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Implementation of Outdoor Assistive Navigation System For Blind People

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ABSTRACT

Pathfinder is a low cost outdoor assistive navigation system. This project use audible feedback technology and for navigation, distance vectors are considered. This project demonstrates the ability to navigate a blind, based on audio which allows the user to move to a known location without the use of a visual aid. The system uses a portable computer, GPS, external memory and a central microcontroller module to generate sound based on the direction that the user must turn in order to face the correct direction. This project is implemented using microcontroller based embedded system connected to GPS. GPS satellites which regularly circle the earth send out signals which the unit detects and quickly interprets. The system can be set to the navigation mode by the user by a keystroke. The system then records the route data from the GPS at regular intervals. The device then stores this information to the system. The user can later replay route information. This helps the person to follow the exact route by getting the information from the stored voice data after comparing with the current GPS data, if the compared data is same as the previously stored location the system will give a message through ear phone using speech processing system otherwise it will give a warning message. This project use speech recognition system, which is done by using two machine learning techniques. They are Mel Frequency Coefficients and k-means clustering.

Keywords : GPS Synthesized directional audio, audible feedback technology, Navigation system.

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I. INTRODUCTION

According to the statistics from the World Health Organization (WHO), about 285 million people are visually impaired worldwide. Of these about 39 million are completely blind, and 246 million have low vision. Moreover, about 65% of these are aged 50 and older, while this age group comprises about 20 % of the world's population. Therefore, with an increasing elderly population in many countries, more people will be at risk of age-related visual impairment. With recent rapid development of technology in computer vision, emerging techniques and researches are using vision as a primary perception sensor for providing information in many applications, such as AR (Augmented Reality), mobile robots navigation, ITS (Intelligent Transportation System) and so on. In order to obtain 3D perception, or environment recognition, or camera ego-motion, the common approaches are based on the principle of triangulation. However, it is commonly assumed that the 3D scene is static, because the triangulation can only be enabled in the situation of the static 3D object in at least two views. If the scene is dynamic, where moving objects appear, the rules of triangulation are generally not satisfied, unless some constraints are further defined -. Another problem is about the depth estimation of an object (the distance between the object and the camera), which is usually lost when projecting a 3D scene on a 2D imaging plane. In this paper, inertial sensors are used to aid visual navigation, because they can sample data in high-frequency rate and give the precise results with absolute metric units in short term without constrained operation .In order to overcome the aforementioned challenges, the following strategies are proposed and the flowchart of the proposed approach is shown in Figure 1. First, a novel and robust methodology, called "A GOF orientation filter", was developed in for real-time 3D orientation tracking with low drift to solve the problem of error growth in orientation estimation using only inertial sensors shown as process (A) in Figure1. Meanwhile, the gravitational acceleration, contained in the accelerometer observations, can be correctly removed based on the pre-estimated orientation from only inertial sensors.

The scale of 3D structure and the objects is determined by using a linear Kalman Filter, called "A GOFl Linear Kalman Filter", which was introduced in details in our previous work . As a result, the camera motion estimated from the SFM will correct the measurements from the IMU and meanwhile the IMU measurements could help correct the inaccuracy of the structure caused by the camera noises Since 2D point correspondences between image frames are used for scene segmentation, it is crucial to find a robust feature points extraction and matching algorithm. In this paper, the SIFT (Scale-Invariant Feature Transform) algorithm, which was first proposed in , is used for finding interesting points even under scale, illumination, small affine and pose changes. The feature extraction based on the SIFT algorithm can be done by using the Harris detector at several scales and then finding local extreme in a pyramidal difference of Gaussians (DOG). Then a SIFT descriptor corresponding to each key-point is generated by measuring the local image gradients at the selected scale in the region around each key- point. After obtaining all correct 2D matched feature points, our goal is to separate them into different groups of feature points so that the motion of each part can be recovered. Two constraints are proposed to separate these matched feature points: AGOF-aided homography recovery constraint and epipolar geometry constraint. AGOF-aided homography recovery constraint As we know, some properties can be easily inferred from camera pure translation. Since the robust orientation can be obtained in real time from our AGOF filter, it can be used to transform a general motion of the camera to a special motion of the camera, in which the camera undergoes a pure translation. There are two special cases of this camera motion with pure translation. The first one is the motion parallel to the image plane, where the translation parallels the image plane, and the rotation axis is perpendicular to the image plane. After rotation recovery, the motion of 2D matched feature points belonging to the static background should be also parallel to each other, which actually reflects the inverse motion of the camera. Therefore, this parallel property can be used as one criterion to sort the 2D matched feature points. The second one is that the motion is perpendicular to the image plane, in which static points have a property of moving along lines in the image plane.

II. LITERATURE SURVEY

An Integrated Indoor/Outdoor Blind Navigation System and Service. consist of, a vocal Communication interface a wireless connection, a wearable computer, and precise position measurement system to guide blind users. It uses DGPS as its location system; it provides the user with an optimal route by means of its dynamic routing and rerouting ability. An OEM ultrasound positioning system is used to provide precise indoor location measurements. The user can switch the system from an outdoor to an indoor environment with a simple vocal command. Limitations are, the algorithm used to calculate the location is for two-dimension using the average height of a person, which results in bigger error if the user sits or lies down. Only use 4 pilots to cover the “Smart House.” thereby the signal may be reflected or blocked by furniture and walls, there are some “dead spots” that have bad data reads.

This project mainly concerns audible feedback technology. This project use distance vectors not motion vectors. So survey mainly focused on devices which used distance vectors. NAVBELT consist of a belt, a portable computer and ultrasonic sensors. The computer processes the signals from the sensors and gives the results to the obstacle avoidance algorithm. The resulting signals are given to the user by stereophonic headphones, using a stereo imaging technique. It provides acoustic signals via a set of stereo earphones that guide the user around obstacles or displace a virtual acoustic panoramic image of the traveler's surroundings. Limitations are it is difficult for the user to comprehend the guidance signals in time. Navbelt lacked the ability to detect overhanging objects, steps, sidewalks, edges etc. It does not allow fast-motion. The system is unsafe when approaching bumps and holes due to its 2D representation. The system emphasis only on 2D GUIDE CANE: The Guide Cane uses the same mobile robotics technology as the Navbelt but is a wheeled device pushed ahead of the user via an attached cane. When an obstacle is detected, guide cane steers away from the obstacle. The user immediately feels this steering action and can follow the Guide Cane's new path easily without any conscious effort. The user no longer needs to actively scan the area ahead of him/her. Determines an appropriate direction to avoid the obstacle, steers the wheels in that direction. The Guide Cane does not use acoustic feedback, so that there is no masking of audio. Limitations are limited number of sonar’s is used for indoor navigation. Accuracy is reduced. Braking systems are not so efficient. Wheel configurations are poor. When the user walks into a dead-end where no avoidance manoeuvre is possible, System for Wearable Audio Navigation: is a wearable computer consisting of audio-only output and tactile input via a handheld interface relies on a Geographic Information System (GIS) infrastructure for supporting geo coding and spatialization of data .Utilizes novel tracking technology. Limitations are, High cost. Different sounds are used for identifying obstacles and navigation. Navigation Beacon sounds guides the listener along a predetermined path. Object Sounds indicate the location and type of objects around the listener. Surface Transition sounds signify a change in the walking surface. A camera computer system to support safe walking of a blind people: A system for detecting moving objects in front of a person on a walk road by a camera mounted on his/her body. The system is equipped with a single camera placed on the chest of a person. It detects moving objects from the camera images by analyzing motion vectors. Limitations are collision detection is not implemented. Hardware implementation is costly. High definition camera is required. Higher precision is required in detecting motion vector. From the literature review it is clear that, better performance is obtained from audible feedback technologies. By using distance vector, system gives better accuracy. The proposed design use audible feedback technology and distance vectors for its implementation.

II. PROPOSED SYSTEM

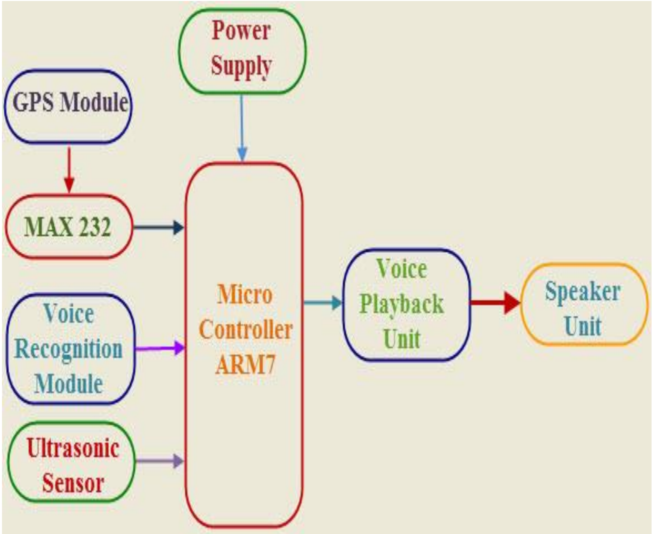

Fig 1. System Block Diagram

III. CIRCUIT DIAGRAM

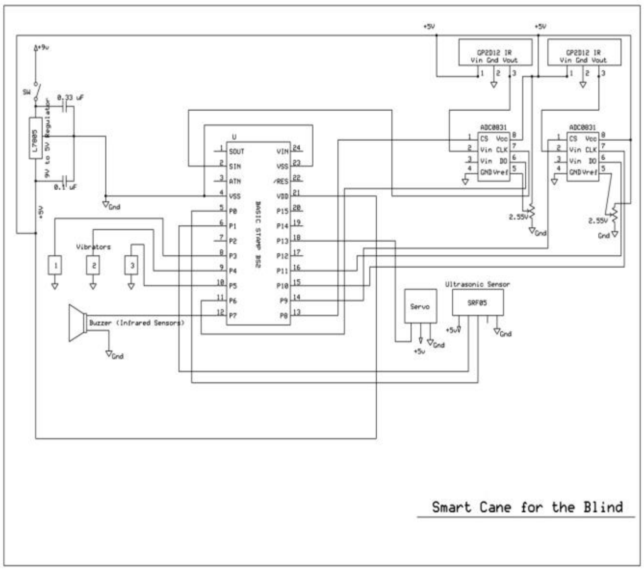

Fig 2. Circuit diagram

IV. ADVANTAGES AND APPLICATION

ADVANTAGES

- Blind person can travel alone without taking help from anyone.
- Low cost.
- Easy to handle.

APPLICATION

- Applicable for blind people , to get information about direction of surrounding situation and place.

V. 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.

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