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Arduino Controller Based Smart Stick for Visually Challenged Using Zigbee Communication

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Abstract— As indicated by human physiology vision assumes a pivotal part. More than 83% of data with respect to environment the individual gets from vision. The most seasoned and conventional versatility helps for persons with visual hindrances are the guide dogs and walking cane. The disadvantages of these guides are scope of movement and next to no data passed on. With the quick advances of cutting edge innovation, both in equipment and programming front can possibly give smart route capacities.
This venture work exhibits an Arduino Uno controller based smart stick, that cautions outwardly hindered individuals over static hindrances, dynamic snags, pit and aides them with the utilization of sound directions about proper way. It diagrams a superior navigational apparatus for the outwardly weakened. An Arduino Uno microcontroller contains all the memory and interfaces required for the application and the APR sound framework is use for sound direction. The general point of the gadget is to give an advantageous and safe strategy for the ignorant concerning conquers their challenges in day by day life. Furthermore this framework can be utilized for both indoor and open air environment. In this venture Arduino programming is utilized to code the microcontroller for controlling and checking the framework and MATLAB pictorially displays the destined path.

Keywords—Arduino UNO controller, IR sensor, proximity sensor, gyro-compass sensor, pit detection sensor, smart stick, APR sound framework, Arduino programming.

INTRODUCTION

Vision is a lovely blessing to individuals by GOD. Vision permits individuals to see and comprehend the encompassing scene. Outwardly tested is the state of lacking visual perception because of neurological and physiological elements. However a World Health Organization review made in 2015, evaluated 285.389 million individuals with visual weakness over the globe.
Lately availability of regular life situations for debilitated or matured individuals draws out in the open hobby. Really there is a considerable measure of extensions for it, for example, textured clearing squares, inclines rather than steps, handrails, lifts, and so on. Be that as it may, enhancements or degrees are restricted to particular spots and it is still troublesome for the impaired to live in a large portion of spots at present. Particularly for visually impaired individuals who have no visual data, there is a great deal of troubles in regular life situations. These individuals have a considerable measure of issues to obtain natural data. In addition, deterrents which are not hazardous to customary individuals have the capacity to wind up risky to them. In spite of the fact that they utilize visually impaired stick to gain this data, it is still hard for them to stroll around in a large portion of the spots furthermore not cover entire territory. A great deal of studies has been done to add to a framework which helps visually impaired individuals.
It depends on the utilization of new advancements to enhance outwardly impeded individual's portability. This venture concentrates on impediment identification and discovering area keeping in mind the end goal to lessen route troubles for outwardly tested individuals. Traveling through an obscure domain turns into a genuine test when we can't depend all alone eyes. Since element deterrents more often than not create commotion while moving, visually impaired individuals build up their feeling of hearing to restrict them.
In this task work to encourage outwardly tested to explore securely and rapidly among deterrents and different perils confronted by visually impaired walkers, a virtual guide is made utilizing a few sensors like infrared sensor, gyro sensor and pit sensor. A deterrent is recognized utilizing infrared sensors, gyro sensor is utilized for heading and pit discovery sensors are utilized to identify the pit in the way. Every one of the parameters from diverse sensors will be recorded and put away in Arduino microcontroller. All information from Arduino controller is sent to collector part utilizing ZigBee correspondence framework. At last graphical mapping is finished by MATLAB.
It is beneficial method for the present environment. As in the present circumstance it is totally subject to GPS. In a few circumstances there will be no accessibility of GPS system and in a few circumstances GPS focuses won't be available much of the time. Also GPS is a paid administration and it won't indicate most secure or briefest way. Henceforth by utilizing this procedure the framework gets to be cost proficient and the checking of framework likewise precise in nature.

METHODOLOGY

The block diagram of the Arduino controller based smart stick for visually challenged is as shown in figure 1 This framework is based on Arduino UNO microcontroller which controls the entire system. Power supply of +5 V is given to the Arduino controller. The shortest and safest path of the destination from starting point will be prerecorded and is stored in EEPROM which is located inside the smart stick.

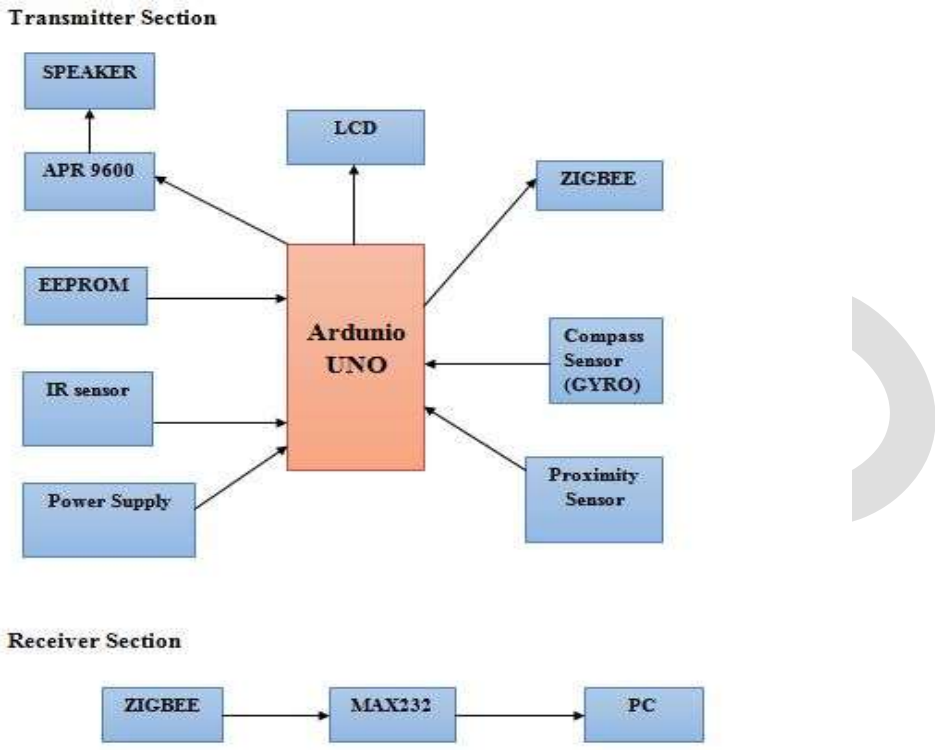

Fig 1: Block Diagram of the system

Once the smart stick is given to the visually challenged, he is guided to the destination in the shortest and safest path using the information which is already recorded in the stick. Initially when the visually challenged person holds the smart stick the gyro compass sensor inserted in the smart stick helps to determine the direction and starts navigating. The speaker is mounted on the stick which continuously gives instruction to reach the destination. Whenever the deviation is required the speaker will instruct the visually impaired person in advance. Proximity sensor attached to the stick helps in detecting both dynamic and static obstacle. In case there is static or dynamic obstacle the speaker alerts the visually impaired by giving instruction message. Along with proximity sensor, the pit detection sensor is also present in the smart stick which helps in determining the pit present while walking to the destination. The speaker gives the instruction to the visually impaired in case of pit and thus helping the visually impaired person to reach the destination without any obstacle.

In this project wireless communication ZigBee module is used. Transmitter end of the ZigBee module is connected to the smart stick and receiver end is connected to the PC. The ZigBee module continuously monitors the smart stick and all the information regarding smart stick will be transmitted to PC.

MATLAB 7 is used to pictorially represent the path travelled by visually challenged using smart stick from starting point to destination. All the information regarding smart stick will be continuously sent to PC by ZigBee module which is attached to the smart stick. Using this information obtained from ZigBee module, graphical representation of the path travelled will be displayed by MATLAB. All the obstacles like dynamic, static and also the pit present in the path to the destination will be indicated in the pictorially representation.

Thus while sitting away from the visually impaired person we can still monitor his path from starting point to destination.

FUNCTIONALOUTPUT

The Arduino controller controls the smart stick and all the information regarding the smart stick will be stored in EEPROM. The path from starting point to the destination will be prerecorded and speaker will give the visually impaired person all the necessary alerts.

In this venture gyro sensors are used to obtain the angle of rotation while moving through the required path. The range is set between --512 to +512. The figure 2 shows the range of gyro compass sensor at 14Deg/sec.

Fig 2: Range of gyro sensor

As the directions to the destined path will be prerecorded, whenever there is a deviation while travelling through the path the speaker located on the stick will inform in advance regarding whether to turn right or left. The same will be displayed on the LCD board present on the stick as shown in the above figure 3.

Fig 3: Directions to turn Right and Left

Once the visually challenged person holding the smart stick reaches the destination the speaker will inform and that will be displayed in LCD as shown in figure 4.

Fig 4: Display of the destination reached

All the information regarding smart stick is transformed to computer using wireless ZigBee communication which is attached to the stick. MATLAB uses this information to pictorially represent the distance travelled and also regarding any obstacles present in the path. The figure 5 shows pictorial representation of the distance travelled.

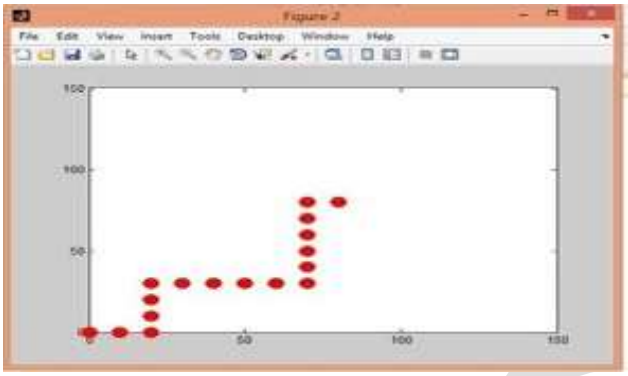

Fig 5: Pictorial representation

OBSERVATION

1. Low power consumption: Very less power is required to run the controller present in the stick. Hence low power consumption.
2. Simple to install: The system is very simple to install.
3. Proximity sensor used in the smart stick detects both the static and dynamic obstacle.
4. No human interface is required for guiding the path.
5. Shortest and accurate path to the destination can be determined.
6. Visually challenged person can be tracked in case if he loses his path.
7. It will perform both in outdoor and indoor environment.
8. Platform independent: Neither windows nor android is required.

LIMITATIONS

1. During stormy season it might be hard to work the framework as it may upset the associations.
2. In the instance of vicinity of any bugs the client is vulnerable with respect to troubleshooting or reinventing the code.

CONCLUSION

In this project Arduino controller based smart stick is designed and developed. All the data regarding the path from starting point to destination is prerecorded and stored in EEPROM. The stick navigates in this prerecorded path and speaker present in the stick helps in guiding the visually challenged person. The speaker will give advance instructions regarding any deviation. Different sensors like proximity sensor and pit detection sensor helps in detecting obstacles and pit along path respectively. All the information regarding smart stick is fed into computer using wireless ZigBee communication. Using this information MATLAB pictorially represents the navigated path and also indicates obstacles and pit, if only present along the path. Thus by using this smart stick visually challenged person can reach the destination accurately in the shortest and safest way without human interference.

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