Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator

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Abstract— This paper presents a theoretical model and a system concept to provide a smart electronic aid for blind people. This system is intended to provide overall measures –object detection and realtime assistance via Global Positioning System(GPS). The system consist of ultrasonic sensor, GPS Module, GSM Module and vibratory circuit(speakers or head phones). This project aims at the development of an Electronic Travelling Aid (ETA) kit to help the blind people to find obstacle free path. This ETA is fixed to the stick of the blind people. When the object is detected near to the blinds stick it alerts them with the help of vibratory circuit (speakers or head phones). The location of the blind is found using Global System for Mobile communications (GSM) and Global Position System (GPS).

Index Terms— GSM, GPS, Ultrasonic sensor, ETA, Obstacle free Path,vibratory circuit,blind stick

INTRODUCTION

Artificial Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The statistics by the World Health Organization (WHO) in 2011 estimates that there are 285 billion people in world with visual impairment, 39 billion of people which are blind and 246 with low vision. The oldest and traditional mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs. The drawbacks of these aids are range of motion and very little Information conveyed. With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind people to navigate safely and independently. Also high-end technological solutions have been introduced recently to help blind persons navigate independently. To identify position orientation and location of the blind person any of those solutions rely on Global Positioning System (GPS) technology. Such systems are suitable for outdoor navigation, due to the need for line of sight access to the satellites, they need additional components to improve on the resolution and proximity detection to prevent collision of the blind persons with other objects and hence subject his/her life to danger. However in comparison with other technologies many blind guidance systems use ultrasound because of its immunity to the environmental noise. Another reason why ultrasonic is popular is this technology is relatively inexpensive, and also the ultrasound emitters and detectors are small enough to be carried without the need for complex circuitry. Apart from the conventional navigation systems, a blind aid system can be provided a new dimension of Real time assistance and artificial vision along with dedicated obstacle detection circuitry. These different units are discussed to implement the design of a 'Smart stick' for blind.

II. SYSTEM DESIGN

The proposed design for smart stick distinctly consists of three units:

- The GPS Unit.
- The Obstacle Detection Unit.
- GSM Unit

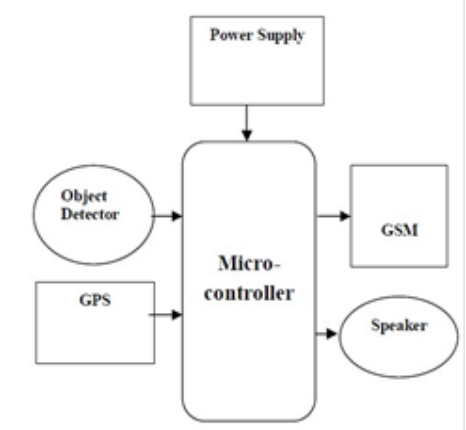

Fig 1. Proposed Smart Stick System

The figure above depicts the proposed design of an embedded smart stick. The elements of the system consist of

various subsystems. The object detector circuitry consisting of sensors such as ultrasonic sensors and Led sensors. Vibratory circuitry consist of an array of mobile vibrators with logic designed to obtain different vibratory patterns. The GPS system, microcontroller and power circuitry (preferably battery-based) are the crucial systems. The proposed system can be designed to a detachable and portable device, which can be mounted on a simple white cane or blind stick. This requires a clear vision of the desired system goals. Various system parameters are thus needed to be evaluated based on the design to be practically implementable

TABLE I
SYSTEM PARAMETERS

NO	PARAMETERS	GOALS
1	SIZE	Compact & Robust.
2	WEIGHT	Less than 3 kg.
3	SPEED (d+a)	0 to 0.5m/s.
4	HANDLING	Maximum support force & forces in X and Y directions for stability and guidance
5	BATTERY CHARGING	About 8 hrs between charges at duty cycle.
6	ON-BOARD COMPUTING	Sufficient for planning, control, health monitoring and communication
7	SENSORS AID FOR NAVIGATION	GPS n Passive signposts acceptable for localization. Infrared (Ultrasonic)sensors acceptable for obstacle avoidance

The above table discussed the various parameters which are to be kept under consideration prior to design implementation. The most important parameters being cost .As 90% of the blind population of the World lives in the developing countries. So an affordable and convincing design has to be put forth for worldwide acceptance.

III. MICROCONTROLLER

The microcontroller used in this GPS and GSM based device with user input interface can be preferably ARM7TDMI based LPC2148 microcontroller, which is having 512KB flash memory and 8 to 40 KB of SRAM and several peripherals. The ARM7TDMI-S is a general purpose 32-bit microprocessor. A unique accelerator architecture and a 128-bit wide memory interface enable 32-bit code execution at the maximum clock rate. The GSM module and GPS will communicate using RS232 protocol with microcontroller.

IV. GSM AND GPS MODULES

The Global Positioning System (GPS) and Global System for Mobile communications (GSM) are interfaced to the microcontroller to detect the blind person location .The proposed architecture consists of a GPS signal receiver and GSM, vibratory circuitry connected to ARM7. This complete setup will be fixed to stick. The GPS will be sending the location information to the controller continuously. The same will be routed to the GSM modem through the controller. GSM willforward this information to the pre fed mobile nos. the user after receiving the message. If the person wants to know the location of the blind person, he has to send one message like TRACK immediately he will get the blind person location coordinates.

V. OBSTACLE DETECTION UNIT

Electronic Travel Aids (ETA) have been classified in three classes:

- Obstacle detectors
- Environmental sensors
- Navigation systems.

The first class is based on sensory or artificial vision systems. The sensory systems emit ultrasonic or laser beams to the environment, which are reflected by the object; the system calculates the distance from the object according to the time difference between the emitted and received beam.

The stereo-vision systems use the object tracking algorithms and calculate the distance by using grayscale method (VOICE).

The proposed system uses ultrasonic sensor which basically works on the principle of the ultrasonic sound generation and alert mechanism. The system is however having a dual feedback mechanism i.e it has an additional vibratory feedback mechanism. This enhances the overall feedback received by the blind user who receives the outputs generated in different formats of vibration ie high, low, medium and strong vibrations.

VI. CONCLUSION

This paper proposed the design and architecture of a new concept of Smart Electronic Travel Aid Stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind person worldwide. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure.

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