



REGULAR ARTICLE

A Haptic Feedback Glove Based on Arduino for the Welfare of Un sighted People

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The paper presents an Arduino-based smart hand glove-like appliance that supports blind people. Due to vision loss, blind people have to tolerate their own inhabit. The work aims to enable unsighted people to move faster and confidence. The smart hand glove is designed with the help of Arduino UNO and HC SR04 ultrasonic sensor. The ultrasonic sensor detects any hurdle in the path of blind people. The appliance detects hurdle in two sections. One section is in front of the person and other section at a certain level below the hand. The hand gloves can detect the obstacle up to a distance of 0-30 cm with a very high response. However, at 450 cm or beyond the ultrasonic sensor does not show any detection. If any obstacle is found by the glove that will immediately indicate the output of the device (buzzer, vibrating motor). In vertical direction sensor detects an object up to a distance of 58 cm. In addition, at the output GSM and GPS, modules are connected. In an emergency, the message can be received by connected people, and also the location of the blind people can be tracked. The smart hand glove ensures the safety and security of the visually disabled person.

Keywords: Un sighted, Hurdle, Arduino, Ultrasonic sensor, GSM, GPS.

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1. INTRODUCTION

A person who is inadequate to see can be termed as an unsighted or visually disabled or blind individual. With the growth of technology, the advancement in modern society can be observed. But physically challenged blind people suffer different hurdles in their daily life. The eyes are the best sensor for a normal person, however, a visually impaired person has to live their life without having the main sensor organ which is the eye. The beautiful world, its society, education, economy, sports, technology, etc. are framed with respect to vision. This becomes very irritating for blind people when they have to depend on others for their daily activities.

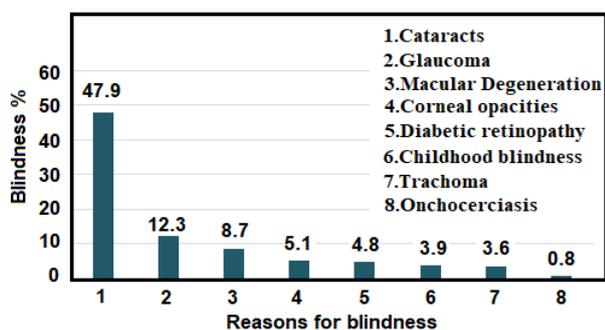


Fig. 1 – Blindness reasons in percentage according to WHO

Various types of unsighted can be seen like color sightless, sightless due to some occurrence, partial sightless, and psychological sightless. World Health Organization (WHO) has reported that over 2.2 billion individuals are bearing the pain of vision disability or blindness

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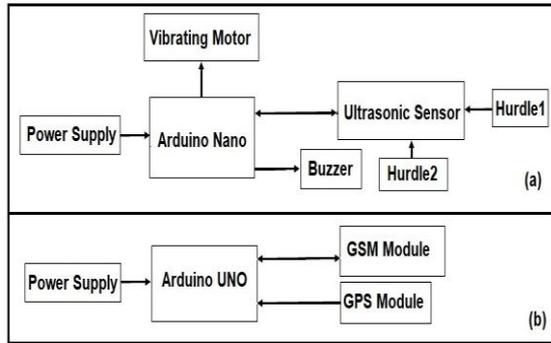


Fig. 2 – A block diagram of the system (a) Hurdle detection (b) location tracking

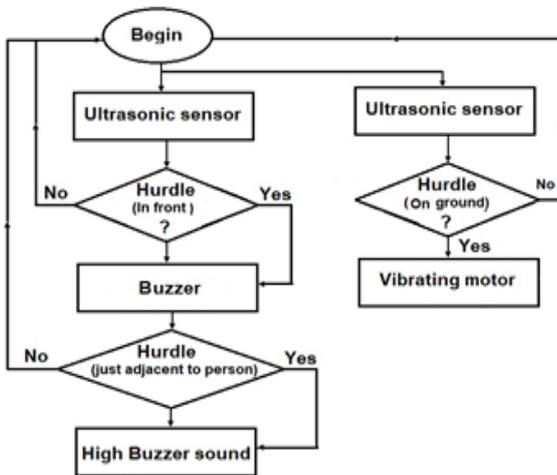


Fig. 3 – Flow chart of system architecture for Hurdle detection

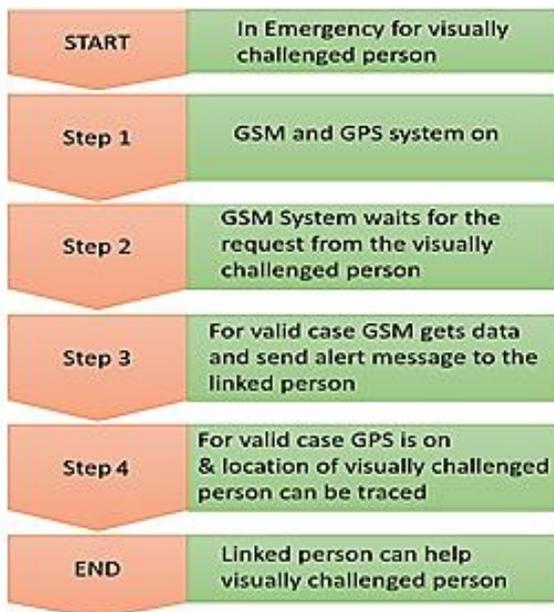


Fig. 4 – Flow chart of system architecture for location tracking schematic

The flow chart of the suggested system is shown in Fig. 3 for hurdle detection: here ultrasonic sensor will detect any hurdle from the front or bottom section. If at the bottom or floor any hurdle is present it will show a vibration. On

the other hand, if any object or hurdles comes in front of the unsighted person then the buzzer will make a beep sound. If the object is very closer to the person then a continuous beep sound will make by the buzzer which helps in alerting the visually challenged person.

Fig. 4 shows location tracking of the system. Here visually challenged person. If an emergency occurs for an unsighted person at that moment he or she can send a message to that person who is linked with the unsighted person. When he receives a message from a visually challenged person then he or she can check the location of the needy person using GPS and further the person can extend a helping hand to the visually challenged person.

The hardware implementation of the system uses an ultrasonic sensor (HC RS04), Arduino board nano and uno, buzzer, vibrating motor, sim 900 a GSM module, neo-6m GPS module, and a hand glove have been used. The two ultrasonic sensors facing the front direction and the other facing the downward direction have been constructed. The front-facing ultrasonic sensor will detect any obstacle in front of the visually challenged person and the downward-facing (on palm) ultrasonic sensor will detect any hurdle at the ground. Arduino nano board is used to connect an ultrasonic sensor, a buzzer, and a vibrating motor. The vibrating motor will act for the detection of any hurdle in the downward direction and the buzzer will act as an output for the detection of any hurdle in front of the unsighted person.

3. RESULTS AND DISCUSSION

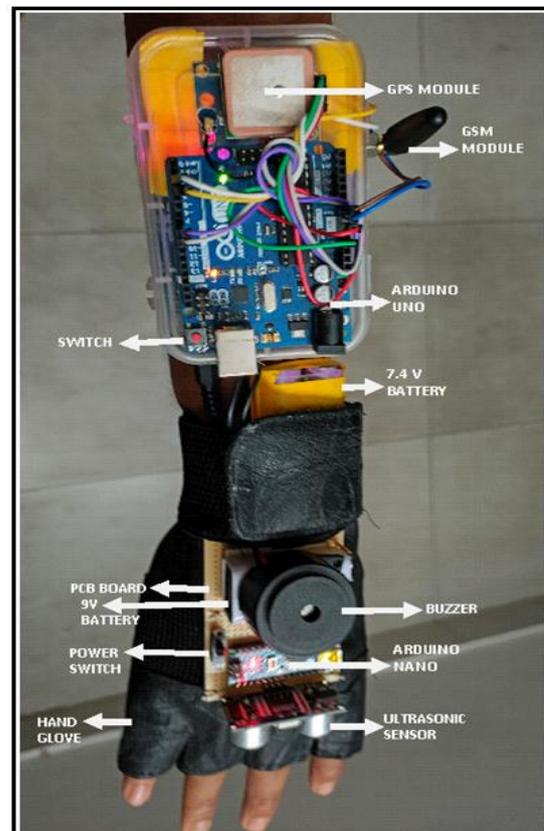


Fig. 5 – Hardware implementation of the suggested system

Fig. 5 depicts the prototype of the system. The required hardware components for the suggested approach have been incorporated within a glove. When any hurdles come just adjacent to the suggested approach then the highest response can be found for the system. In addition, if the suggested system is too far from any hurdle then the system shows no response.

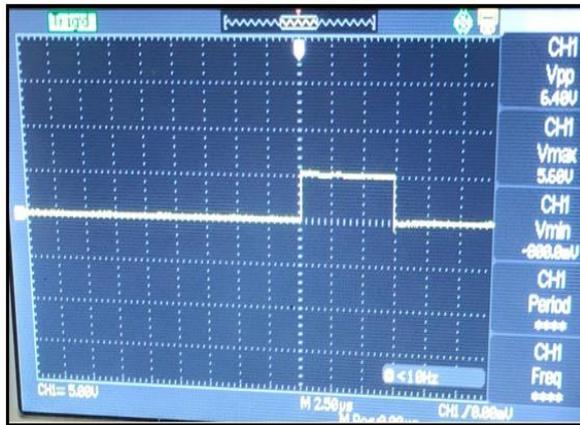


Fig. 6 – The output waveform of the ultrasonic sensor

Fig. 6 depicts the output response of the ultrasonic sensor. The microcontroller of Arduino helps in conveyance with the ultrasonic sensor.

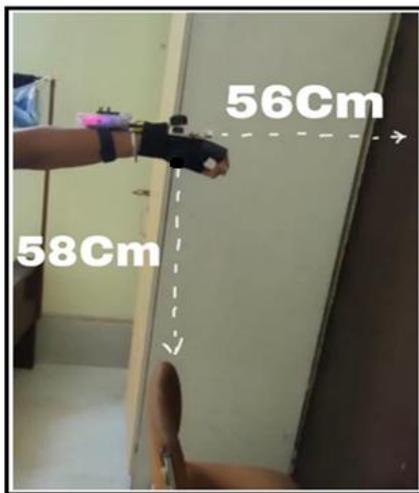


Fig. 7 – The system is placed horizontally and vertically

Fig. 7 describes the distance measurement of the front and downward hurdle of the smart appliance. Table I describes the suggested system and front hurdle distance. When the front hurdle is very near to the unsighted person with the proposed smart appliance then a high beep sound is obtained to alert the person. On the other hand as the distance between the hurdle and the

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smart appliance increases the sound of the beep also decreases accordingly. At a distance of 450 cm and above the buzzer shows no response.

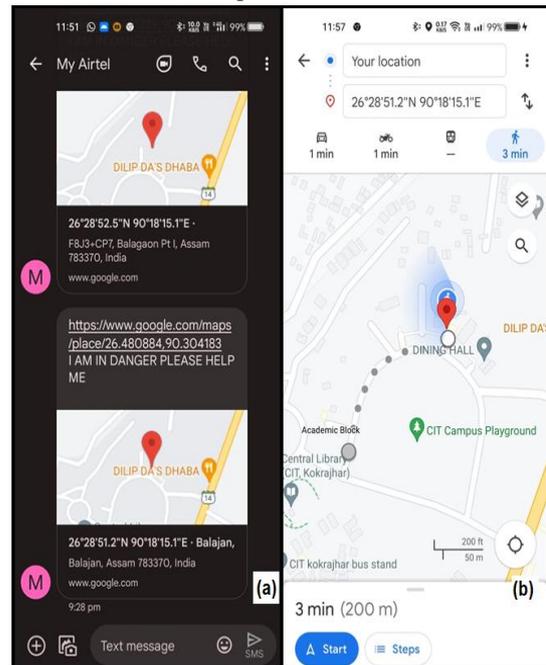


Fig. 8 – (a) Message send to a linked person (b) Location trace

Fig. 8 indicates the output of GSM and GPS for live location tracking of the unsighted person. When the visually challenged person is in an emergency or accident then immediately the person can send the message to the linked person which is shown with the help of Fig. 7 (a). In addition, the linked person can track the location of the unsighted person who is wearing this smart appliance which is shown with the help of Fig. 7 (b).

4. CONCLUSION

In the reported work a method of hurdle detection and location tracking approach for the welfare of unsighted persons have been incorporated. The suggested system has been designed with the help of Arduino. Also, the tracking of the location of a visually challenged person in an emergency can be applied by using the suggested smart appliance. The hurdle can be detected when the system is very nearer (0-30 cm) to it and if the hurdle is 450 cm or above then there is no detection. The system uses two power supplies for different Arduino which is the limitation of the suggested approach. In the future water sensor and depth or pit, sensors can be incorporated into the system for hurdle detection. Overall, the suggested system is adequate for the welfare of the visually challenged person.

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Рукавичка з тактильним зворотним зв'язком на базі Arduino для людей з вадами зору

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У статті представлено розумний пристрій на базі Arduino, схожий на рукавичку, який допомагає людям з вадами зору. Через втрату зору незрячі люди змушені перебувати у власному середовищі. Мета роботи – допомогти незрячим людям рухатися швидше та впевненіше. Розумна рукавичка розроблена за допомогою Arduino UNO та ультразвукового датчика HC SR04. Ультразвуковий датчик виявляє будь-які перешкоди на шляху незрячих людей. Пристрій виявляє перешкоди у двох секціях. Одна секція знаходиться перед людиною, а інша – на певному рівні нижче руки. Рукавички можуть виявляти перешкоди на відстані 0-30 см з дуже високою точністю відгуку. Однак на відстані 450 см або далі ультразвуковий датчик не показує жодних результатів. Якщо рукавичка виявляє будь-які перешкоди, це негайно сповіщає про це вихідний сигнал пристрою (зумер, вібратор). У вертикальному напрямку датчик виявляє об'єкт на відстані до 58 см. Крім того, на виході підключені модулі GSM та GPS. У разі надзвичайної ситуації повідомлення можуть бути отримані підключеними людьми, а також можна відстежувати місцезнаходження незрячих людей. Розумна рукавичка забезпечує безпеку та захист людей з вадами зору.

Ключові слова: Невидимий, Бар'єрний, Arduino, Ультразвуковий датчик, GSM, GPS.