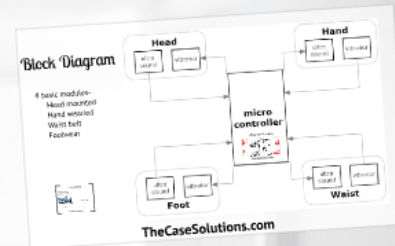
Sample test cases

User wearing the components feels vibration on skin which approach any kind of obstacle.
The intensity of vibration varies with the distance of obstacle.
A synthesized head to feet vibration is used to indicate stairs or inclines.

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References with shortcomings

- Smart Cane: Assistive Cane for Visually-impaired People.
 - Cane senses only a limited environment, only frontal detection and it is a costly venture.
- Navigation Using a Haptic Hand-Mounted Device For the Visually Impaired.
 - Difficulty in Orientation, and training required in landmark recognition and spatial navigation.
- Blind Navigation with a Wearable Range Camera and Vibrotactile Helmet.
 - Wearable Kinect is quite expensive, Precision & Dynamic range still under research, Longer Training period.

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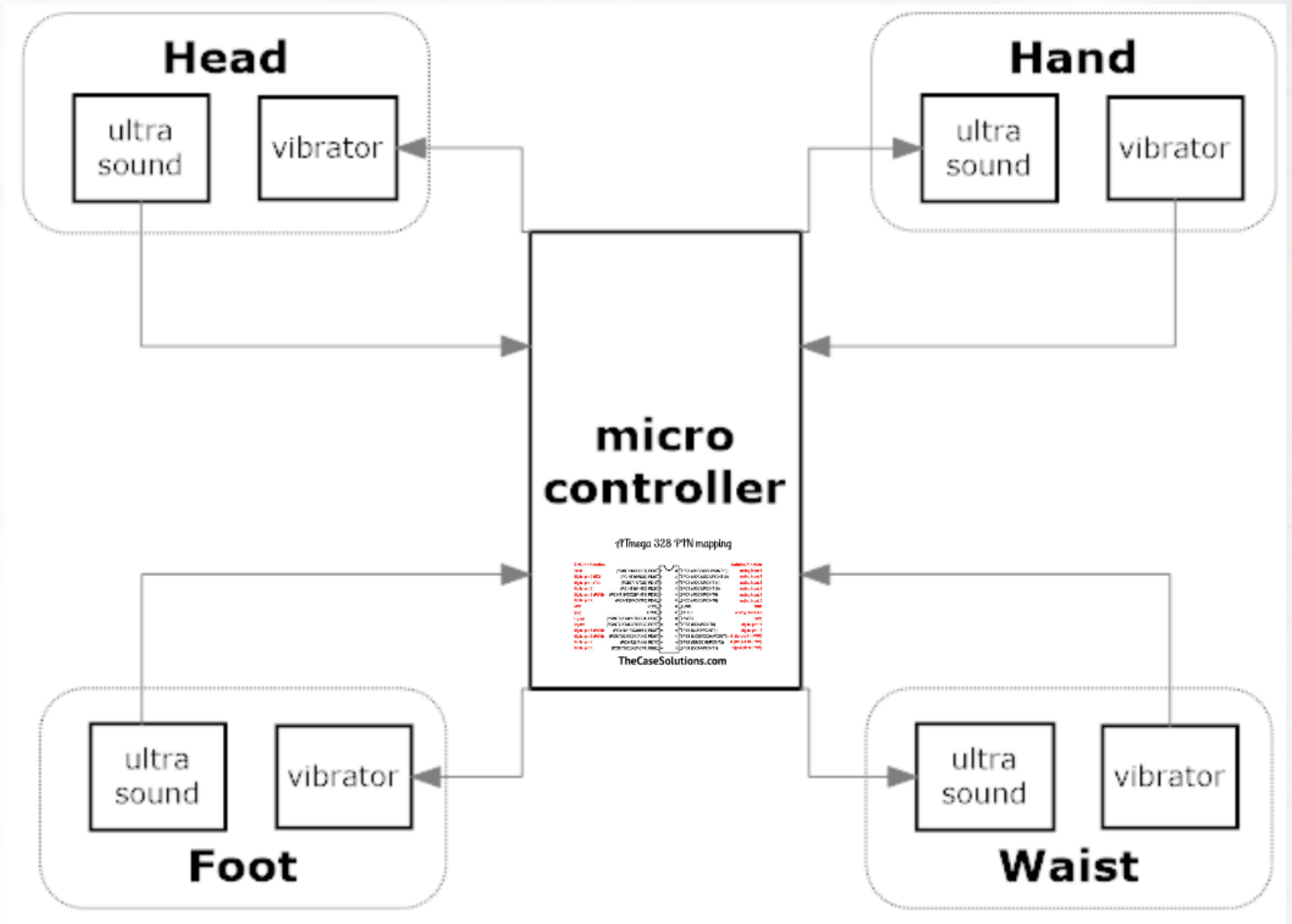
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Block Diagram

4 basic modules-
Head mounted
Hand wearied
Waist belt
Footwear

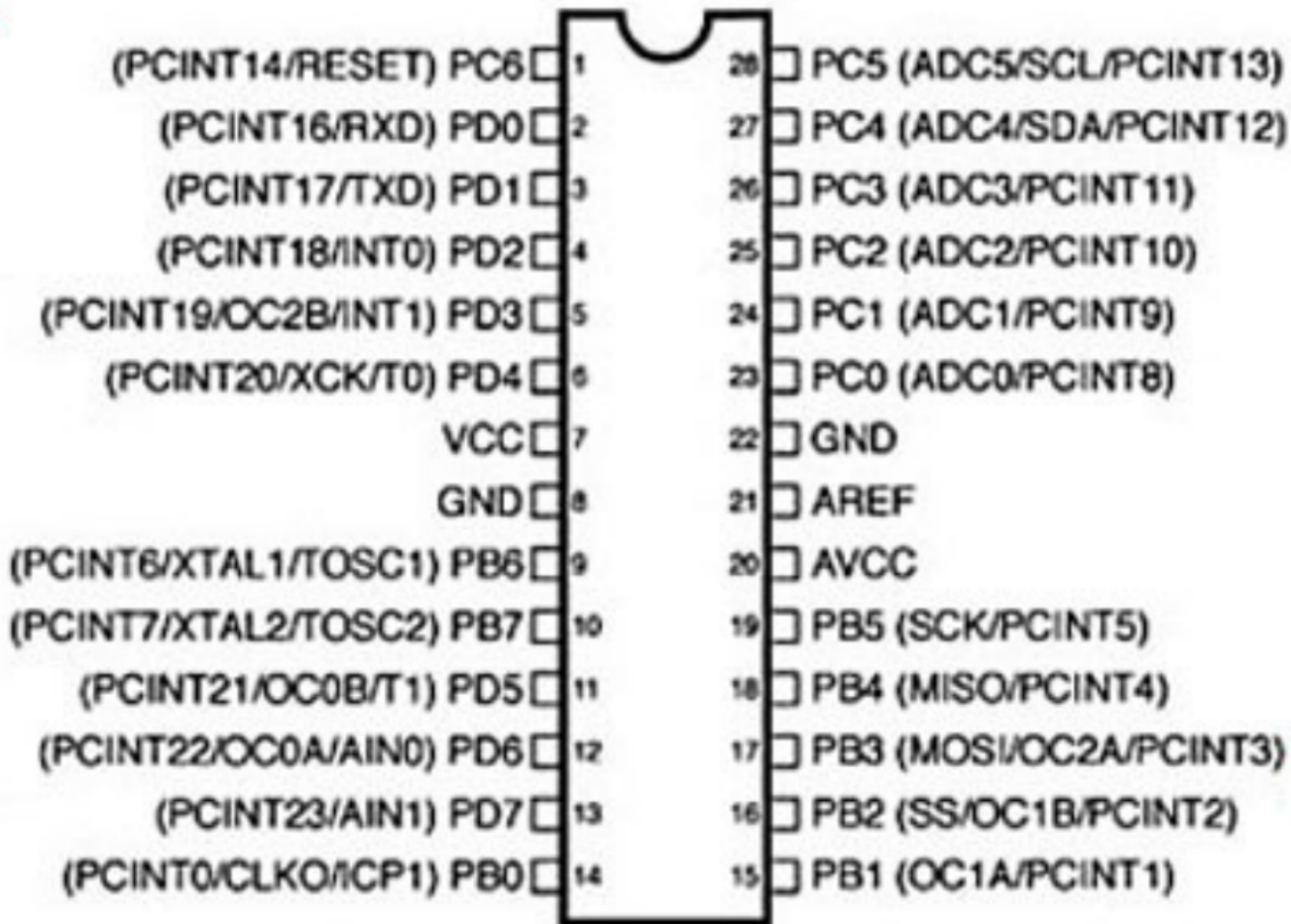


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ATmega 328 PIN mapping

Arduino function

- reset
- digital pin 0 (RX)
- digital pin 1 (TX)
- digital pin 2
- digital pin 3 (PWM)
- digital pin 4
- VCC
- GND
- crystal
- crystal
- digital pin 5 (PWM)
- digital pin 6 (PWM)
- digital pin 7
- digital pin 8



Arduino function

- analog input 5
- analog input 4
- analog input 3
- analog input 2
- analog input 1
- analog input 0
- GND
- analog reference
- VCC
- digital pin 13
- digital pin 12
- digital pin 11 (PWM)
- digital pin 10 (PWM)
- digital pin 9 (PWM)

I/O Components

Ultrasonic Distance Measuring Sensor

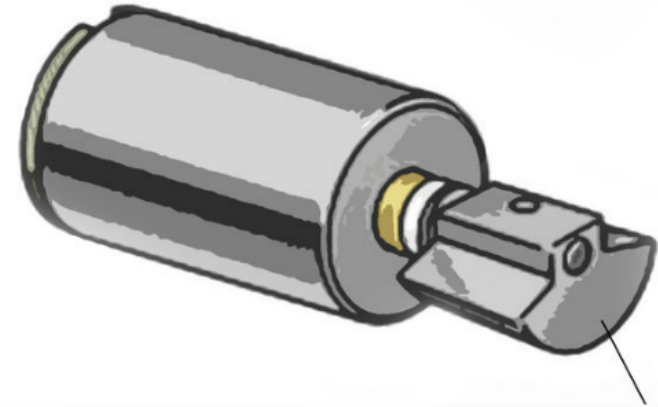


Ultrasound sensor working

Works on a principle similar to sonar which evaluate attributes of a target by interpreting the echoes from sound waves.

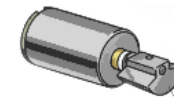
Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. The time interval between the sent signal and received signal is determined to measure the distance from an object.

An ultrasonic pulse is sent at time t_0 . The pulse is reflected by the object. The sensor receives the signal back, it converts it into an electric signal and output to signal pin. When the echoed signal is faded away, the next pulse can be sent again. The time period between the two pulses should be no less than 50ms.



Vibrating Motor

Vibration motor working principle



When the motor is powered on, the motor will start to vibrate. The motor will stop when the power is cut off. The motor will start to vibrate again when the power is turned on.

