SMART GLOVES FOR BLIND

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Abstract - *In order to help the visually challenged people, a study that helps those people to walk more confidently is proposed. The study hypothesizes a smart walking gloves that alerts visually-impaired people over obstacles, pits thus this device could help them in walking with less accident. It outlines a better navigational tool for the visually impaired. It consists of a simple walking equipped with sensors to give information about the environment. GPS technology is integrated with microcontroller which will help their loved ones to keep eye on them. In this system ultrasonic sensor, GPS receiver, vibrator, PIC controller and battery are used. The overall aim of the device is to provide a convenient and safe method for the blind to overcome their difficulties in daily life.*

***Key Words*: Arduino, Smart Cane, Zero Update Algorithm, Servo.**

1. INTRODUCTION

Nowadays, technology and human life cannot be separated as it has become the phenomenon of the world. But, how the technology can help people that visually impaired? Blind people usually can estimate the obstacle in front them without knowing the actual distance of the obstacle from them. Mobility for the blind people can be defined as mobility to move with safety and ease through environment without rely on other. Most commonly mobility aid used by the blind are cane and guide dogs to facilitate their movement. But there are problems for this navigation supports. The cane provide limited preview for the user and as a result, user has to be more careful to walk and mobile very slowly. As for the guide dogs, the training and coordinating the dogs with blind people are difficult task and the result are minimal.

In order to overcome this problem, research on the assistant devices for the blind has been done by many people to help reduce the limited ability of the blind people. The assistive glove for the blind is a device that can help visually impaired to facilitate movement and to perform daily activities without relying too much on others. The glove with the integration of ultrasonic sensor HC-SR04, Arduino UNO microcontroller will help blind to facilitate movement and give alert to user if there are obstacle in front of them in the range 2 cm to 300 cm.

2 .LITERATURE SURVEY

To make the System more efficient there are various system that relates to the development for projects related to the blind persons. These literature survey help us to overcome various design and program related improvements.

In "Voice based email system for blinds" by T.Shabana1, A.Anam, A.Rafiya, K.Aisha. says "In today's world communication has become so easy due to integration of communication technologies with internet. However the visually challenged people find it very difficult to utilize this technology because of the fact that using them requires visual perception". Even though many new advancements have been implemented to help them use the computers efficiently no naïve user who is visually challenged can use this technology as efficiently as a normal naïve user can do that is unlike normal users they require some practice for using the available technologies. This paper aims at developing an email system that will help even a naïve visually impaired person to use the services for communication without previous training. The system will not let the user make use of keyboard instead will work only on mouse operation and speech conversion to text. Also this system can be used by any normal person also for example the one who is not able to read. The system is completely based on interactive voice response which will make it user friendly and efficient to use.

Navigation System for Visually Impaired People by Chaitali Kishor Lakde and Dr. Prakash S. Prasad says Navigation assistance for visually impaired (NA VI) refers to systems that are able to assist or guide people with vision loss, ranging from partially sighted to totally blind, by means of sound commands. Many researchers are working to assist visually impaired people in different ways like voice based assistance, ultrasonic based assistance, camera based assistance and in some advance way researchers are trying to give transplantation of real eyes with robotic eyes which can capable enough to plot the real image over patient retina using some biomedical technologies.. There are some limitation in system like obstacle detection which could not see the object but detection the object and camera based system can't work properly in different light level so the proposed system is a fusion of Color sensing sensor and the obstacle sensor along with the voice based assistance system.

3. EXISTING SYSTEM

According to Mazo and Rodriguez the blind Cane is one of the assisting tools for the visually-impaired and it is really important. According to Herman , one of the main problems of the visually-impaired, is that most of these people have lost their physical integrity. Also, they do not have confidence in themselves. This statement has been proven by Bouvrie, in which an experiment name ─Project Prakash‖ has been carried out. It was intended at testing the visually-impaired to utilize their brain to identify set of objects.

According to Chang and Song , this can also be applied to different situation. When the visually-impaired walk into a new environment, they will find it difficult to memorize the locations of the object or obstacles. These examples demonstrate the difficulties of visually- impaired people. The Guide Cane is designed to help the visually-impaired users navigate safely and quickly among obstacles and other hazards. Guide Cane is used like the widely used white cane, where the user holds the Guide Cane in front of the user while walking.

Smart Cane has been designed by students from Central Michigan University where this invention uses Radio Frequency Identification (RFID). RFID is used to detect objects or obstacles in front of the user and detects the RFID tag that has been placed in several areas to navigate the users. This invention is just like a normal stick but is equipped with a bag, worn by the user. The bag supplies electricity power to the invention and informs the user through speakers inside the bag. For users who do not have the ability to hear, there are special gloves that will vibrate at every finger, in which different vibrations in each finger have different   meanings. However, this invention has several weaknesses and is only suitable for small areas. This is because it only detects the area with RFID tag otherwise this invention only works as a regular blind cane. In addition, this invention requires a high cost if it is used in the external environment because the larger area that need to be tagged, the higher cost is needed.

3.1 SCOPE

To achieve the objectives, the scope of this project are determined. For the hardware, ultrasonic sensors will be used as a sensor to detect obstacles at the front and it will send signal to Arduino UNO which act as microcontroller. The microcontroller will then process data and send the signal to Servo Motor which will guide through its vibrating feedback. For the software, the design of the circuit is done using Fritzing software and the program will be done using Arduino software by installing through Arduino library. This will also produce:

- Independent Mobility
- Easy to access location
- Easy to call in emergency
- Better way to explore surrounding
- Low cost device to handle with ease
- System is flexible and secure to use
- Saves times and reduce interdependency

3.2 PROPSED SYTEM

The concept of integration of system is illustrated in figure 3.3, this is the concept of the project that shows the position of all the component which will be discussed in next section. All the components were integrated with glove and used by blind person.
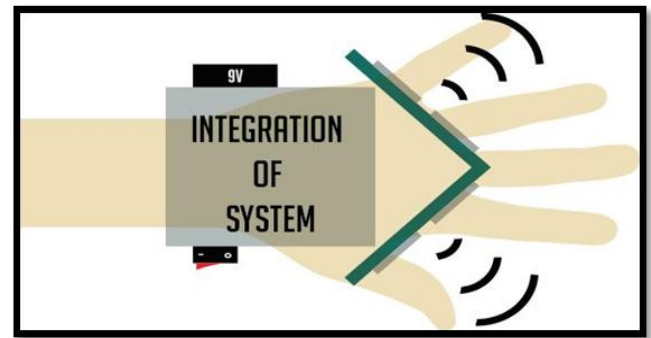

Figure 3.2.1: Overview of the system

Sonar radiation of system is shown in figure 3.2.2 which show the outcome of this system. If the ultrasonic sensor detect the output below 1 meter from the user, buzzer and LED will trigger and Vibrator Motor will decode the sound only if the obstacles detected exactly at 1 meter. The same process happen for distance 1.5 meters and 2 meters
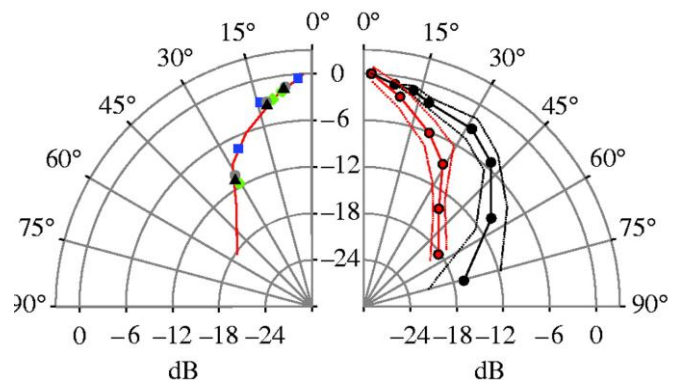

Figure 3.2.2: Sonar radiation

3.3 IMPROVEMENT IN EXISTING SYSTEM

We are implementing the system in such a way that it help them to overcome every day-to-day life obstacles. Thus we are implementing a integrated system called as "HUB" which consist of numerus features such as GPS tracking,emergency calling features and lot other features ca be add to system. As android application play a vital role in our life but in such topics which cover the for blind, the adroid application cannot be taken as helping hand for blinds in emergency situations so, we are using the Near Field Communication Technology which is widely known as 'NFC'. Just tap the smartphone with gloves and you are ready to go. It will help them in emergency situations by just tapping smartphone to gloves and family members will be notified by text messages.Thus NFC will help them to cover wide rage of situation handling by just tapping the phone to gloves.

Now this shows us limitation for the project that the smartphones need to support the NFC Feature. Thus every research start with its limitation heces it open new doors to explore more.

3.4 SYSTEM REQUIREMENT

Software:

There are two main software used in developing this project which are Arduino software and Fritzing software. Arduino software used to write the program using C language and Arduino language. It is used to compile and install the program into the microcontroller. It also has the function to monitor the distance between obstacle and ultrasonic sensor. It will display the value of distance and make the project easier to be tested.

Fritzing software is used to design the circuit connection of all the hardware. Since all the hardware will have their own library, Fritzing software is a suitable software to be used in this project as it will help in showing the circuit connection and the schematic of the system.Besides that, SolidWorks also used to design structure of frame which is used to hold the position of ultrasonic sensors.

Hardware

There are six main hardware in this projects.

1. Ultrasonic Sensor
2. Sensor Position
3. Arduino UNO
4. Switch
5. USB to TTL Converter Adapter
6. Servo Vibrator Motor
7. Jumper Wires

4. IMPLEMENTATION FOR METHODOLOGY

Smart solutions have been proposed for reducing the disease impact (artificial body parts, augmented reality sensors, etc). Due to the big effort in improving the usability of technological devices for impaired people, the uncanny valley has been filled up and we are facing at threshold of a new era in adopting these cyber-physical system.

Algorithm

We introduce a fast and reliable algorithm to estimate the position of the hand considering only the x-acceleration. The algorithm is based on the well-known Zero Velocity Update approach, adopted in pedestrian dead reckoning the peaks are isolated using fixed threshold, while crosstalk and noise are regarded as a bias and estimated when the hand is still. In this work we introduce the Zero Update algorithm.

In pedestrian navigation systems, the position of a pedestrian is computed using an inertial navigation algorithm. In the algorithm, the zero velocity updating plays an important role, where zero velocity intervals are detected and the velocity error is reset. To use the zero velocity updating, it is necessary to detect zero velocity intervals reliably. A new zero detection algorithm is proposed in the

paper, where only one gyroscope value is used. A Markov model is constructed using segmentation of gyroscope outputs instead of using gyroscope outputs directly, which makes the zero velocity detection more reliable.

Ultrasonic Sensor HC-SR04

This type of ultrasonic sensor has an ability to determine the distance of objects with high accuracy and provide stable reading of data. The sensor widely used for the blind because it does not affected by environmental noise. It works by transmitting an ultrasonic burst and provide output pulse which correspond to the time required for the burst echo to return to the sensor. The distance to the target or objects can be calculated by measuring the echo pulse width.

Arduino UNO

Arduino Uno is the main part of this project which it act as microcontroller. Since the price is very cheap and easy to use, it is very good for the development of new products or interesting projects. Coming with 14 digital pin, 6 analog pin, 16 MHz crystal oscillator and USB connection, it is suitable to be used as a microcontroller. Based on ATmega328, this microcontroller board can simply connect to computer using USB cable or using adapter to connect with battery to get started.

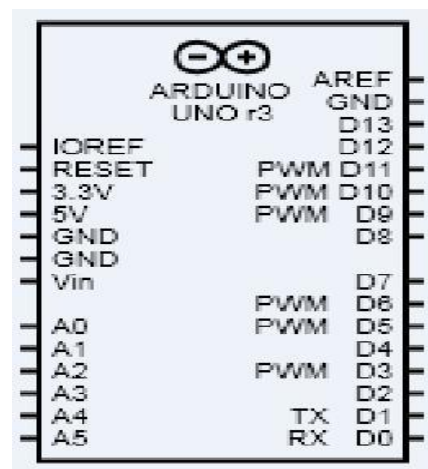**Figure 4.1:** Arduino UNO

**Figure 4.2:** Structure of Arduino UNO

Figure 4.1 and 4.2 both shows the Arduino and the pin structure while Figure 4.2 shows the complete schematic diagram of Arduino UNO including the integrated circuit and all the other components.

In this project, Arduino UNO was powered with 9V battery which is in the range of recommended voltage. Although the board can operate at 6V up to 20V, if the supplied voltage is less than 7V, the 5V pin may supply less power resulting unstable condition for the board. Besides, if the supplied voltage more than 12V, the voltage regulator will overheat and the board will damage.

Servo Motor:

Servo motors are great devices that can turn to a specified position. Usually, they have a servo arm that can turn 180 degrees. Using the Arduino, we can tell a servo to go to a specified position and it will go there. Servo motors were first used in the Remote Control (RC) world, usually to control the steering of RC cars or the flaps on a RC plane. With time, they found their uses in robotics, automation, and of course, the Arduino world.

Here we will see how to connect a servo motor and then how to turn it to different positions.
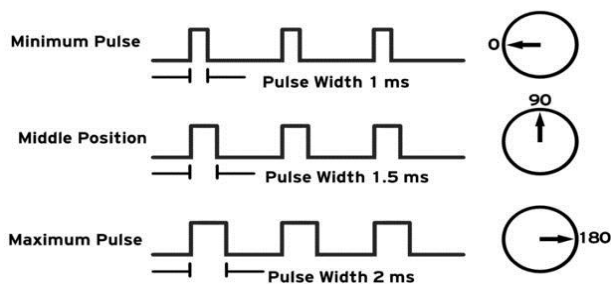
Figure 4.3: Direction for Servo Motor

5. CONCLUSIONS

Smart glove for the blind project is to help blind people walk and estimate the distance from obstacles. Main component for this project are Arduino UNO, Vibrator motor and ultrasonic sensor. Based on the experiment that have been conducted, there are few advantages and limitations of this project. One of the advantages of this project was the use of ultrasonic sensor. This sensor was very sensitive and will trigger faster when it detect obstacles. Besides that, the cost to develop this project was low and can be afforded by blind people. The limitation of this project was the ultrasonic sensor used can only detect the obstacles but cannot illustrate the shape of the obstacles. Furthermore, this assistive glove can only be used by blind people but not the blind and deaf people. Future improvement can be made to increase the performance of this project.

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