BRAILLE WATCH

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Abstract

Touchscreen technology has brought about significant improvements for both normal sighted and visually impaired. Visually impaired people tend to use touchscreen devices because these devices support a screen reader function providing a cheaper, smaller alternative to screen reader machines. Worldwide over 285 million people are blind or visually impaired. There are various ways for visually impaired people to know time. They include verbally asking another person, using an Analog Braille watch and using watch which tells time via voice. There is a demand or way for blind person to receive information at any time and in any place through Digital Braille watch. It's not something most of us think about on a daily basis but most watches are basically useless for visually impaired person. The Digital Braille watch is the most creative solution which uses motorized smart watch that uses Braille to give time. It consists of rechargeable Battery which will be cost efficient and also consist of touch sensors. A smartwatch with a unique interface is able to translate basic notifications for blind users by dynamically reproducing Braille on its specialized surface, helping they stay connected in our modern digital world. GPRS tracker is also inbuild in the watch to keep track of visually impaired person.

Keywords: *Rechargeable Battery, Touch Sensors , GPRS tracker.*

1. Introduction

Blindness is strictly defined as the state of being totally sightless in both eyes. A completely blind individual is unable to see at all. The word blindness, however, is commonly used as a relative term to signify visual impairment, or low vision, meaning that even with eyeglasses, contact lenses, medicine or surgery, a person does not see well. Worldwide over 285 million people are blind or visually impaired. There are various ways for visually impaired people to know tell time. They include verbally asking another person, using an analog Braille watch, and using a watch that voices the time. However, it is an inconvenience to always ask another person for the time, an analog Braille watch can be misread, The analog versions have a protective glass or crystal cover that is flipped open when time needs to be read and the clock-hands are constructed to not be susceptible to movement at the mere touch of the finger that a blind person uses to observe their positions and the audible watch can be disruptive to others. There are those who are blind and have used Braille for most of their life but repeatedly misread a watch due to the fact that they have difficulty in distinguishing the length of the minute and hour hands. Braille Watch brings new possibilities to millions of visually impaired people. Braille technology reduces size, weight and price by more than ten times. A smart watch with a unique interface is able to translate basic notifications for blind users by dynamically reproducing Braille on its specialized surface, helping them stay connected in our modern digital world. Due to problems with the current method of telling time for visually impaired individuals as stated in the previous section, our goal is to create a digital Braille watch that displays military time and does not cause disruption to others.

2. Proposed Methodology

The Digital Braille watch gives proper time to visually impaired person when required in Braille language. The technology of small push pull solenoids are used to design the watch. There are total of 16 solenoids used. For 1 digit it is required to have either 3 x 3 or 2 x 2 matrix, to reduce the load as well as power consumption 2 x 2 matrix is convenient. There are 8 solenoids for hours and 8 solenoids for minutes. The specific amount of solenoids will go high as per the digits in time. As the digits are raised the person will move a hand around the raised digits and will know the time by feeling it. The solenoids are connected to a small diode to minimize the complexity as well as to avoid reverse current. The whole setup of 16 solenoids and their respective diodes is connected to the Arduino ATMEGA. The push pull mechanism of solenoid is controlled by Arduino ATMEGA. The micro-controller has 16 Analog pins and 16 Digital pins. The controller is well programmed to perform push pull mechanism. As the circuit is very complex and connections are way too much it is convenient to design a PCB (Printed circuit Board). With the help of PCB the size of the entire circuit is reduced to some extent. A Switch is used to ON – OFF the solenoid working. The user will press the Switch whenever he wants to know the time, this will consume less power and will also avoid heating of Solenoids. After a particular delay the solenoids will again go back to its original position. The watch is also interfaced with GSM module and GPRS tracker. The tracker will track down each and every movement of the user and will give a message to his friend or relatives if the user takes a wrong path. A Buzzer facility is given which will vibrate or give a beeping sound after a particular amount of time.

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3. Literature Review

A. Digital Braille Watch (comparison of different methods stating their pros and cons)

Electrocutaneous Display One option for displaying military time using Braille involves sending controlled electrical signals to the skin, which nerve endings can then interpret as pressure or vibration. Depending on the arrangement of electrodes used in this electrocutaneous approach, the user will interpret different sensations. For this project, four electrodes in a square arrangement can represent the four Braille dots needed to distinguish the different numbers. An electrotactile electrode consists of several basic components. An electrode array model in Dr. Tyler's research laboratory had an annulus located within a shallow well for each electrode, and these were arranged in a standard grid pattern; see Figure 1 for dimensions. The electrical signal, whether it is a controlled amount of current or voltage, originates from the annulus of the electrode. The power and circuit controls to create this signal are a separate unit, far larger than the electrode itself. The well surrounding the annulus insulates it from closing the circuit with the metallic plate around it. When the electrode is sufficiently powered and an individual presses their skin to the electrode, they close the circuit between the annulus and the plate. Human skin varies in terms of the thickness of layers, density of sweat glands, presence of hair follicles, and density of nerve endings (Saladin, et al, 2008). All of these factors play roles in how well a signal is conducted, and what type of sensation the individual perceives. Factors favoring the conduction of electricity include a thinner epidermal layer, increased presence of sweat glands and hair follicles, and presence of pressure and vibration sensitive nerve receptors. Contrastingly, a thick epidermal layer, lack of pores and secretions, and scarcity of proper nerve endings makes signal transmission difficult. The epidermis acts as an insulator, thereby blocking any electrical signals trying to cross into deeper tissues. The outer skin is penetrable, as sweat glands and hair follicles act as conductive passageways to cross the insulating epidermal layer. Sweat is rich with electrolytes, providing a path to the dermal tissue. Once in the dermis, the electric signal is much freer to spread through the tissue. Nerve endings are located in this layer, and are responsible for relaying information to the brain about changes like pressure, temperature, vibration, pain, and other sensations. Specialized encapsulated corpuscles and receptors associated with hair follicles are needed for pressure and vibration sensation, and can be found in various combinations and densities across the skin of the body (Saladin, et al, 2008). Controlling the voltage or current of the applied electrical signal is important so that the desired nerve receptors are stimulated, and also so that the user is not endangered by higher than necessary currents or voltages. A current control system would be more ideal for skin profuse with sweat glands, because these glands act as shorts in the circuit when crossing the epidermis. Without current control in this situation, the user could receive a dangerous shock or burns because of the large amount of current crossing the skin. Voltage control is better in situations where the skin is less permeable to electricity (i.e. minimal pores, low amounts of electrolytes in solutions like sweat, etc). Thus, depending on the area of skin the electrodes will come in contact with, the circuit must either have controls in place to limit the current flowing into the skin, or the voltage applied to it.

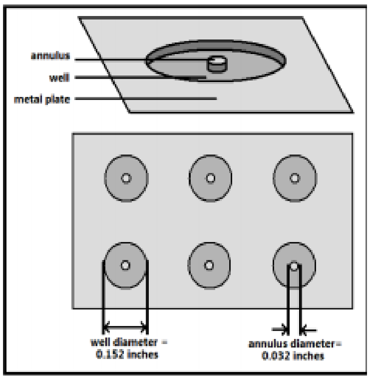

Figure 1: Electrocutaneous electrode,

CONS: Although there is significant potential with this type of technology, there are downsides to be considered. The scope of the research necessary before a finished product can be reached will require extensive technical and human testing, purchasing of custom equipment, and attention to detail. Given the budget constraints of this project, as well as the desire to create a product as soon as possible for our client, this makes an electrocutaneous display unfavorable. In addition, some aspects of this design may not be feasible regardless of the availability of time and money. The challenge would be creating a power supply capable of delivering the necessary voltage, with a reasonable amount of time between charges and/or battery replacements, and being ergonomically practical for an individual to carry around with them. Associated with such a power supply is the risk of electrical shock due to malfunction, damage, or misuse. If the electrodes were applied to the wrist when intended for the finger, the voltage applied would be quite excessive, and could harm the user or damage the watch itself. The user should feel completely safe using this product and not hold the lingering fear that it could cause them harm. 9 Several aspects of this design detract from the usability and cohesiveness with the user's daily activities and life style, making it a less desirable option

B. Braille Watch prototype which utilizes pin, disk, gear mechanism and motor.

The disk and pin design, much like its name suggests, consists of disks and pin sets. Four disks are located beneath the watch surface, one for each Braille numeral. Above each disk four pins are positioned so that they rest on the disks surface. The portion of the disk against which the pins rest has both raised and recessed sections (Figure 2). If a pin is on raised surface, it will be pushed slightly above the watch plane, and if not, the top of the pin will remain flush with the surface of the watch. When the disk rotates different combinations of pins are raised. In this way all necessary numbers can be displayed. A clear benefit to this design is that only four moving parts are needed. This cuts down the energy necessary to run the watch. Disks can be rotated using small servos. Not only does this design permit smaller components, but it also removes ambiguity of Braille number display. A clear benefit to this design is that only four moving parts are needed. This cuts down on the energy necessary to run the watch. Smaller servos than those which last semester's group used can be utilized, since the disk would not have to turn more than 165 degrees to achieve numbers zero through nine. this design permit smaller components, but it alsoremoves ambiguity of the Braille number display. The pegs stay in place, causing the Braille dots to remain aligned. And though this design provides little room for alignment error in the disk placement, its benefits far outweigh its minimal downfalls. The rotating disks, sliding plates, and disk and pins designs were evaluated on a weighted one to ten scale for a variety of design criteria (Table 1). The most important criteria were given more weight in the matrix and include ergonomics, aesthetics, accuracy,and design simplicity. These aspects were determined to be the most important design characteristics since they are critical in terms of the ease of use and effective functionality of the final product.

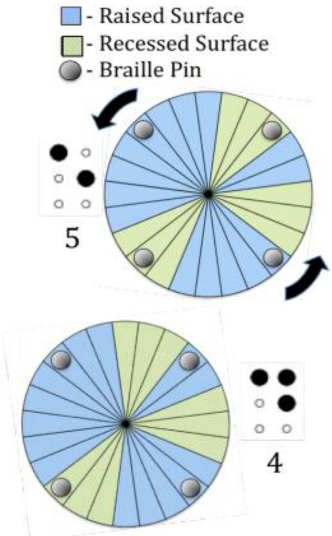

Figure 2: The raised and recessed surface on the disk caused different numbers to be displayed.

C. *Digital Braille Watch using sliding plates.*

The sliding plate design is rather unique from previous design concept. It consists of eight plates that lay paired up along the watch, with each pair creating a single Braille digit. Every plate can slide up or down within the face of the watch, revealing one, two or more number of dots. An advantage to this design is its potential to be small. The plates would be thin, which corresponds with making a light and ergonomically friendly watch. Additionally this model is likely to have alignment errors that could cause over confusion. Each Braille dot would be spaced at a standard distance relative to others. Nonetheless, there are drawbacks. This design contains complications with regards to the mechanism driving it. While possible, sliding the plates back and forth to specified positions becomes intricate, making it challenging to create. Also the power requirement is more.

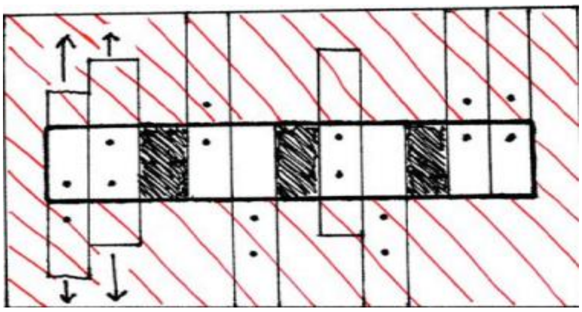

Figure 3: plates slide up and down to display the correct time

D. *Piezoelectric Concept of Linear Motor*

The paper tells us about concept related to reading assistive technologies for visually impaired: the BrailleBook is a model that is able to convert entire eBook to Braille code and to regenerate them in mechanical Braille terminals. The BrailleBook comprises of software-based translator that converts smoothly and reliably any eBook into Braille. Most tactile devices commercially available are piezoelectric Braille terminals. In existing Braille configuration, pins are spaced 2.54 mm apart and generates vertical strokes of 0.7 mm. Each stroke delivers a 170 mN pull force at bandwidth of 6 Hz. To reach the goal of compactness over traditional Braille actuators, we focused our attention on piezoelectric linear motors.The piezo-motor has been used to design and develop a significant actuator . This taxel is shown in Fig. 4. The taxel is stable due to friction between the slider and the shaft of the model, the slider is capable of retaining its position without any power. For displacement of position energy is required. Stability avoids power usage, useless output work, and a gradual degradation of the actuator’s performance. This paper has shown a significant model of reading device for visually impaired: the TactoBook, a system which aim is to make eBook accessible to the blind. The fundamental idea is to translate electronic book to Braille using standard resources.

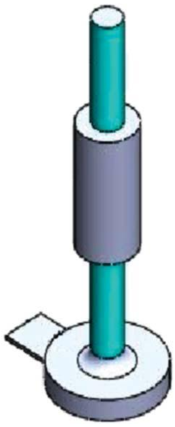

Fig 4:conceptual design

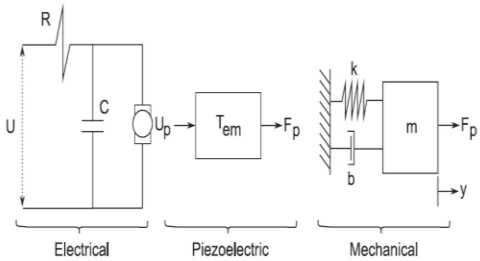

Fig 5: electromechanical model

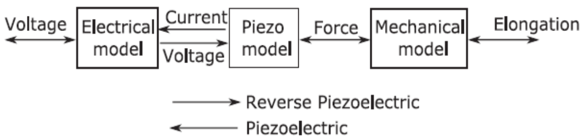

Fig 6: Block diagram

4. Conclusion

A Digital Braille Watch can be implemented using a push pull solenoid mechanism. The prototype could be able to met all of the major design specifications, with the exception of having a self-contained power supply.This prototype can demonstrate that it is possible to create a Digital Braille Watch that is silent, easy to read and can improve the daily life of visually impaired person.

Acknowledgment

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