IJCTA, 9(10), 2016, pp. 4859-4869

Development of Assistive Technology Tools for Visually Challenged to their Better Life

***A. Raghunath ** Dr. K. Radha Rani ***P. Sindhu ****N. Surya**

Abstract : As per WHO there are around 285million visually impaired worldwide facing many challenges and problems in their life, some of them are:

1. They are facing problem during commutation.
2. Problems in learning activities.
3. They have no recreation.
4. Problems in domestic work.

Findings : Keeping in view the basic requirements for visually challenged, we designed video games for their relaxation, as human beings need recreation for reducing stress. Ordinary human beings relax by watching TV, playing sports and games, watching movies, reading books.. but, visually challenged have no such recreational activities. These video games help them to get out of stress as they are stress busters. Navigation is a major threat which hinders their moment so, we developed (RFID) which lessen their burden to commute and to move towards destination and GPS sensors helps them to identify the location their location and helps them to navigate freely and easily. Depth sensors guide them in finding out the sudden elevations in depth like pits on the road, steps in buildings which prevent them from injuring themselves in case they fall into pits and fall over their steps. For has sile-free commutation the vehicle sensors helps them immensely as these sensors guide them identifying their vehicle numbers and make them convenient to identify the vehicle and make their commutation a convenient experience.

Novelty /Improvement : This project proposes the development of a navigation system and refreshment tools for the visually challenged people. Infuture improvements are to be made such that all these chips and RFID's lie on single integrated chip.

Keywords : GPs sensors,Depth sensors,Vehicle recognition tool for blind,video games for challenged people.

1. INTRODUCTION

Computer games are spread throughout the world, games are easy for skilled and trained they include the capabilities of sight, hearing as well as cognitive attention. The core gamers are the main source of the revenue to the game developing industry, due to many disabilities the casual games have 20% have difficulties in it.

Game Accessibility special interest group (GA-SIG) was formed by the International Game Development Association (IGDA) in 2004 but the GA-SIG is not active for a period of ten years, topics like "Inclusion" and "Accessibility" have gained momentum.

* IT akkineniraghunath@gmail.com VFSTR UNIVERSITY, EEE

** korrapati_radharani@gmail.com RVR&JC, IT

*** popurisindhu86@gmail.com VFSTR UNIVERSITY, IT

**** Surya.nalluri225@gmail.com VFSTR UNIVERSITY

Actively balancing missing skills than focus on presentation and easier control that are spread in a wide range are the interesting scientific challenges.

2. ACCESSIBILTY

Disabilities are limited, conditions are systematically structured into visual disabilities, according to Accessibility, such as visually impaired, low blindness, passive color vision, deafness and being hard of hearing (severe and profound, moderate, mild) among auditory disabilities as well as paralysis, neurological disorders, age related, repetitive stress injury, steadiness cognitive disabilities like among mobility disabilities, and cognitive disabilities like attention deficit disorder, dyslexia and memory loss disabilities1.

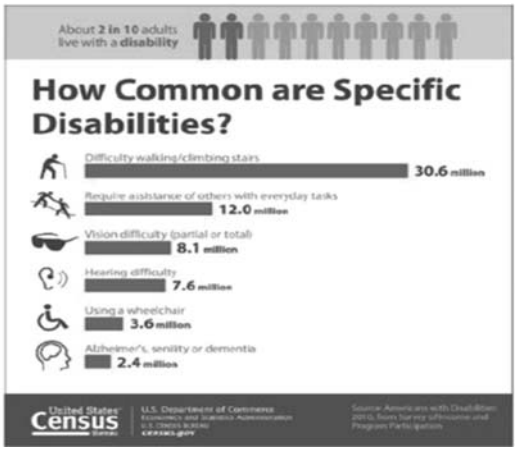

Fig. 1.

As per as U.S. Census Bureau of statistics on American disabilities facts, two out of ten adult people are living with disabilities. Around 23% of people in U.S are living with multiple disabilities.

Category	*Number*	*Percentage*
No disability	160.120.00	77.0
Severe disability	30.714.000	14.8
Not severe disability	17.221.000	8.2
Total population	208.059.000	100.0

Thus more efforts are placed on topical of includification by computer gaming industry. Gaming is made easy by game developing companies by using new technologies like keyboards, mouse or game controllers that are quite difficult to use for gamers with difficulties and disabilities in motion and also cognized, 3D cameras, face tracking, motion sensors, gesture recognition possibilities for inclusion. But technology is not enough, The gamers, game developers with useful hints and information on websites which provide a full list of accessibility guidelines with the support of Able Gamers foundation to help developers making accessibility guidelines. But not enough to make games more accessible. Coming to reality the disabled gamers want to play the same games as able ones in a similar way. We now discuss the new ways to develop computer games for disabled play equally- and enjoy in the same way, by means of artificial intelligence.

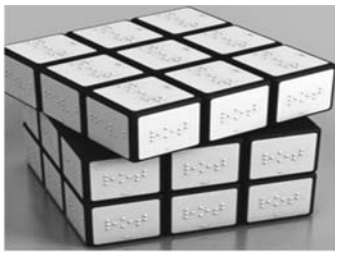

Fig. 2.

2.1. Current Work

Identification of generations, including Action, Ames, MMOG, platforms, Role playing, shooter, stimulators, sport, strategy Adventure, Arcade, Real-time strategy according to a sequential order. Target groups help with setup of extensive experiments, respective associations from Vienna on topics of different forms of disabilities in finding respective participants.

Generations map will be the result, especially from disabled gamers to see which generations they will be able to play because the map is based on abilities of them. And developing a software component that substitutes the disabilities of gamers and make them active in both single player and multiplayer environments without knowing their opponent ability status. So new algorithms and new machine learning methods based on supervised learning methods to perform a smooth transition between human abilities and algorithmic substitution have to be developed for automatic recognition of disabilities.

Development of adaptive player models that can replace missing playing abilities in computer games and automate the respective machines.

The novel execution algorithm will be developed based on previously learned player models for controlling parts of the steering and interaction controls. Execution of supporting commands should not annoy other players and it should be transparent even. The subset of commands to be automatically selected that to be controlled by an algorithm, if the player has significant disadvantages in these categories that are explained by the natural skill variance of player with out disabilities, To create at least the impression of competitiveness like creating special computer controlled non player characters created to be easily defeated by heavily disabled player and mainly like multiplayer environments, or giving advantages like more energy ,robustness etc to become competitive with out loosing any control on it we think about the aspects of empowerment. Evaluating our models is done again by running experiments in a kind of Turing test settings, and make disabled to compete with disabled players generally and their playing performance is valued here for them.

The computer game industry will be trained to make games accessible by broader game community, grade of inclusion for simplifying the buyer's decision will be developing a certified inclusion label. The main objectives of this project are

1. The Video game genre map based on the ability of the player to be developed.
2. Detection and execution algorithms, empowerment measures and ability player model to be identified
3. Labeling evacuation and knowledge transfer to be maintained
4. Respect to subjective and objective empowerment proper evaluation measures to be taken

2.2. Innovative Aspects:

1. First innovation aspect says that Influenced by technology and design a classification is done in computer game genres by the player's ability in motion, coordination, cognition, audio, visual capabilities reaction time is not yet available this is first innovation aspect.
2. Second innovation aspects says that for automatic detection of missing abilities of a person by the machine learning algorithms. During game play the learning parameters for a player model machine learning algorithm. And the output is that missing abilities to be balanced by offering player models for the transition from players with general players, innovative aspect here is the player models that are selected automatically and trained in the multiuser environment by learning techniques by gaps, and then executes in maps. We have to concentrate on three main aspects
    - Video game genre map based abilities
    - Methods of parameterizable, learning and adaptive player models.
    - To detect and execute a subset of commands for player models, adaptively substituting missing abilities, following other options of empowerment is to be considered.

2.3. Prospective Benefits

This will offer benefits for various members in an area or disabled members interested in computer games. The gamers with disabilities play off-the –shelf hard-core

games at several levels as all other members. The positive experience may significantly enhance better living, self-esteem and loneliness, exclusion, alleviate depression. This influence care giving people, including parents for the gaming industry this may be a main step to sell them hitherto highly selective games to larger users and make high marketing and revenues. This may affect millions of disabled people and when taking the world wide into an account.

3. DEVICES RUNNING ON ARTIFICIAL INTELLIGENCE

1. Radio-frequency identification (RFID) is an automatic identification method, storing and data retrieving data using devices are the main things in RFID.

   The RFID tag is incorporated into product, person for identification purpose by using radio waves. Tags can read things several meters away round the reader's sight

   Most RFID tags consist of 2 parts. One is integrated ic for storing and processing data, modulating, demodulating signals the second is an antenna for transmitting and receiving signals. Chip less RFID allows for discrete identification of tags without using IC on it allows tags to be printed onto assets at low cost comparatively

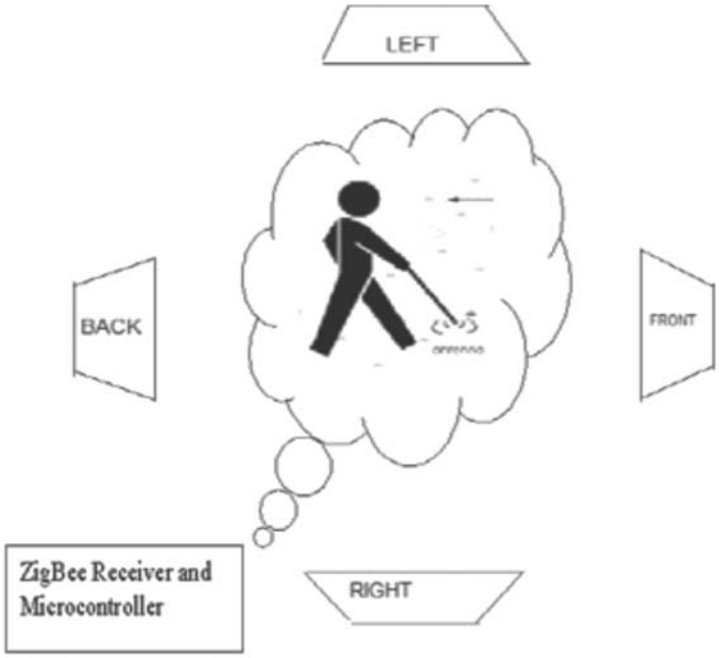

Fig. 3. Left, Right, Front And Back: Locations Of Arrays Of Rfid Tags

When a visually challenged person comes in the vicinity of particular RFID tag, it activates and transmits encoded data to a receiver in the walking cane and is transmitted to Zigbee transmitted in the same coin through the data cables. The transmitter subsequently transmits data to the Zigbee receiver, placed at home, micro controller based voice guidance system is activated in order to generate a proper voice message to blind people.

3.1. Gps Sensors

With rapid changes in technologies, both software and hardware firms have brought potential to intelligent navigation. Recently, many electronic travel aids (ETA) have been designed to help blind for navigation independently. To identify the orientation, position, location of blind person any of those solutions rely on Global positioning

system (GPS) technology which are suitable for outdoor navigation. They need additional components to improve on the proximity detection and resolution to prevent collision. However, they use ultrasonic sounds because of its immunity to the environment noise and it's very inexpensive as well as small enough to be carried. Apart from this a blind aid system has to provide a new dimension of artificial vision and dedicated obstacle detection circuitry. These units are discussed to design a 'smart stick' for blind.

Design- its design deals three units

- GPs unit
- Gsm unit
- Obstacle detection unit

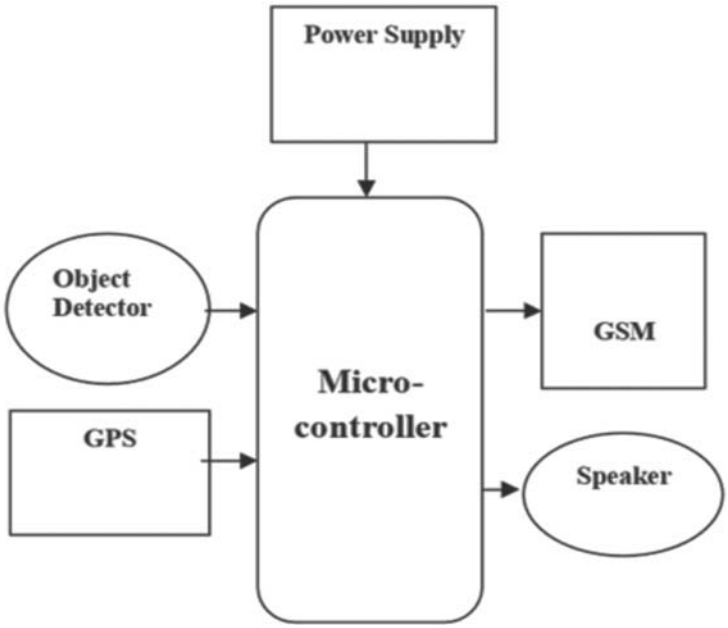

Fig. 4.

This is the design of smart stick. The elements of the system are divided into subsystems. Object detector circuitry consisting of sensors such as led and ultrasonic sensors. Mobile vibrators designed with logic designed to obtain different vibratory patterns are placed in vibratory circuitry. GPs system, Micro controller and power circuitry (battery based) are the crucial systems.This device can be mounted on a simple white cane or a blind-stick.

Table 1. System Paremeters

No.	*Parameters*	*Goals*
1.	Size	Compact & Robus.
2.	Speed (D+A)	0 to 0.5m/s.
3.	Handling	Maximum support force & forces in X and Y directions for stability and guidance
4.	Battery Charging	About 8 hrs between charges at duty cycle.
5.	On – Board Computing	Sufficient for planning, control, health monitoring and communication
6.	Sensors Aid For Navigation	GPS n Passive sign posts acceptable for localization. Infrared (Ultrasonic) sensors acceptable for obstacle avoidance
7.	Inputs	Handle forces and voice commands

Electronic Travel Aids (ETA) has been classified into three classes :

- Obstacle detectors
- Navigation system
- Environmental sensors

Sensors / artificial vision systems are based on first class. Ultrasonic or laser beams emitted by sensory systems, which are reflected by the objects. The difference between emitted and received beam are used to calculate the distances from the stick. Object tracking algorithms and calculate the distance by using grayscale method.

3.2. Depth Sensors

For decades, researches have been done to design new navigation devices for blind. Many were brought out to find out obstacles on their path, but they used to face many problems while travelling on an uneven paths and pits, recently, laser canes were built that uses optical triangulation which is having three laser diodes among them the first points towards the ground detecting a drop in elevations and heights, second point outs towards the street in front of the user which is parallel to the ground, third points straight ahead with an angle of 450 from the ground which is helpful to protect the visually challenged. There are many proposed methods of detecting obstacles on the ground using sensors in ultrasonics's integrated on the cane and users' shoulders.

Here the architecture and data flow of proposed haptic feedback system.

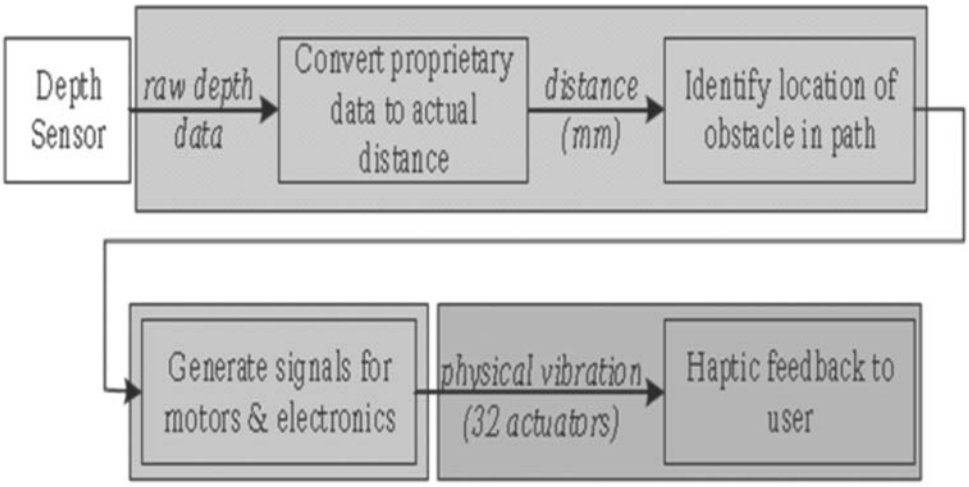

Fig. 5.

This is a tablet computer proposed system which decodes proprietary data present in the sensor and bring it out to a meaningful format. Depth images are generated by the tablet computer and this is decoded into matrix form 640*480 elements, which represent the distance of object respect to the user. After generations of matrix it is further divided into eight zones of which four zones on right, namely (R1, R2, R3, R4) and four on the left, namely (L1, L2, L3, L4) each corresponding a column in vibration module. A later nearest neighbor algorithm is used to find the location and closed obstacle respect to the user and appropriate signals from the haptic feedback unit are generated and the system identifies the obstacles that are both static and dynamic.

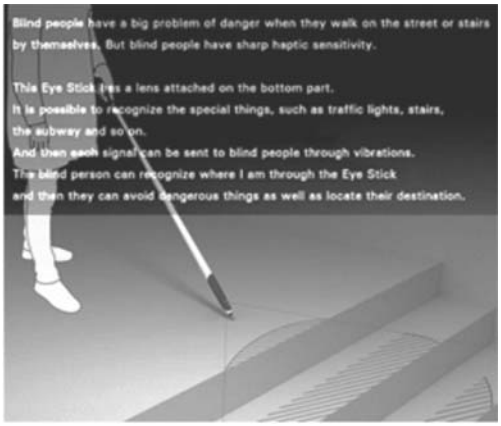

Fig. 6.

And through an audio feedback system the information is provided to the user.

If the location and information of the obstacle are found to be nearer than the Ardunino micro controller generated signals to the respective vibration motors. The left-hand and right hand vibration modules are activated by I/O expanders and are transmitting information.

The vibration module is an array of Shafter less 8mm motors worn into gloves, and function as vibrate tactile feedback delivery mechanism.

The i/o expander generates the signals then the motors in the gloves are vibrated which are generated based on the obstacle presence that lies within the range of depth sensor field of view, the density of vibrating motors is proportional to the distance of the obstacle to avoid the collision during navigation.

Fig. 7. Vibration motors in the left hand glove

Case 1: (Identification of the closest object) In this test the system was programmed in such a way to obtain in its field of view, and to turn the appropriate number of LED'S with respect to distance

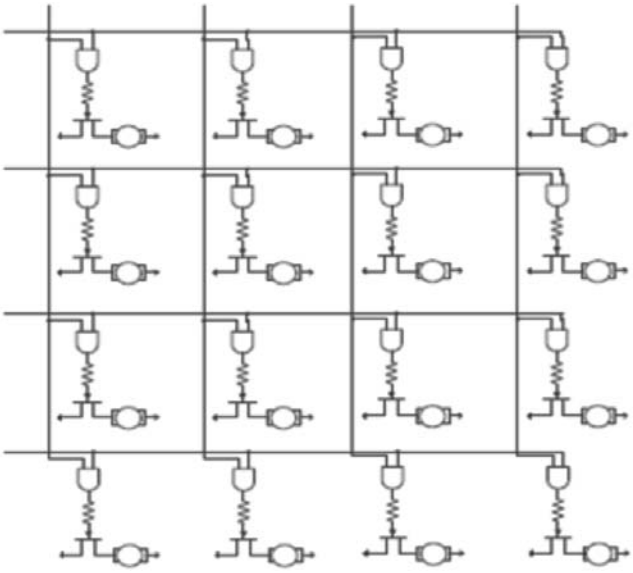

Fig. 8.

Depth images as obtained from the sensor, and Zone of partitions (R1, R2, R3, R4, L1, L2, L3, L4) as presented above.

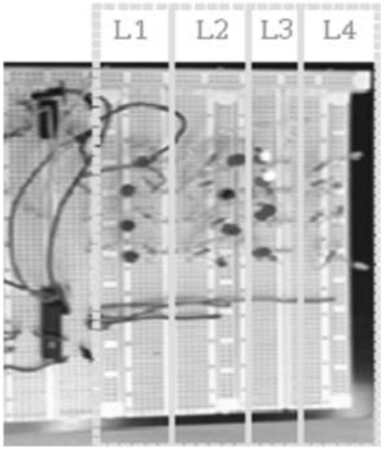

Fig. 9. Verification of closest object detection test

After filtering and processing the data the closed object is identified and was detected in the L-3 zone, The LED's are activated in this zone as this information was transmitted to the left hand micro controller. And the process of verification done can be seen in the above figure.

Case 2 : (Detection of human) The system is programmed such that it filter through the depth image, which detect the presence of a human and his location and turn on the respective number of LED's with respective the distance detected.

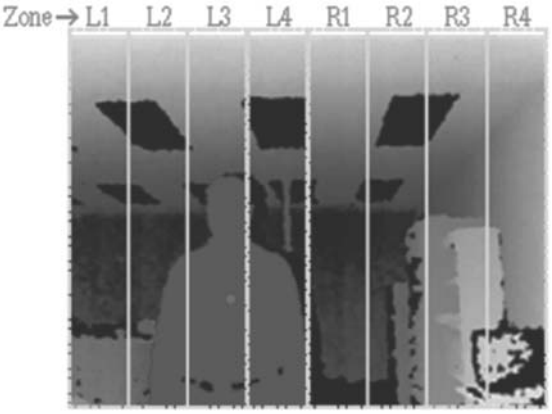

Fig. 10.

This image shows the images obtained from the sensors, human detected is marked in blue, and zone partitions, and their respective center of mass is even marked with red dot which comes under zone L3, the three LED, s are activated by the micro controller on left hand through the I/O expander

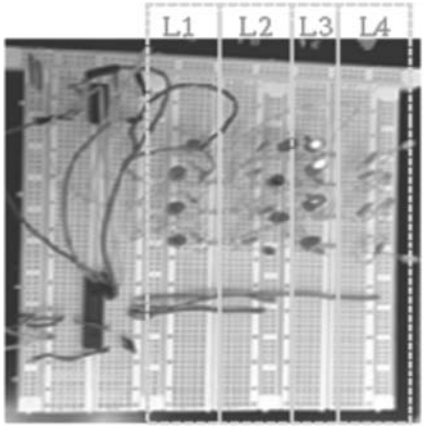

Fig. 11.

Case 3: (Measure between points): This test was designed to identify any human on the path of navigation has stretched his hands, to mark that region as no-pass region. The system identifies the location of human, measures the distance between the hands and informs the blind user so that he/she can move around by to avoid obstacles in the path. Here the presence of human is marked in blue, the red dot represents the location of head, left hand, right hand side, center of mass and distance is represented in mm between two hands on the left side (mag: 1373.8055), the system can identify. Including depth and human movements in real time.

3.3. Vehicle Recognition Tool For Blind

Fig. 12.

Generally in heavy traffic cities it is a hard task for a visually challenged to get into a bus. In India there are more than 8million blind people which has 20% of the worlds blind count.

The architecture of system is generally consists of two parts, bus transceiver segment and VIP transceiver segment. The devices when switched on starts to transmit the signals up-to some distance around 10meters.

The VIP receivers the signals from the bus and thus the VIP can able to access on their wish. First the VIPs will use braille keyboard that is included in the Personal Digital Assistant(PDA) in order to give input to device for bus number.

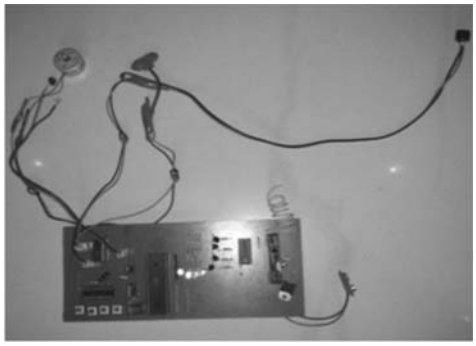

Fig. 13. VIP'S PDA

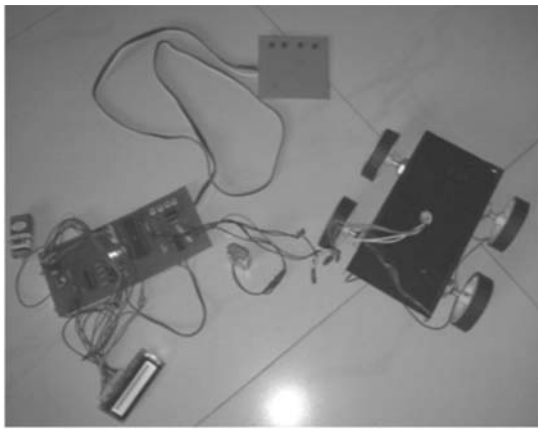

Fig. 14. Bus Module 1

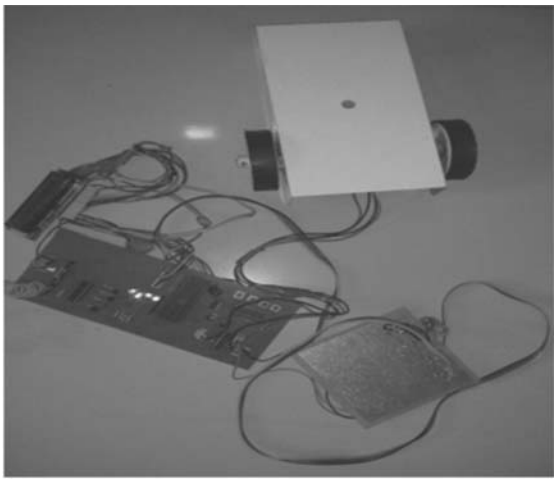

Fig. 15. Bus module 2

When ever he reaches a bus depot he just turn on the device by setting the bus route number in it,his device will start emitting request along with bus route number wished by the VIP. After receiving the request of VIP through a buzzer and LCD installed over the panel of the driver, the bus driver who is moving to same destination having same route number which VIP is waiting for,will send an acknowledgement to the person. The PDA will have a buzzer or a vibrato Installed over it,so the person will get to know that his bus is coming and he will get in to it when it arrives .

4. ACKNOWLEDGEMENTS

We are very much thankful to the DST SEED organization for providing financial support for development of DST project.

5. CONCLUSION

This project proposes the development of a navigation system and the refreshment tools for the visually challenged people. These assistive technology tools help in refreshment and with navigation of visually challenged people and helps in further development of health purpose, household work purpose, mobile app development, for education and which are useful in further job environment.

6. REFERENCES

1. D. Parry, H. Jennings, J. Symonds, K. Ravi, M. Wright, “Supporting the.
2. Visually Impaired using RFID Technology”, *Proceedings of Health Informatics New Zealand Annual Conference and Exhibition*, Oct 2008.
3. B. Sterbenz. Genres in Computerspielen. Verlag Werner Huebscher, 2011.
4. S. Vickers, H. Istance, and M. J. Heron. Accessible gaming for people with physical and cognitive disabilities: a 0framework for dynamic A0daptation. In CHI’13 Extended Abstracts on Human Factors in Computing Systems, pages 19–24. ACM, 2013..
5. G. Sainarayanan, R. Nagarajanand S. Yaacob, “Fuzzy image processing scheme for autonomous navigation of human blind,” *Applied Soft Computing*, vol.7, no.1, pp. 257-264, 2007.
6. D. Baldwin, “Wayfinding Technology: A Road Map to the Future,” *Journal of Visual Impairment & Blindness*, vol. 97, no.10, pp. 612-620, 2003
7. Newswire. Survey: ’disabled gamers’ comprise 20% of casual video games audience. PR Newswire, Apr. 2008.
8. Barrie Ellis et.al. Full list of game accessibility guidelines, Jan. 2015.
9. M. Bousbia-Salah, M. Bettayeb, A. Larbi, “A Navigation Aid for Blind People,” *Journal of Intelligent & Robotic Systems*, vol. 64, no.3, pp. 387- 400, 2011.

10. J. Ortega, N. Shaker, J. Togelius, and G. N. Yannakakis. Imitating human playing styles in super mario bros. Entertainment Computing, 4(2):93–104, Apr. 2013.

11. Smart stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS Shruti Dambhare M.E 3rd SEM (ESC) G.H.R.C.E. Nagpur Prof. A.Sakhare M.Tech (ESC) G.H.R.C.E. Nagpur.

12. Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator M. Naveen Kumar#1 , K. Usha*2 #M.E Student, *Associate Professor Department of ECE, M.V.S.R. Engineering College, Nadergul, Andhra Pradesh, India.

13. Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator Nallaparaju Venkata Kalyan.

14. Design of a GPS based Virtual Eye for the Blind People Rupali Kale&* and A. P. Phatale& &Department of Electronics, J.N.E.C, Aurangabad India Accepted 10 June 2014, Available online 28 June 2014, Vol.4, No.3 (June 2014).