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DESIGN OF GUIDE CANE FOR BLIND PEOPLE BY USING MICROCONTROLLER

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Abstract
A blind person daily encounters many difficulties such as walking on the road, finding right path. In this project the guide cane comes as a solution to enable them to identify the world around by integrate the traditional white cane with an interface consisting of AT MEGA 8L microcontroller and ultrasonic sensors to detect all obstacles (forward, above knew) and pits ,and water sensor to detect water on the ground. The result of ultrasonic sensors alarm with different ring for each sensor, and vibrations for water in the bath, The result of ultrasonic sensors alarm with different ring for each sensor, and vibrations for water in the bath, all this alarms buzzer will be stopped once it is taken guide cane out from obstacles and water. This can considerably alleviate the risk of the blind people injuring himself. The circuit designed firstly by Proteus Virtual System Modeling then the guide cane was actually assembled which works efficiently 87%.
Keywords: guide cane, ATMEGA 8L, ultrasonic sensor, PTFE

1. Introduction

A report by World Health Organization (WHO) and International Agency for Prevention of Blindness (IAPB) stated that there are approximately 285 million persons around the world who are visually impaired, out of which 39 million are completely blind. 90% of the worlds visually impaired live in developing countries(Organization, 2013) . The lack of visual observation is a loss of freedom to those people. This means they are dependent on other human being for navigation in both indoor and outdoor areas. A white cane is one of the most common mobility aids for the visually impaired(Kim and Cho, 2013). However, cane can only sense an obstacle up to 1 meter. It is unable to warn the user when there is an obstacle, pit, and water on the ground in their path until the user has touched them. The objective is to avoid all this limitations by designed guide cane.

2. Literature Review

2.1Traditional Mobility Aids

Traditional mobility aids have acted as an important and effective tool for helping visually impaired travelers detect objects in their local environment. Three widely used traditional aids exist, are described below:

2.1.1 Human guide

This is where a person with sight serves as a guide to a person who is visually impaired. But in practice not a permanent solution for aiding the blind in mobility and navigation. A blind person lacks privacy and can have a feeling of being a burden to his or her guide (Nandhini et al., 2014).

2.1.2 Long cane

The traditional long cane, widely used by blind and visual impaired people detects ground irregularities and obstacles but fails to detect potential collisions above the user waistline, or detect obstacles or drop-offs in the path approximately 1 m in front of them.

2.1.3 Dog guide

The puppy intended to be a guide dog is carefully selected and trained at special schools, and the guide dog user also has to be trained that's mean a lot, and furthermore they are exist for only a few years.

2.2 Technology Canes

The term technology cane is used for a group of obstacle detection canes that are constructed on long cane principles but use additional technology to detect obstacles and relay information about the obstacles to the cane bearer. The following two main technologies are used in the obstacle detection component of these modern technology canes:

2.2.1 The Laser Cane

The Laser Cane, available from nurion industries, is a primary mobility aid that combines a long cane with a laser obstacle detection system. Short pulses of laser are transmitted. The laser light reflects off obstacles in its path. This reflected light detected by the sensors mounted on the cane. Sensors are positioned to detect obstacles straight ahead near ground level and at head height, as well as obstacles to either side or a downward pointing sensor is used to detect drop-offs. Information about the presence of obstacles is provided to the user through both vibrations and beeps.

Disadvantage: Not all materials will be detected by laser. For example, light will pass straight through transparent glass, it will not be reflected, so the laser sensors will not detect it. , whereas an ultrasound system will; (2) the user is informed only of the approximate distance to the closest object (short pulses of laser) (Hersh and Johnson, 2010).

2.2.2 IR cane

Its white cane with an infrared sensor witch it an electronic instrument that emits and receive infrared radiation that to detect the presence of objects in the vicinity (Haidar et al., 2015). Ultrasonic is like an infrared where it will reflect on a surface in any shape. However, the ultrasonic has a better range detection compared to infrared (Gayathri et al., 2014).

3. SYSTEM DESIGN

3.1 Block Diagram of system

The control unit consists of an ATMEG8L microcontroller Witch it sense the environment by receiving input from ultrasonic sensors and water sensor and affect its surroundings by controlling alarm and vibrations. The sensor output is calculates the distance based on the Bascom program (Figure 1).

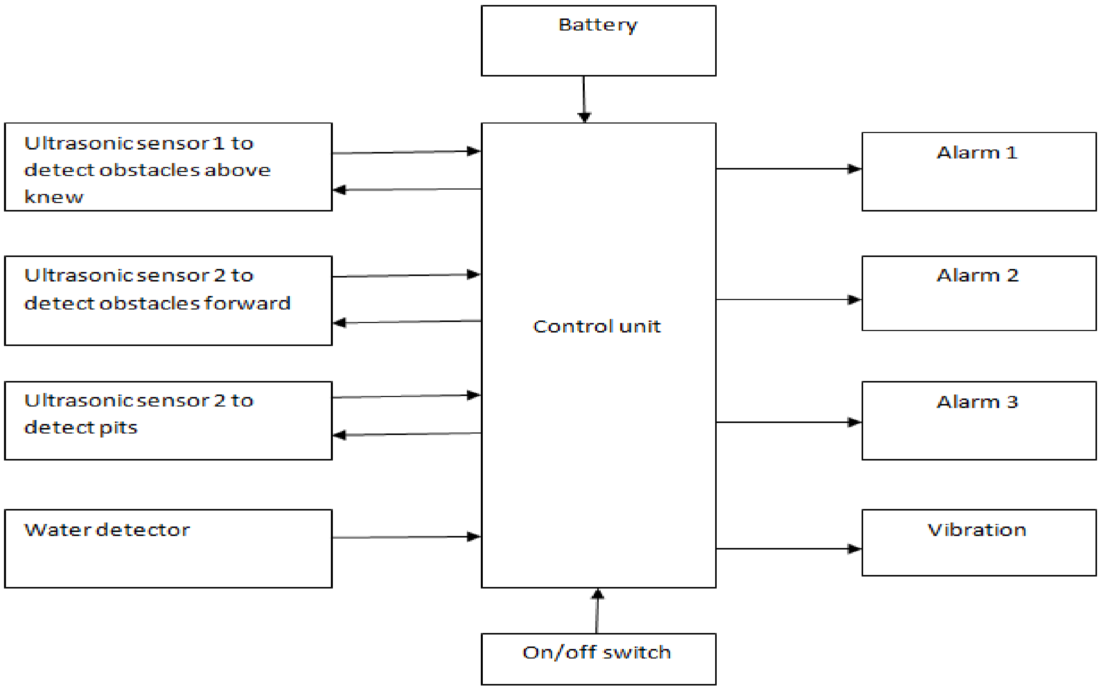

Figure 1: Block diagram of the guide cane

3.2 Software implementation

In this project we choose Proteus Virtual Modeling (VSM) software to develop and test the circuit control before physical prototype (Figure 2).

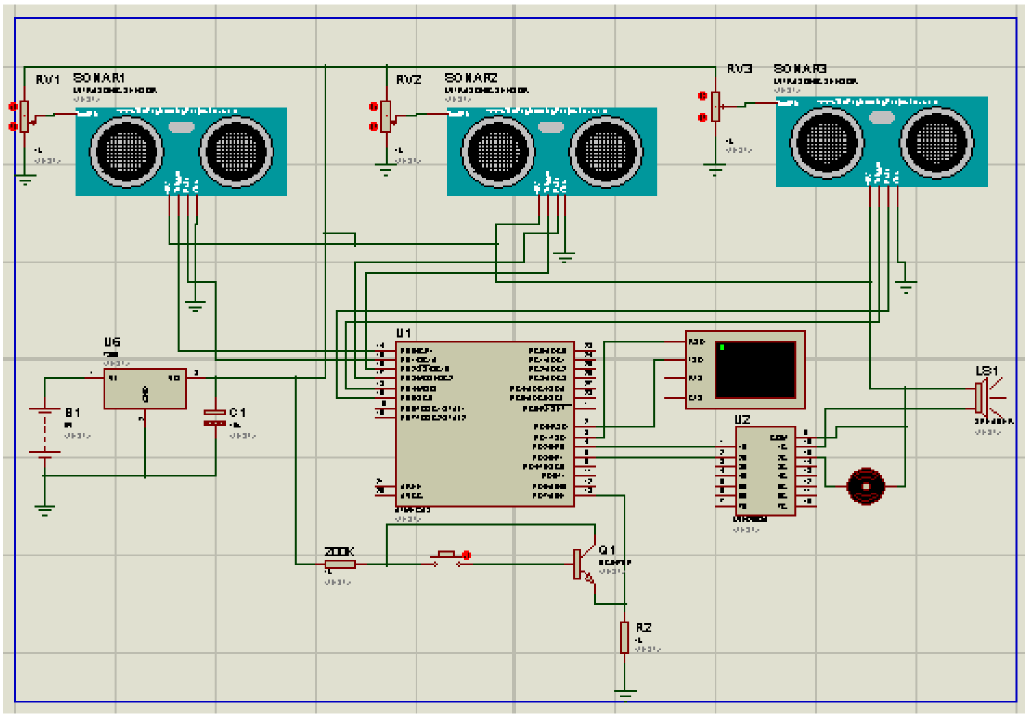

Figure 2: The whole circuit design using Proteus simulation.

3.3. MATERIALS

The major components of the guide Cane are as follows: AT Mega 8L microcontroller, 3 HC-SR04 Ultrasonic Sensors Module, DC Vibration Motor
PTFE, and ATmega8 (L)
The Atmel ®AVR® ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed. The Atmel AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers [7].

HC-SR04 Ultrasonic Sensor features: working vltage -DC 5 V, working Current -15mA

Working Freq.-40Hz, max Range -4m, min Range -2cm, measuring Angle -15 degree
Trigger Input Signal -10uS TTL pulse, echo Output Signal -Input TTL lever signal and the range in proportion and dimension -45*20*15mm(Sheth et al., 2014).

DC Vibration Motor

This is the type of DC vibration motors used in mobile phones. It requires a voltage supply of 1.3 v to 3 v with current around 125 mA. This type of motors can be programmed to control the speed of it by using the PWM (Pulse width Modulation) method. The speed of the motor is 13500 rpm and the diameters of the motor is 4 mm to 10 mm and the length is 2mm to 15 mm (Al-Barrm and Vinouth, 2014).

D. PTFE (Teflon)

Its Polytetrafluoroethylenematerial, the molecular structure of PTFE is based on a linear chain of carbon atoms which are completely surrounded by fluorine atoms. The carbon-fluorine bonds are among the strongest occurring in organic compounds. As a result, PTFE has. It has self-lubricating capabilities, Unlimited shelf life and Very high electrical resistance, so we designed as joint between apart of shaft to make easy folding the guide cane and filter to detect water detector from Clay and dust (Iacono et al., 2007).

3.4 HARDWARE DESCRIPTION

Through the archicad, the images of the cane and the length of the right person for each stick were obtained.

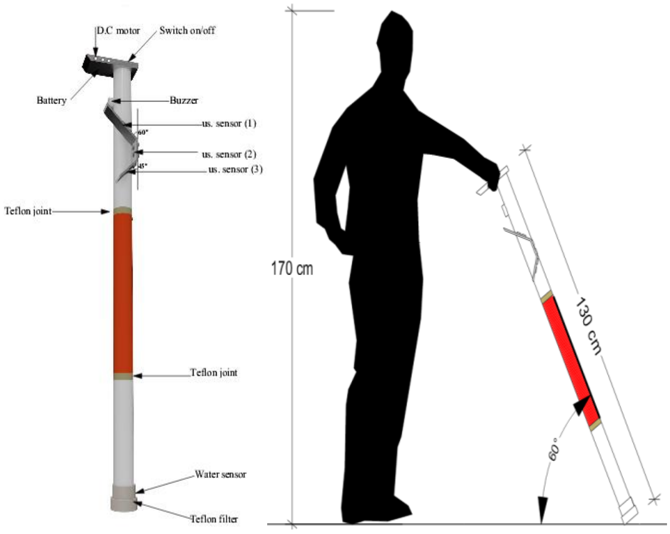

Figure 3: Prototype Design, major component and elevation of guide cane

Figure 3 contained the following details: Sensor 1: ultrasonic sensor for obstacles above knew to cover the head (42cm -50 cm) range of detection; Sensor 2: ultrasonic sensor for obstacles forward (less than 50cm); Sensor 3: ultrasonic sensor for pits (100cm-120cm); Water detector: to detect water on ground (≥2cm); Teflon joint: to make easy folded cane; Teflon filter: to protect water sensor from Clay and dust so as not to be destroyed.

4. Result

4.1. HCSR04 sensor longitudinal distances test

In this test actual distance is distance measured by tape or scale and measured distance is the distance measured by the ultrasonic sensor by moved the object around the HCSR04. See more in figure (6).

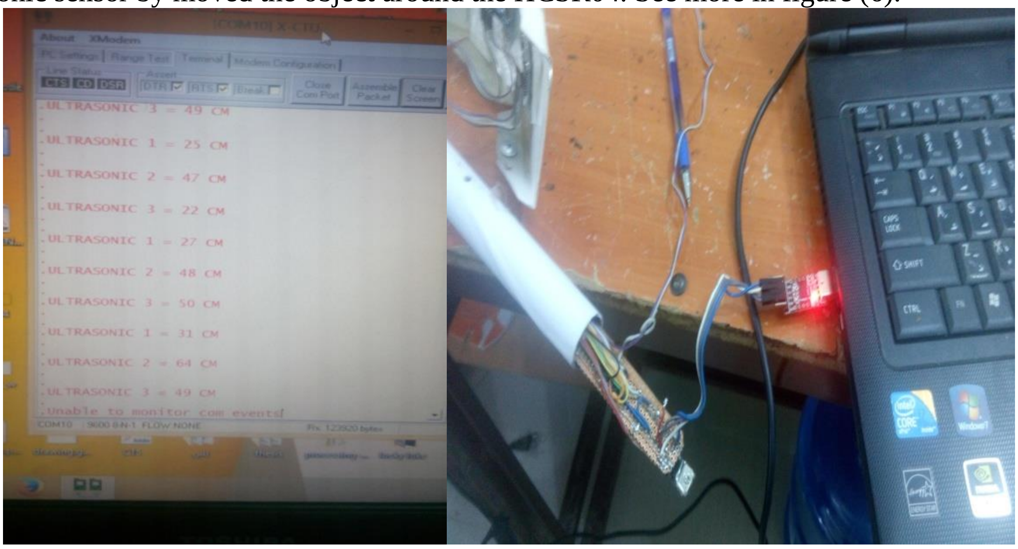

Figure 4: HCSR04 sensor distance test

Table 1: Result of distance measurement by HCSR-04

Set no	Actual distance	Measured distance	Error %
1	20	18	10
2	40	36	10
3	60	52	13
4	80	70	13
5	100	86	14
6	120	102	15
7	140	118	16

Table 4.1 shows us the mapping between actual and measured distance. So we calculated Mean of Error=13% that's lead to the guide cane work 87%, his value is almost accurate which makes our system more reliable.

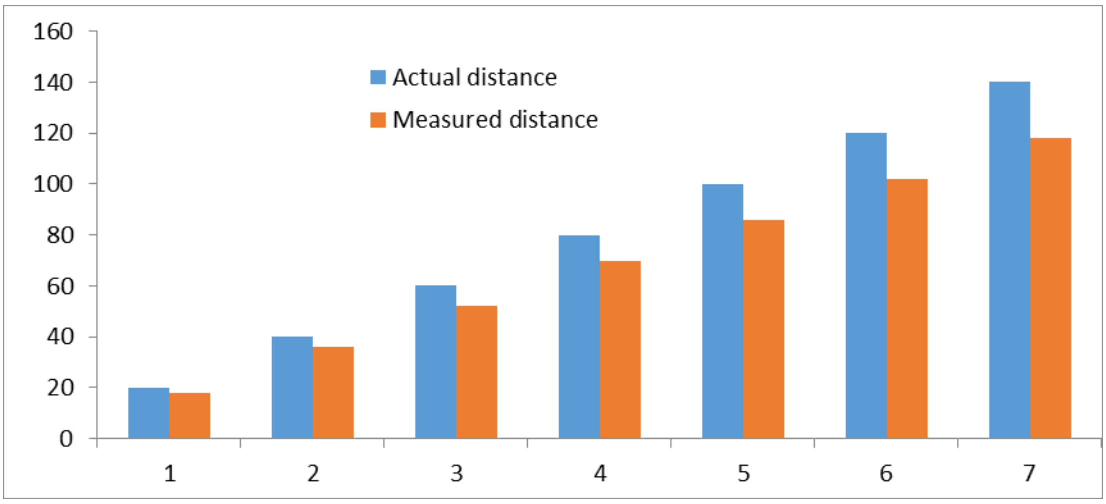

Figure 5: Relationship between actual distance and measured distance.

The graph b/w actual value and measured value is almost linear (Figure 5). We observed that there is considerable error in the measured distance as compared to actual distance. Error is large at the higher distance of the obstacle.

4.6 detection zone at angle 15° left and right

Ultrasonic sensors have an advertised angle that represents a cone that the sensor can detect objects in. For the HC-SR04 this angle is 30 ° (measurement angle) and effective angle 15°. In this test we will find the detection zone at angle 15° left and right horizontally at distance 64cm, In first experiment, we placed an obstacle on the right hand side of the sensor. Similarly we did the experiment for the obstacle at left hand side. The experimental setup can be shown as in Figure 6.

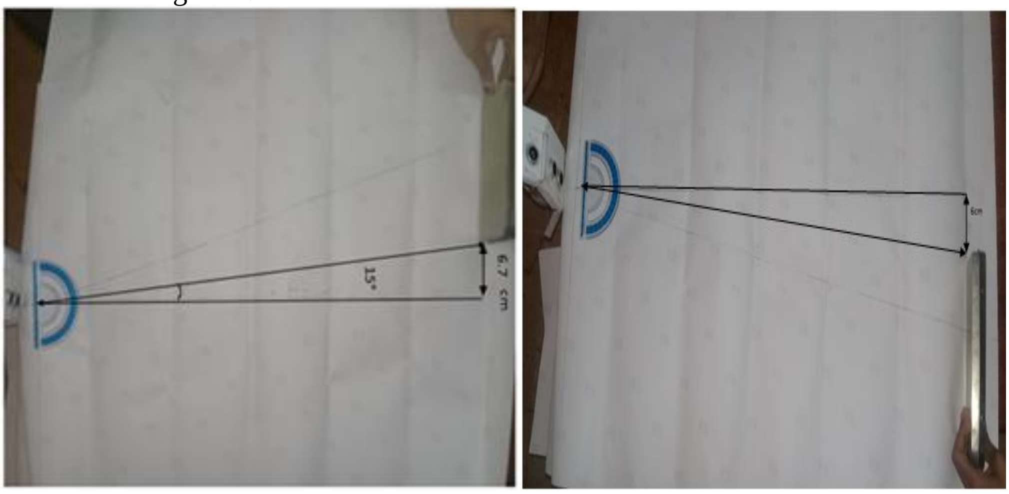

Figure 6: Detection zone at specific distance and angle (a) left side, and (b) right side.

After carrying out number of experiments, the average value for both of the measurements was calculated. For a right hand side obstacle, the detection zone6.7cm was found to be (fig a) for left hand side obstacles, it was 6cm (fig b) that mean the total zone for single HCSR04 at angle 15° and distance 64cm equal 12.7cm.

Specification of guide cane: cheap mobility cane, light weight components integrated to the cane which makes it user friendly, and fast response of obstacles, bits and water.

5. CONCLUSION

The guide cane includes 3 ultrasonic sensors to detect all obstacles (forward, above knew) and pits, and water sensor to detect water on the ground. The result of ultrasonic sensors alarm with different ring for each sensor, and vibrations for water in the bath, all this alarms buzzer will be stopped once it is taken out from obstacles and water. This can considerably alleviate the risk of the user injuring himself. A global positioning method will added to find the position of' the user using the global positioning system (GPS) and guidance to their destination will be given to the user by voice navigation. Some more applications like fire or smoke alarm can also be included.

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