A Low Cost Outdoor Assistive Navigation System for Blind People

Prof. P. R. Badadapure[1], Nikale Dhiraj Anil[2], Nagare Kirankumar Sampat[3], Nanaware Satyaraj Babasaheb[4]
[1, 2, 3, 4] Department of Electronics and Telecommunication
[1, 2, 3, 4] JSPM's Imperial College of Engineering, Wagholi

Abstract- *This paper presents a novel wearable navigation system for the blind and visually impaired in unknown dynamic environments. Usually, feature-based visual navigation and 3D reconstruction works very well for static environments. In this paper, a dynamic environment is considered, where a moving object is viewed by a moving monocular camera with inertial sensors. A novel method based on feature points from a video sequence is proposed to not only estimate the camera motion itself but also the 3D motion of the moving object so as to infer the depth between the camera and the moving object. Firstly, this video sequence is segmented into static and dynamic areas by two geometry constraints: AGOF-aided homography recovery constraint and epipolar geometry constraint, which is the first key contribution of this paper. Then the motion area related to each moving object can be considered as if a static object were viewed by a "virtual camera", while the extracted features from the static background are used for estimating the motion of the "real camera", compared with the "virtual camera". The second key contribution is to solve the problem of scale ambiguity in monocular camera tracking. The scale is firstly adjusted to be global using a closed form solution with I-point algorithm and then estimated in metric unit with the help of inertial measurements. After obtaining the motions for the real and virtual camera, the third key contribution is that the 3D moving object's motion can be derived from these two motions, because the virtual camera's motion is actually the combined motion of both the real camera and the moving object. As a result, blind people can avoid collision with moving objects. Finally, we demonstrate the robustness and effectiveness of our proposed method using a series of experimental results.*

Keywords- Blind navigation, dynamic scenes, 3D reconstruction, scale ambiguity, structure from motion.

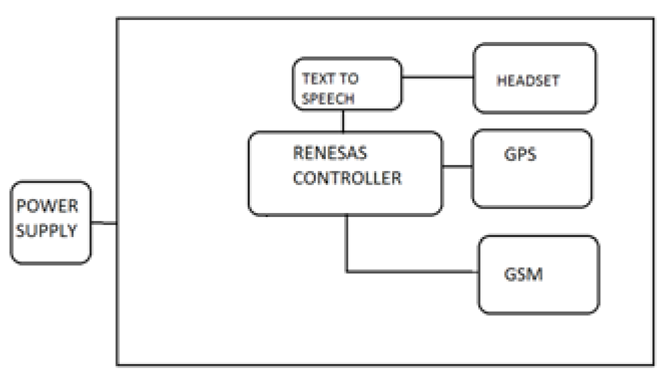
I. INTRODUCTION

Although there are several systems are available for navigation for blind people. But our system is having the smarter controller in which crystal oscillator is inbuilt. And one more advantage of our system is, it is low cost system as compare to previous one. The hardware which we are going to use will give the location of that blind person to his family, will also inform to that blind person by headset using voice. Navigational help for blind people was thereby not the primary goal, but to analyse if after a training period of six weeks new sensorimotor contingencies can be learned. They showed in different experiments, that newly obtained sensory information can improve the performance of the test persons in a trial.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

1. 1.The Navbelt- A computerized multi-sensor travel aid for active guidance of the blind
   Author: J. Borenstein
   Remark : it informs us about the technologies that can be used for blind people
2. An Interactive image registration technique with an application to stereo vision
   Author: B.D Lucas and T. Kanade
   Remark: The navigation systems can be used for blind people, with the help of GPS & GSM.
3. Parallel tracking and mapping for small workspaces
   Author: G. Klein and D. Murray
   Remark: It gives the information about tracking the obstacles and using of sensors for it.
4. Object recognition from local scale-invariant features
   Author: D. Lowe
   Remark: It is about the recognition of locations and obstacles with the help of sensors

III. SYSTEM ARCHITECTURE



Description:

We are developing the system for navigation system for blind people; we are using the renesas controller in place of ARM7 or PIC controller. Our system can be attach to the stick of blind person, and after that it will start working, and the locations saved in GPS, when the person is over there, the reading of latitude and longitude is messaged to the GSM sim card which is inserted in the slot of card.

GPS

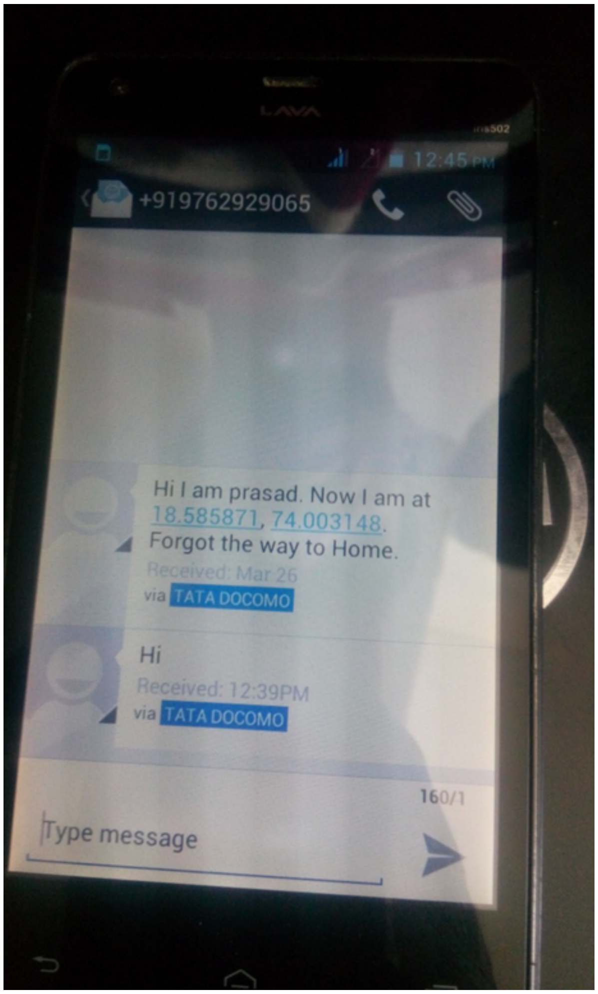
NAVSTAR GPS consists of 21 satellites at an altitude of 20200 km above the earth's surface . These satellites are so arranged in orbits to have atleast four satellites visible above the horizon anywhere on the earth, at any time of the day. GPS Satellites transmit at frequencies L1=1575.42 MHz and L2=1227.6 MHz modulated with two types of code viz. P-code and C/A code and with navigation message. There are two types of observable are of interest for the user . The GPS satellites act as reference points from which receivers on the ground detect their position. The fundamental navigation principle is based on the measurement of pseudoranges between the user and four satellites Ground stations monitor the orbit of every satellite. It is by measuring the travel time of the signals transmitted from the satellite four distances between receiver and satellites will yield accurate position, direction and speed. Though three-range measurements are sufficient, the fourth observation is essential for solving clock synchronization error between receiver and satellite. Because of the term "pseudoranges" is derived. The secret of GPS measurement is due to the ability of measuring carrier phases to about 1/100 of a cycle equaling to 2 to 3 mm in linear distance.

Text To Speech

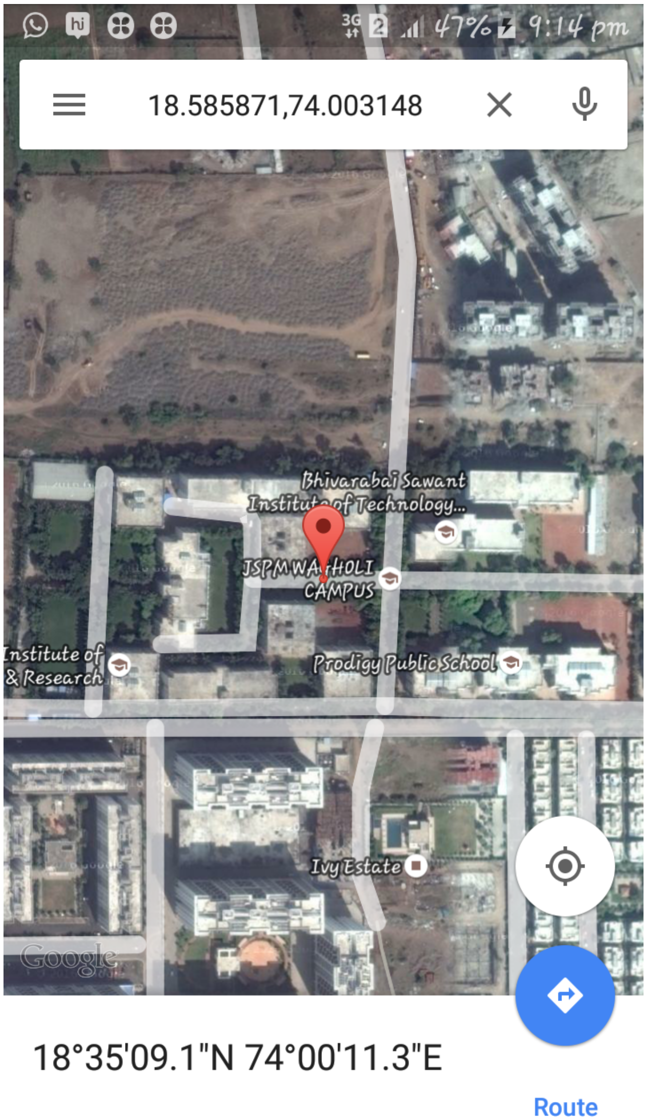
The Emic Text-to-Speech (TTS) Platform is a hardware designed for text-to-speech applications. The Emic Platform is a fully integrated module. This converts a stream of digital text into a high-quality English-speaking voice. It provides a simple way to speech-enable any embedded application. It Required a simple 2-wire serial interface and two optional I/O lines for status notification. The Emic Platform can easily be integrated into nearly any new or existing design.

The Emic Platform is controlled through a simple set of commands and off-loads. Most of the computational required for TTS from the host controller. It consists of a number of functions for core TTS functionality and abstracts the low-level hardware from the end-user application, making it extremely simple to add TTS capabilities to any product.

IV. RESULT



When the system is with blind person, the locations filled in the GPS will give the reading of LANGITUDE and LATTITUDE to the GSM no. and it will show that reading on Google map.



V. ACKNOWLEDGEMENT

I would like to firstly thank our guide Prof. P. R. BADADAPURE for deeming meworthy of his guidance and for the invaluable words of advice, support and help given to me during the entire duration of the making of my project and its report. And simultaneously playing the role of H.O.D of E&TC .Helped us for completing our project successfully.

I would also like to express my thanks to all peers and colleagues who have constantly endured my eccentricities during the making of my project.

VI. CONCLUSION

As a proof of concept, our design works pretty well. It can detect the surrounding situation which is passing from transmitter to receiver. It also provide a good sensitivity and does good job of accessing system. With right adjustment our product or our design will be valuable to blind people.

There are still several problems with our current design. The largest problem is that we currently use expensive components which hinder the range of the system. Additionally we still have not designed a good way to make our design visually appealing.

REFERENCES

[1] K. Möller, J. Möller, K. O. Arras, M. Bach, S. Schumann, and J. Guttmann, "Enhanced perception for visually impaired people evaluated in a real time setting", in World Congress on Medical Physics and Biomedical Engineering, O. Dössel and W. C. Schlegel, Eds., (Springer, Munich, Germany, 2009), vol. 25/4, pp. 283-6, 2009.

[2] F. A. Geldard, "Some neglected possibilities of communication," Science, vol. 131, pp. 1583-1588, 1960. [4] F. A. a. S. Geldard, C. E., "Multiple cutaneous stimulation: The discrimination of vibratory patterns," The Journal of the Acoustical Society of America, vol. 37, pp. 797-801, 1965.

[3] E. C. Lechelt, "Sensory-substitution systems for the sensorily impaired: the case for the use of tactile-vibratory stimulation," Percept Mot Skills, vol. 62 (2), pp. 356-8, 1986. [6] M. Zöllner, S. Huber, H.-C. Jetter, and H. Reiterer, "NAVI: a proof-ofconcept of a mobile navigational aid for visually impaired based on the microsoftkinect," presented at the Proceedings of the 13th IFIP TC 13 international conference on Human-computer interaction - Volume Part IV, Lisbon, Portugal, 2011.

[4] S. K. Nagel, C. Carl, T. Kringe, R. Martin, and P. Konig, "Beyond sensory substitution--learning the sixth sense," J Neural Eng, vol. 2 (4), p. 29, 2005.

[5] P. Bach-y-Rita, C. C. Collins, F. A. Saunders, B. White, and L. Scadden, "Vision substitution by tactile image projection," Nature, vol. 221 (5184), pp. 963-4, 1969. [11] J. B. F. Van Erp, "Vibrotactile spatial acuity on the torso: effects of location and timing parameters", in Eurohaptics Conference, 2005 and Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems, 2005. World Haptics 2005. First Joint, (2005), pp. 80-85, 2005.