Indoor Navigation for Visually Impaired People Using Visible Light Communication.

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Abstract: **As outdoor navigation is available nowadays, indoor navigation has become a need for the visually impaired persons to help them navigate swiftly. In this system we utilize visible light communication to obtain positional information about the visually impaired to provide them the appropriate direction as needed.Experiments were conducted targeting visually impaired people. Although acquiring accurate positional information and detecting directions indoors is difficult, we assume that using this system, accurate positional information and travel direction can be obtained utilizing visible light communication technology, which employs LED lights, and smart-phone.**

Keywords: **Indoor navigation (IN), Visible light communication (VLC), visually impaired people (VIP), Location-based services.**

I. INTRODUCTION

In today's world we use various technologies for navigation like GPS, voice navigation, guide dogs etc. Most of these can also be used by the visually impaired people for navigating outdoors.

As compared to public navigation no advances are being made for the visually impaired people. However methods like acquiring positional information using radio waves and preparing tactical maps are there but are facing problems repeatedly. While the GPS is also not available indoors.
To addresses these issues we develop an indoor navigation system that utilizes visible light communication technology which employs LED lights and a geomagnetic correction method aimed at supporting the visually impaired people to navigate indoors.

II. LITERATURE SURVEY

There has been some past contributions to facilitate the movement of the visually impaired people indoor. The earlier methods used for their navigation were:

1. Radio Waves Positioning:-

In this method a number of various LAN access points were employed that send out radio waves that can detect the positional information of the visually impaired person.
However this method encountered issues with fluctuating positional accuracy due to the radio waves reflected back from obstacles in the surrounding environment.

2. Tactical Maps:-

In this method to navigate indoors, the person was to develop a mental map so that he can visualize a mental layout of the indoor architecture of the environment.
These tactical maps were not easy to visualize and also it took long time for the visually impaired person to memorize it by touch.

3. Path Planning:-

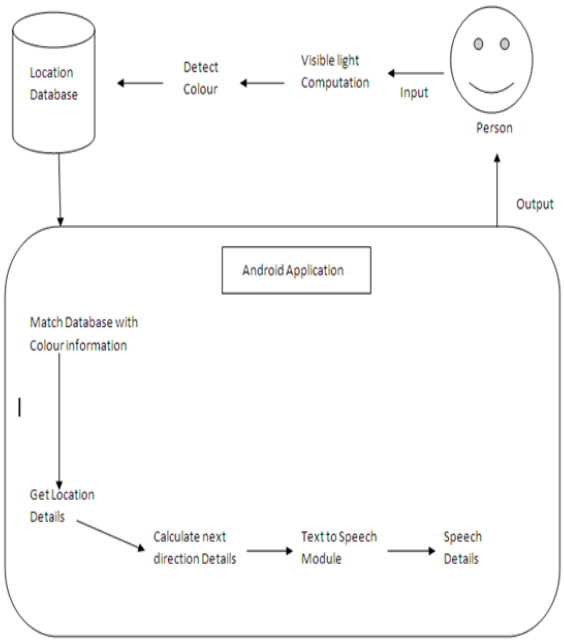
This algorithm uses Dijkstra's algorithm as a base to calculate the minimum path to the destination or through an intermediate node. Though it induced signal delay and latency in the system due to its complexity.

4. Guide Dogs:-

These are service animals which can be used to assist the visually impaired people. However these animals are required to be trained as per the needs and require human interaction to be fully acquainted to their behaviour.
However they have some limitation and cannot be used everywhere like they are colouring blind and cannot understand red signal etc.

III. PROPOSED SYSTEM

The performance of the system depends upon a number of factors such as the integrity of location database and the calculation of correct direction. The system latency also need to be considered when taking performance into consideration.



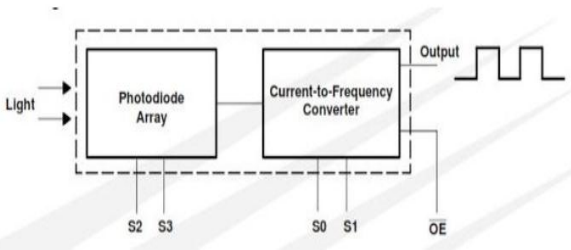
The input to the system is provided by the visually impaired person through speech through which the route to the destination is decided. Then the system provides direction from point to point throughout the travel of the visually impaired person.

1. Algorithm for Text to Speech

```
repeat
{
   for each word
   {
      if word in base
            generate speach
      else
         for each twoletters
         {
            if twoletters in base
                  generate speach
            else
            {
            for each letter
                  generate speach
            }
         }
   }
}
until end of text
```

When an appropriate word corresponding to the text is found in the database the sound associated with it is generated.
If a word is not matched to the database, the corresponding word is broken into fragments and sound for each fragment is found and played inorder of the required word. Sounds of even separate characters can be grouped together to form a word which does not belong to the database.

TCS230 Color Sensor:



TCS230 sensor is a color detector with four input LED's .It consist of photodiode array which detects the intensity of the color detected and sends these sensed electrical impulses to the current to frequency convertor, which converts this to the corresponding frequencies to be given as input to the LED's.

Specifications of TCS230

- Single-Supply Operation (2.7V to 5.5V)
- High-Resolution Conversion of Light Intensity to Frequency
- Programmable Color and Full-Scale Output Frequency
- Power Down Feature
- Communicates Directly to Microcontroller/Arduino
- S0~S1: Output frequency scaling selection inputs
- S2~S3: Photodiode type selection inputs
- OUT Pin: Output frequency
- EO Pin: Output frequency enable pin (active low)

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