A SMART STICK WITH KEYPAD FOR DUAL SENSORY IMPAIRED

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ABSTRACT

In today's modern world many technologies has been implemented for blind, deaf and dumb separately. No new technology has been implemented for the people with dual sensory impaired (all three). In this paper a new method has been implemented where the features needed by these dual sensory impaired for communication, emergency alert and obstacle detection comes under a single stick with foldable one. By using this stick the dual sensory impaired people can able to travel anywhere which will widen their view with the society

KEYWORDS: Arduino Mega, Ultrasonic Sensor, Vibration Motor, Servo Motor, LDR, Gesture Sensor

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INTRODUCTION

Obstacle detection and communication are two major factors that are to be considered when designing a product that aims to aid the people who are sensory deprived at the same time. Such people make use of their hands and tools such as white canes for obstacle detection. Hand gestures and language like braille are used as a mean for communication. People, while using white cane, perceive the presence of nearby obstacles by touch sense through the impact created by the cane on the obstacle in its path. This technique, though perfected to its limits by the people wielding it, is still limited when we consider the possibilities of perception that can be obtained through a hand held device. Hence, this project plans to enhance the cane through obstacle detection module and braille keypad.

The recognition of the surrounding is obtained with the help of an obstacle detection module that is placed near the bottom of the stick. This allows the module to operate within its max range of 15° angle with respect to the vertical direction. However, this range is insufficient for the obstacle detection along the horizontal direction. Hence, this obstacle detection module is mounted on a 360 degree range rotation that is capable of swinging the obstacle detection module horizontally.

In the literature, different techniques have been proposed for sticks. In [1,10], proposed an idea of designing electronic stick using Global System Messaging (GSM), Global Positioning System (GPS) and Ultrasonic technology. In [2,4,6,7], the system uses six dot vibrators to display characters and System having Braille pad for writing the Braille letters. SMS facility used for communication.[3], merging data provided by the two sensor types to allow more accurate information, to be transmitted to the user via a

Bluetooth module as a voice message specifying the object nature, characteristics and the distance between the detected obstacles. In [5], multiple sensors are used to detect obstacles. [8] a device control section which will

be operated by using Braille touch keypad, the device control section of a microcontroller connected with the load devices. The AC devices can be controlled to the controller through a relay.

In [9], proposed the implementation of braille to word and audio converter as output using FPGA.[11-12], are liable solution encompassing of a cane and a shoe that could communicate with the users through voice alert and pre-recorded messages. [13], new technique and communications method for blind persons. Conversion of English language to braille and it was detected by Six vibration motors that are placed in the glove.[14], the user pushes the lightweight GuideCane forward and When the GuideCane's ultrasonic sensors detect an obstacle, the embedded computer determines a suitable direction of motion that steers the GuideCane and the user around it [15] focus on a navigation system called Virtual Leading Blocks for the Deaf-Blind, it consists of a wearable interface for finger braille. It uses two Linux-based wrist watch computers as a hybrid interface for verbal and non-verbal communication in order to inform users of their direction and position through the tactile sensation.

THEORETICAL BACKGROUND

Stick and Keypad Specification

This product is mainly built around a walking stick of robust aluminum construction with foldable one. The length of the stick is 92 cm and thickness is 18cm. The keypad is designed to be a handheld device of dimensions **100mm*50mm*15mm**. Buttons are spaced with **10 mm** gap to provide an ergonomic handle

Figure 1: Block Diagram for Dual Sensory Impaired.

DESIGN METHODOLOGY

The stick or mainly consists of the following modules:

- Obstacle detection
- Extending the range of detection
- Emergency alert
- Night alert for society
- Communication

Obstacle Detection

Figure 2: Block Diagram for Obstacle Detection.

To detect the obstacles obstacle detection sensor is used. The sensor will emit the sound waves and detect the obstacle or object and bounce backward to the sensor. The input from obstacle detection sensor will be provided to processor where it performs the distance calculation. If the calculated range is below 400cm it provides a vibration alert to the user. The obstacle detection sensor has to detect the obstacle within the range of 400 cm. The obstacle detection sensor will have transmitter and receiver pin. To initialize the transmitter pin it will send a pulse of minimal timer period of ten micro second delay. Within that delay it will send eight sonic burst of data at 40 KHz. The sound wave will detect the obstacles. When it detects, the receiver pin will be high and the timer will start and when the wave bounces back from the obstacle and reaches the sensor, receiver pin will go low and the timer will be stopped. The processor will get the timer value from timer register and calculate the distance.

Procedural Calculation

$$\text{Distance} = (\text{speed} \times \text{time}) / 2$$

$$S = \text{speed of sound} = 344 \text{ m/s}$$

$$T = \text{time calculate the to and fro distance}$$

$$\text{Speed of the sound} = 340 \text{ m/s}$$

$$= 0.034 \text{ cm/us}$$

$$\text{Time} = 271 \text{ us} = 271 \text{ us} \times 0.034 \text{ cm/us} = 9.214 / 2$$

$$= 4.607 \text{ cm}$$

To display the value in centimeter it should be divided by 59. The timer value loaded in the timer register is 380000 microsecond. The received value from the timer register will be calculated using the above formula. Once the range is detected if the range is below 400 cm the vibration motor will provide a vibration alert to the user.

COMMUNICATION

The dual sensory impaired people will find difficult to communicate with normal people because the language used for communication will be different for both of them. By using this keypad they can communicate easily with normal people because it converts the braille language into text which is understood by normal people.

Figure 3: Block Diagram for Communication.

Figure 4: Hardware Result for Braille Keypad.

The input of Braille language is given to the processor by keypad. The input from this keypad is communicated to the society with the help of an LCD display. The keypad consists of six buttons. The micro controller will convert the braille input to text format. The Braille keypad functions based on the concept that all the buttons pressed before complete release of those buttons together constitute the input given by the user. Thus the program consists of two major functions – Wait For Release and Read Keys.

Steps to Display a Character c

Set $x=0$. When a button, is pressed x becomes 1. Left shift the x values 5 times (based on the number given in binary digit arrangements). Perform OR operation $a|x$ and store the value in a

$x=100000$ (left shift)

$a=000000$

$a=100000$

Then check if any other buttons are pressed. Button 4 is pressed. Corresponding binary digit 2. Left shift x value 2 times and

$x= 100$

$a=100000$

100100

Then again check if buttons are pressed. If not display the character. The character for the buttons pressed is C.

To Display a Number 1

Same process is carried out as character. Before entering a number # symbol has to be pressed. After the button 5 is pressed it will generate the a value and perform ascii conversion a binary digit value will be 100000. Generate the ascii value for binary number 100000. The ascii value for a is 97. To convert the character in to number

$c=c-48$

c value is 97

$C=97-48 = 49$

The corresponding ascii value for character a is 1, therefore the number 1 will be displayed.

ROTATION OF ULTRASONIC SENSOR WITH SERVO MOTOR

Figure 5: Block Diagram for Servo Motor Rotation.

To detect the movement of hands gesture sensor is used. The gesture sensor will detect to which direction the hand is moved and provide the direction to the processor. Based on the input provided by gesture sensor, the processor will make the 180 degree ranger rotation to rotate in the specified degree. The communication between the gesture sensor and processor is done through I2C.

Emergency Alert

Figure 6: Block Diagram for Emergency Alert.

When the dual sensory impaired people is in danger or they lost in some places, they will need the help of others. Therefore to alert the near by people this module is used. In emergency situation when the on/off control is pressed a signal will be send to the processor. The processor will process the signal and send the output signal to the emergency alarm pin. A continuous sound will be produced until it receives the next signal from processor.

LED LIGHT FOR NIGHT ALERT

Figure 7: Block Diagram for Night Alert.

The LED light is used to alert society. Three white LED's are placed in the top, middle and bottom of the stick. When the intensity of the light increases the resistance of LDR decreases so the LED will not glow. When the intensity of light decreases then the resistance will increase so which in turn LED will glow.

RESULT

The hardware experimental setup is shown below how the proposed work of the project of a smart stick for dual sensory impaired is implemented in Arduino Mega

Figure 8: Experimental Setup of Smart Stick.

Figure 9: Experimental Setup of Smart Stick Topview.

CONCLUSIONS

Thus the hardware for dual sensory impaired people is done using arduinomega. Both the smart skicksor and braille keypad has been integrated as one device with additional features added. This project will help the dual sensory impaired people to avoid obstacles and communicate better

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