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SURVEILLANCE AID SYSTEM FOR THE VISUALLY IMPAIRED PEOPLE (SASVIP)

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ABSTRACT

Today, Blindness Aid System is a part of a visually impaired person's life. The Surveillance Aid System a new computer-vision based Aid System for the visually impaired people to predict and detect dynamic objects as they move around. The Aid System uses Lasers and Digital Video Images to create a three-dimensional acoustic map. The information received from the map is passed through the Headphones that assist the visually impaired people to "See the World" through sound. It is always tedious for blind people to move in a dynamic environment. This project is developed to overcome the drawbacks of the existing system, by making use of a CCTV Camera with built-in audio to assist the visually impaired person to detect and avoid dynamic obstacles, which helps the visually impaired people to act independently and to overcome their day-to-day challenges in life.

Keywords- Three-Dimensional Acoustic Map, Aid System, Dynamic Environment, CCTV camera, Moving Obstacles.

1. INTRODUCTION

Blindness is the condition of lacking visual perception due to Physiological and/or Neurological factors. There are two types of blindness, where Complete Blindness is that a person cannot see at all and Partial Blindness is that a person has limited vision. Visually impaired people face many problems and hurdles in performing their day-to-day duties to lead a normal life. To be simple, visually impaired people have to put on more effort in leading their life than normal people do. Various technologies have been developed to help the visually impaired people. Day-by-day advancements in the field of Science introduces new technologies for the benefit of visually impaired people to make their life easy and comfortable.

Some technologies are:

The C-5 Laser Cane [1], was introduced by Benjamin et al. It is based on optical triangulation with three laser diodes and three photo-diodes as receivers. The Laser Cane can detect obstacles at head-height, drop-offs in front of the user, and obstacles up to a range of 1.5 m or 3.5 meters ahead of the user.

The Mowat Sensor [1], is a hand-held ultrasonic-based device, that informs the user of the distance to detected objects by means of tactile vibrations. The frequency of the vibration is inversely proportional to the distance between the sensor and the object.

The Nottingham Obstacle Detector [1], is a hand-held sonar device that provides an auditory feedback, in which eight discrete levels of distance are distinguished by different musical tones.

The Binaural Sonic Aid [1], comes in the form of a pair of spectacle frames, with one Ultrasonic wide-beam transmitter mounted between the spectacle lenses and one receiver on each side of the transmitter. Signals from the receivers are frequency shifted and presented separately to the left and right ear. The resulting interaural amplitude difference allows the user to determine the direction of an incident echo and thus of an obstacle. The distance to an object is encoded in the frequency of the demodulated low-frequency tone.

The Guide Cane [2], is a novel device designed to help blind or visually impaired users navigate safely and quickly among obstacles and other hazards. During operation, the user pushes the lightweight Guide Cane forward. When the Guide Cane's ultrasonic sensors detect an obstacle, the embedded computer determines a suitable direction of motion that steers the Guide Cane and the user around it. The steering action results in a very noticeable force felt in the handle, which easily guides the users without any conscious effort on their part.

The CASBliP is the existing technology. It stands for **COGNITIVE AID SYSTEM FOR BLIND PEOPLE** [4**].** The main aim of CASBliP is to develop a system capable of interpreting and managing real world information from different sources to assist visually impaired users. The main disadvantage of CASBliP is that it can detect only static objects. This is a huge risk factor at situations when a visually impaired person crosses the road.

We create a device that supports blind people to detect and identify dynamic objects, using CCTV cameras.

2. EXISTING SYSTEM

There have been some astounding breakthroughs in the development of new technologies to assist the visually impaired which aim to replicate the functions of the eye. One among them, is the **Cognitive Aid System for Blind People (CASBLiP)**, which uses lasers and digital video images to create a three-dimensional acoustic map, which, when relayed through headphones, enables users to "see" the world with sound. Laser and digital video camera images will be used to analyze the distance of obstacles and help to predict the movement of people and motor vehicles as the user nears them. This spatial information will then be transformed and presented to the user via headphones as an "audible map".

The signals received via headphones will guide and assist the user to negotiate and navigate the obstacles and dangers of the outside world.

The user will also wear glasses with miniature video cameras mounted on them. These cameras will provide the necessary video vision.

As the person wearing a **CASBliP** setup moves around, the sounds received via headphones will alter and the stereo audio system will enable the person to interpret sounds and then place them in accordance with their distance from them. For example, as the person walks away from an object, the sound will decrease. Similarly, if the person walks closer to an object, the sound will increase. If an object is on their right, they'll hear it in their right and if it is on their left, they'll hear it in their left.

The **CASBliP** project has been three years in the making so far and has been made possible by funding from the European Union (EU). There are a number of universities and blind institutions involved in the consortium.

Researchers from the University of Bristol used algorithms and real-time image processing to identify common street objects and obstacles, such as trees and street furniture to create a “depth map”, capable of calculating distances. This “depth map” was further enhanced into a three-dimensional acoustic map by the University of Laguna in Spain. The University of Marche further supported CASBliP setup with a gyroscopic sensor to detect how the user moves their head. The Francesco Cavazza Institute in Italy played their role in enhancement of this setup, by installing a GPS navigation system to help complement other technologies and to add verbal directions to reach the required destination.

All the developed components along with their respective technologies were put together to create a device that "sees" the world through hearing.

So far, two prototype devices mounted on a helmet have been developed. They have been tested in real world environments by participants from the German Federation of the Blind and Partially Sighted and the Francesco Cavazza Institute in Italy.

The first design (M1) uses a laser sensor that was initially developed by Siemens to detect passengers in cars. The system cannot be seen by others as it is mounted within glasses and uses infrared light. It is effective for users that are capable of recognizing familiar items such as trees or people from the sound information they receive. This model was designed mostly for a static environment.

A second version (M2) sees two digital video cameras added to either side of a helmet. This system can predict and detect the movement of objects at a very less efficiency rate. Hence, even though **CASBliP** is considered to be an evolution in the field of technology for the visually impaired, its usage was limited to a static environment, which is obsolete in a real-time situation.

3. PROPOSED SYSTEM

The aim of building **Surveillance Aid System for the Visually Impaired People (SASVIP)**, is to overcome the static-environment limitation in **CASBliP**. **SASVIP** is intended to work in a dynamic environment with an increased stability, reliability and efficiency.

SASVIP uses a wireless CCTV Camera with a built-in audio system, which helps the visually impaired people to “SEE” the world through sound.

First, with the use of a camera lens, the CCTV camera records and/or acquires data from the location or premises it is fixed. It then transmits the signals on to the monitor or to any other display device.

This wireless camera is mounted on either side of the helmet and is used to record moving obstacles. The video can be viewed instantly and the microphone will assist the blind people to stay away from the obstacles. This will help the blind people to move around independently in a dynamic environment.

A. Artificial vision system

This system analyzes the scene in front of the user to estimate the characteristics of stationary obstacles and moving objects for reasoning (about their level of danger to the user) and sonification.

In particular, detection of fast moving objects are estimated through their relative position, direction of motion and speed, and detecting obstacles ahead in front of the user [9].

To summarize, the intention is not to recognize various classes of objects, but to determine potentially hazardous ”unknown” objects, to restrict further movement by the user, which helps the user to make appropriate decisions as to what to do next.

Even so, this is still a very challenging task due to the complexity of outdoor environments (not only in terms of lighting conditions and scene ambiguities, but also in terms of motion) and due to the movement of the user’s cameras. It is also of vital importance to be able to cope with the real time computational requirements.

In the light of these, a stereo pair of cameras and a 6DoF inertial sensor are used as the key components of the vision system, in which these sensors are rigidly attached to each other. The cameras are equipped with auto-iris control in order to adapt to illumination changes.

B. Depth estimation and image segmentation

In order to estimate the distance of objects from the user in an efficient manner, a stereo grid with two cameras is used instead of a single camera, since it is generally faster in temporal depth estimation.

The Firewire interface is chosen to allow real-time frame rates while supporting two cameras. The intrinsic and extrinsic parameters of the two cameras are pre-computed using a classic chart-based calibration technique. Normally, sparse depth estimation (correlation-based patch correspondence search and reconstruction) is usually computationally efficient.[9]. However, it is not desirable in our application since it often results in isolated regions even though they may belong to a single object which makes it difficult to sonify.

Several methods have been experimented, including belief propagation, dynamic programming, sum of absolute difference with winner-take-all optimization, and sum of squared differences with iterative aggregation, but the classic chart-based calibration is best suited for this setup.

C. Obstacle detection and motion estimation

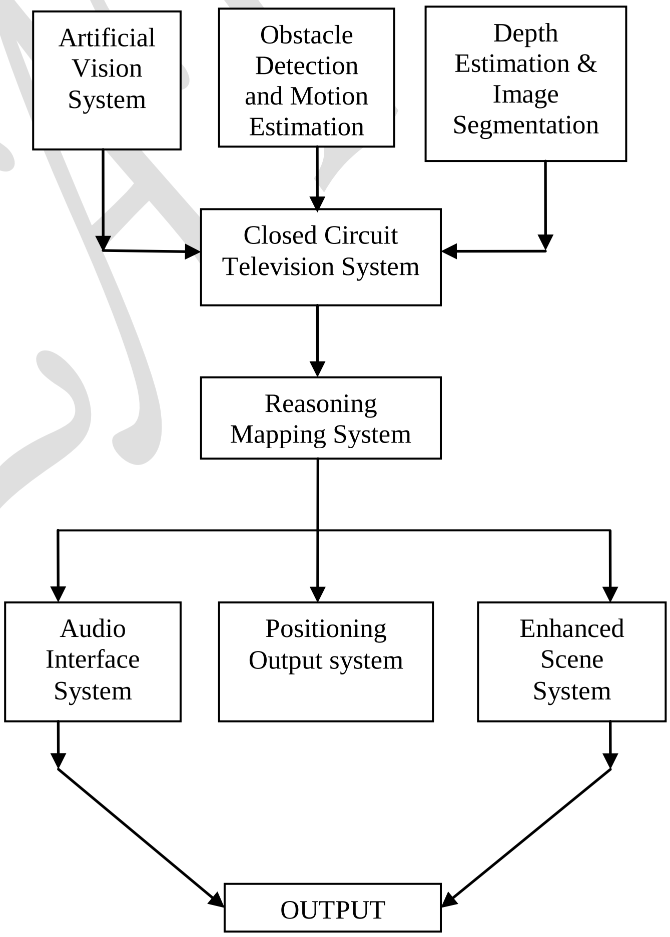
Objects immediately in front of the user may pose danger and must be detected [9]. This can be quite efficiently carried out by thresholding the dense depth map, with the threshold conveniently obtained based on stereo parameters and distance of interest.

Morphological processing can follow to remove isolated regions for the ease of sonification. This information will be used by the sonification module to enhance its decision based on the CMOS sensor (described later) which is specifically applied to the detection of immediate objects up to 5m away [9].

Note: All this will be in addition to the information derived by the user with the traditional white cane. The proposed method here is simple and can provide better warning to the user of obstacles above the ground level.

D. 3D real world recognition system

3D CMOS image sensor is able to acquire object distance information for every single pixel from time of flight (TOF) measurements. This novel approach is based on ultra fast electronic shutters, scanner less pulse TOF imaging with full solid state devices.



REFERENCES

[1] http://www.personal.umich.edu/~johannb/Papers/Paper65/Paper65.html
[2] http://citeseerx.ist.psu.edu/viewdocs/summary?doi=10.1.122.1249
[3] http://www.gizmag.com/visually-impared-see-the-world- sound/12164

[4] http://casblipdif.webs.upv.es/index.html/
[5] http://www.fastuk.org/research/projview.php/id/1427
[6] Ftp://ftp.cordis.europa.eu/pub/ist/docs/cognition/casblip-arp2006_en.pdf
[7] http://www.zimcos.co.uk/cctv-camera-functions/
[8] http://www.tech-faq.com/how-cctv-works.html
[9] http://casblipdif.webs.upv.es/Reports/Final%20Activity%20Report%20CASBliP.pdf