# 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 smartwatch 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.

***Keywords* – Rechargeable battery,touch sensors.**

## I. 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 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 not to 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 hours 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.

## II. LITERATURE REVIEW

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

Electrocutaneous Display is used for displaying military time using Braille which involves sending controlled electrical signals to the skin, which nerve endings can then interpret as pressure or vibration. The user will interpret different sensations, based on the arrangement of electrodes used in this electrocutaneous Display. In this project, four electrodes in a square arrangement represents four Braille dots that are needed to distinguish the different numbers. 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. 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 when the skin is pressed to individual electrode, they close the circuit between the plate and the annulus. Human skin varies in terms of the density of sweat glands, thickness of layers, density of nerve endings and . All of these factors play an important role in indentifying how well a signal is conducted, and what type of sensation the individual perceives. Factors affecting the conduction of electricity include presence of pressure and vibration sensitive nerve receptors, increased presence of sweat glands and hair follicles, and a thinner epidermal layer. Signal transmission becomes difficult because of a thick epidermal layer, lack of pores and secretions, and scarcity of proper nerve endings. 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 provides a path to the dermal tissue as it is rich in electrolytes. In the dermis, the electric signal is much freer to spread through the tissue. Nerve endings are responsible for relaying information to the brain about changes like pressure, temperature, vibration, pain, and other sensations. 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 Controlling of the current and voltage of the electrical signal is important so that the desired nerve receptors are stimulated, and also so that the user is not dangered by higher than necessary currents and 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.

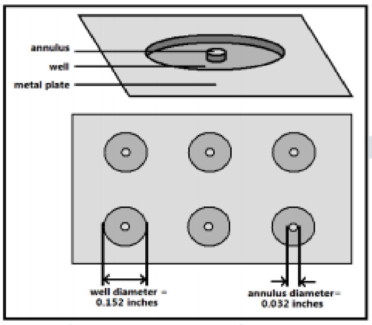



Figure 1: Electrocutaneous electrode

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

The design consists of a set disks and pin .In this design, there are four disks located below the watch surface, one for each Braille numeral. There are four pins which are rested on the disk 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 the pin is not on the raised surface, it will remain beneath the surface of the watch. As the disk rotates different combinations of pins are raised. In this way the digits are displayed. The major advantage of this design is that only four moving parts are needed. Therefore power required to run the watch is also less. Small servos can be used to rotate the disks. As smaller components are used the design is very compact. One more advantage of this design is that the motor would not have to turn more than 165 degrees to achieve numbers zero to nine. The pegs stay in place, causing the Braille dots to remain aligned. The major disadvantage of this design is that it is not convenient to place a watch in hand which consists of servo motor, and also even if someone wears it then the vibrations of the servo motor will irritate the user.

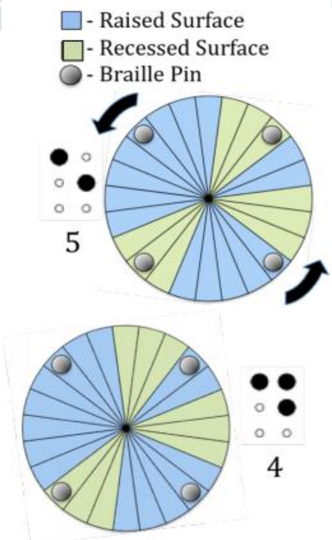



Figure 2: The raised and recessed surface on the disk caused different numbers to be displayed

C. *Digital Braille Watch using sliding plates*

The sliding plate design is different from previous designs as it contains less power. It consists of eight plates that are placed one below the other, along the watch, with each pair creating a single Braille digit. Every plate can slide up and down within the face of the watch, revealing the dots as per the digit. Advantage of this design is that it very small and compatible. The plates are very thin, which makes the watch lighter as well as compact just like the regular watch. One of the drawbacks of this method is that if the alignment of the plates are not proper then it will create confusion. Therefore each Braille dot is spaced at a standard distance relative to others. This design also contains complications with regards to the mechanism driving it. Sliding the plates back and forth to specified positions becomes intricate, therefore it is very challenging to create such type of watches.

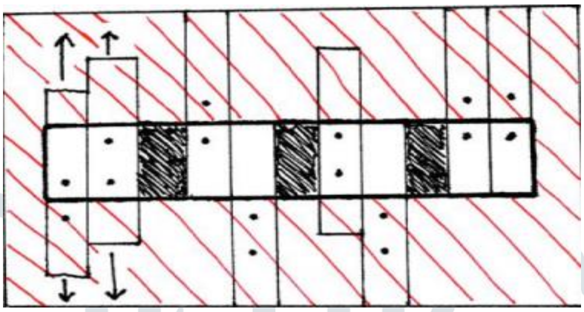


Figure 3: plates slide up and down to display the correct time

D. *Piezoelectric Concept of Linear Motor*

This paper introduces a novel concept on reading assistive technologies for the blind: the TactoBook, a system that is able to translate entire electronic books (eBook) to Braille code and to reproduce them in portable electronic Braille terminals. The TactoBook consists of a computer-based translator that converts fast and automatically any eBook into Braille. Most tactile devices commercially available are piezoelectric Braille terminals. In the standard Braille configuration, pins are spaced 2.54 mm apart and produce vertical strokes of 0.7 mm. Each pin delivers a 170 mN pull force at refreshable bandwidth of 6 Hz. To overcome the compactness problem of traditional Braille actuators, we focused our attention on piezoelectric linear motors. This piezo-motor has been used to design and develop a novel tactile actuator (taxel11). This taxel is shown in Fig. 4. Note that a plastic contact pin has been simply attached to the slider. The taxel is bi-stable: due to friction between the slider and the shaft, the slider is capable of retaining its position without any power. Energy is only needed when changing from one position to another. Stability avoids power consumption, useless output work, and a gradual degradation of the actuator's performance. This paper has presented a novel concept of reading assistive device: the TactoBook, a system which aim is to make eBook accessible to the blind. The fundamental idea is to translate eBooks to Braille using standard computational resources.

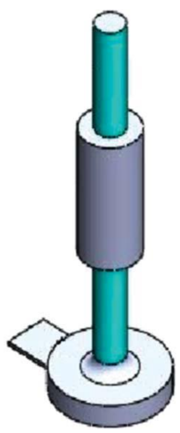


Fig 4:conceptual design

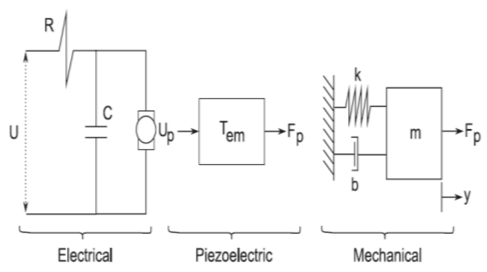



Fig 5:Electromechanical model

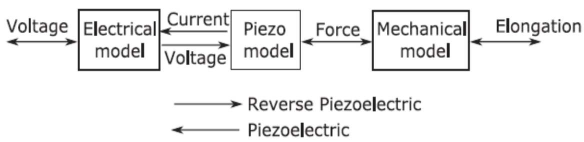
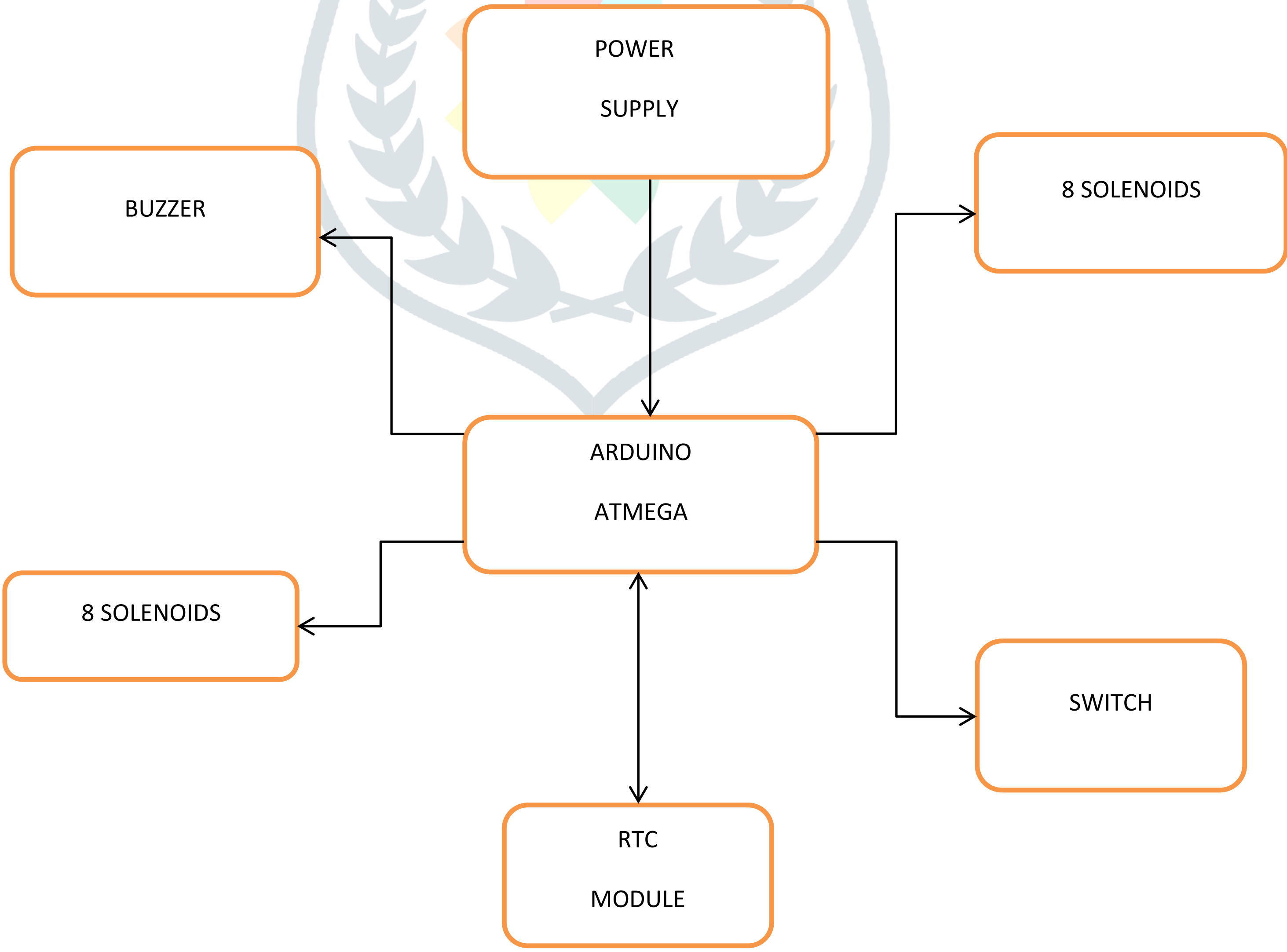



Fig 6: Block diagram

## III. IMPLEMENTATION DESIGN

The technology of prototyped Digital Braille watch gives proper time to visually impaired person as and when required. The Arduino ATMEGA is the heart of this project which has 16 analog pins and 16 digital pins. All the analog pins are used for solenoids and 3 digital pins are used for switch, buzzer and RTC module. The controller is well programmed to perform push pull mechanism. For this prototype external power supply is used and later on if needed, it can be replaced by portable batteries. RTC module is used to keep track of current time. Total of 16 solenoids are used to develop the digits. 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 combination 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. A switch facility is provided to automatically turn ON the solenoids for a specific time when user asks for time and after a particular delay the solenoids will again go back to their original position. This enables less power consumption and avoid heating of solenoids. Every solenoid is connected to a small diode to minimize the complexity as well as to avoid reverse current. A Buzzer facility is also given which will vibrate after a particular amount of time. 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..

## IV. BLOCK DIAGRAM



## V. CONCLUSION

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

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