Smart Stick for Blind using Machine Learning

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Abstract:- Today technology is growing to a bigger extent, but there's no price effective device for visually impaired folks. For a visually impaired person it becomes not possible to try to to his/her day to day activities, so sensible Blind stick will facilitate visually impaired folks in moving and permitting them to perform their work simply. The sensible stick can have sensors embedded with it, thereby it senses the objects/intruder, once associatey objects or obstacles are available in vary of an supersonicdevice then the person is alerted with a fast reaction time employing a vibrator. The general system conjointly encompasses a GPS module, so the person with incapacity will recognize this location with the assistance of a electro-acoustic transducerand a speaker. this technique conjointly has a feature wherever within which the person with incapacity will contact to a particular person whose range is keep in an exceedingly microcontroller just in case of any emergency. this techniqueconjointly encompasses a water device at very cheap of the stick and Infrared device for effective obstacle detection. coming up with a price effective and economical blind stick is that the main aim of the project.

Keywords:- Sensible Belt, Rasberrypi, Ultrasonicsensor

I. INTRODUCTION

There area unit regarding 253 million folks digest vision impairment, thirty six million area unit blind and 217 million have moderate to severe vision impairment. eighty one of individuals World Health Organization area unit blind area unit aged fifty years and on top of (WHO estimation). the quantity of visually impaired folks area unit expected to grow within the future because of numerous reasons. As a result, there's a necessity for a value effective system which will be employed by blind folks so as to steer simply and well. it's necessary that a sensible resolution is planned for the blind folks in order that they will use this in their way of life.

II. PROPOSED WORK

A. Existing System

Google Glass may be a wearable laptop with Associate in Nursing optical head-mounted show that's being developed by Google within the Project Glass analysis and development project. Google's mission is to supply a mass-market pervasive laptop [i.e., computing that may seem everyplace and anywhere. Google Glass displays info in an exceedingly good phone-like hands-free format that may interact with the net via tongue voice commands. it isn't a combine of "Google Glasses," but one Google Glass telephone receiver. Glass contains a terribly easy, clean style that, in some regards, is beautiful and elegant; in others, crude and clumsy. We'll begin with the elegant bits, most compelling being the plastic-backed metallic element band that sweeps around and forms the frame. Glass will perform

With a Wi-Fi or Bluetooth knowledge association – it's a completely freelance device. This suggests you'll leave your phone behind and walk around anyplace with Wi-Fi while not losing association. But this costs around 14000$(around 900000 rupees) that isn't attainable to use by most of the blind folks in a developing country like India.

There area unit many comes projected as mentioned within the literature survey however the thought of this project is to make a product that is cheaper, and conjointly which mixes the simplest feature on with location help. Most of the systems uses the idea of image process which suggests there's a requirement of camera that makes the system pricey, and conjointly these system contains a demand to capture plenty of images/frames per second that will increase the necessity for giant storage and once more making the merchandise costlier. The key agenda of this project is to develop a value effective economical system.

The stick is embedded with Raspberry Pi, GSM module, GPS module, vibrator, switches and sensors. If any device is invoked, the vibrator that is placed over the handle vibrates. If the visually impaired person needs to grasp their current location they'll press the switch assigned for that purpose, associate degree audio relating to this location is detected by the blind man with the help of a Bluetooth audio device. totally different types of devices like water sensor, supersonic device and Infrared device ar placed at numerous elements of the stick creating it strong. If the visually impaired person conjointly needs some facilitate throughout some emergency, a decision or a message is shipped to a group of mobile numbers hold on during a small controller. Developing the merchandise at bottom value becomes the key agenda of the project. If the person wants to grasp the directions to induce to the proper location, he/she will really press a button associated for the aim, the direction based mostly} audio message is detected by them victimization the Bluetooth based audio device. Infrared device that is gift at rock bottom of the stick will find presence of holes and stairs.

B. Methodology

The stick is embedded with Raspberry Pi, GSM module, GPS module, vibrator, switches and sensors. If any device is invoked, the vibrator that is placed over the handle vibrates. If the visually impaired person needs to grasp their current location they'll press the switch allotted for that purpose, associate degree audio relating to this location is detected by the blind man with the assistance of Bluetooth audio device. totally different types of devices like water sensor, supersonic device and Infrared sensor ar placed at numerous elements of the stick creating it strong. If the visually impaired person conjointly wants some facilitate throughout some emergency, a decision or a message is shipped to a group of mobile numbers stored during a small controller. Developing the merchandise at bottom value becomes the key agenda of the project. If the person needs to grasp the directions to induce to the proper location, he/she will really press a button associated for the aim, the direction primarily based audio message is detected by them victimization the Bluetooth primarily based audio device. Infrared device that is gift at rock bottom of the stick will detect presence of holes and stairs. Google Assistant is deployed here for swish interface for voice and audio I/O.

C. Obstacle Detection

To observe obstacles whereas walking, we tend to use unhearable sensors. These sensors are embedded within the stick and area unit organized in several orientation. Output from these sensors are processed in an exceedingly microcontroller and appropriate undulation feedback are provided. relying upon the output of unhearable devices/IR sensor, necessary vibration modules are activated to tell the person concerning the obstacle.

D. Navigation

The basic plan here is to integrate Google Assistant in our good stick that is a powerful tool for pursuit and navigating within the very best means. User can have a Bluetooth enabled speaker from that he are ready to hear the stereo sound directions facultative him to navigate to a location.

E. Emergency alert

This system additionally includes a feature wherever within which the person with incapacity will contact to a specific person whose range is keep in an exceedingly microcontroller just in case of any emergency. He/she can press the switch appointed for it.

III. LITERATURE SURVEY

Paper [1] Title: Smart Stick for the Blind a total answer for achieve the goal. This framework utilizes IR sensor, Ultrasound sensor and water sensor to identify the snag. Be that as it may, this framework just gives a caution if any of the sensor is activated, it utilizes a ringer to alarm the visually impaired individual. This framework does not utilize any area identifier or area marker.

Paper [2] Title: Pothole location for outwardly hindered which uses a camera that catches picture 15 outline for each second and dependent on the idea of picture preparing the pothole is distinguished. Issue with this framework is utilization of camera makes it costly, and furthermore a ton of pictures caught every second expands overhead and capacity necessity.

Paper [3] Title: Smart Walking Stick for Blind portrays about a Stick which use Raspberry Pi [10] and a ultrasonic sensor to identify articles and gatecrasher, the framework likewise has a camera inserted with it, and dependent on the pictures caught the items are identified. The articles are examined dependent on the arrangement of picture datasets that are now put away. This framework nonetheless, turns out to be expensive because of the utilization of high-endcamera and furthermore on account of capacity limitations as enormous volume of datasets are should have been put away. This framework, in some cases may likewise be incorrect in light of the fact that the hindrances are distinguished dependent on dataset (huge arrangement of pictures) as various items differ in their shape and size.

Paper [4] Title: Smart Belt for Blind uses a belt inserted with ultrasound sensor which identifies the obstruction. The belt likewise has a bell which vibrates when impediment is recognized. The whole framework is created so that the separation determined is sent as a sound message for the visually impaired individual, where in which he hears the separation determined utilizing a speaker.

Paper [5] Title: A wearable ultrasonic hindrance sensor for outwardly disabled. This framework utilizes a couple of ultrasound sensor on either side over the tie of the goggles. This task can identify the interloper before the visually impaired individual who is wearing the goggles. This framework isn't powerful as the sensor implanted with the goggles makes it heavier and furthermore it can't identify complex items, for example, water vehicle and so forth

IV. REQUIREMENT SPECIFICATION

❖ *System Requirement*

A. Hardware Requirements
- Raspberry Pi 3 B module.
- Ultrasonic sensors.
- IR sensor
- Vibrator
- Bluetooth module.
- Push Buttons
- Stick body(plastic)

B. Software Requirements
- Raspberry pi programming with Python
- Google Assistant SDK.

V. ABSTRACT SPECIFICATION OF SUB-SYSTEMS

A. Obstacle Detection System:

The fundamental principle is to sight presence of obstacles victimisation multiple inaudible sensors and provides feedback in undulation kind. associate degree inaudible detector could be a device which will live the space to an object by victimisation sound waves. It measures distance by causing out a wave at a selected frequency and listening for that wave to convalesce. These sensors are going to be embedded within the stick and are organized in numerous orientation. Output from these sensors are going to be processed in Raspberry Pi 3b microcontroller and appropriate undulation feedback are going to be provided. So, whenever the person confronts any obstacle ahead of him, the inaudible detector detects it and informs the user about it through a undulation feedback.

B. Communication System:

An fundamental a part of our verbal exchange machine is the GPS and GSM module that is embedded inside the Raspberry pi 3b module. In GPS, the GPS satellites circle the Earth two times a day in a specific orbit. each satellite tv for pc transmits a unique signal and orbital parameters that allow our clever stick device to decode and compute the perfect location of the satellite. GPS receiver in our clever stick use this statistics and trilateration to calculate a user's precise place. basically, the GPS receiver measures the distance to each satellite by using the amount of time it takes to receive a transmitted sign. With distance measurements from some more satellites, the receiver can determine a user's function and display it electronically to measure our going for walks route, or find a way home from everywhere. GSM is a mobile network, which means that cellular phones connect with it by using searching for cells in the instant place. There are 5 distinctive cellular sizes in a GSM network—macro, micro, %, femto, and umbrella cells. The insurance place of every cellular varies in keeping with the implementation environment. So, our clever stick connects to a device of some other user on every occasion the consumer presses the assist button. It straight away sends a SOS assist message specifying the place of the consumer to the intended the man or woman. Google Assistant paperwork every other crucial part of our verbal exchange system. The Google assistant affords an interface to the person in the shape of a audio comments in case of any occasion. to be able to integrate it in our clever stick we use Google Assistant SDK. The Google Assistant SDK lets you upload hotword detection, voice manipulate, natural language expertise and Google's smarts to our device. The SDK provides alternatives for integrating the Assistant into our stick: the Google Assistant library, and the Google Assistant gRPC API. The library is written in Python and is supported on gadgets with linux- armv7l and linux-x86_64 architectures (like the Raspberry Pi three B and Ubuntu computers).The library exposes a excessive stage, occasion-based totally API that is easy to extend. It provides the following features out of the box like fingers loose activation,

audio capture and playback. The Google Assistant gRPC API is the pleasant option for flexibility and huge platform assist. It exposes a low stage API which without delay manipulates the audio bytes of an Assistant request and response. thus it forms an intuitive feature in our blind stick which presents a easy and smooth interface to the user.

VI. IMPLEMENTATION

The given model has supersonic device and water sensor hooked up thereto. If any of the device is triggered then the there'll be vibration. The blind man just in case if he's any emergency will endure the emergency button, a message is distributed concerning his current location to a pair of individuals whose mobile range is saved within the small controller. The model takes voice input and offers out the voice output concerning a way to navigate from a specific purpose. If the blind man needs to grasp this location he is in he will press the situation button and can receive a voice output concerning his location. Object identification victimisation machine learning is tried and tested. The given model is trained with 900 pictures having four categories and tested with three hundred images. 80-90 percent accuracy is realizable The accuracy achieved is improved more increasing the standard of dataset. For our model we have a tendency to 1st listed out all the sensors/microcontrollers needed and so analyzing the compatibility and price we have a tendency to selected the acceptable sensors/microcontroller that are:
1. Renesas Microcontroller(RL78)
2. Ultrasonic Sensor (HC-SR04) x 2
3. Moisture Sensor (SEN-13634)
4. Relay Switches
5. Bluetooth (HC-05)

➢ *Coding*

First, we analyzed the nation and collection diagrams and then we wrote a pseudo code for each module. Then we used Renesas dice Suite software to application the pseudo code in embedded c program languageperiod. any other a part of the coding required us to increase an android app which interfaced with the Bluetooth module. We wrote the code thus while both of the switches had been pressed. set of rules Used for object identification the usage of system mastering: Convolution Neural Networks.
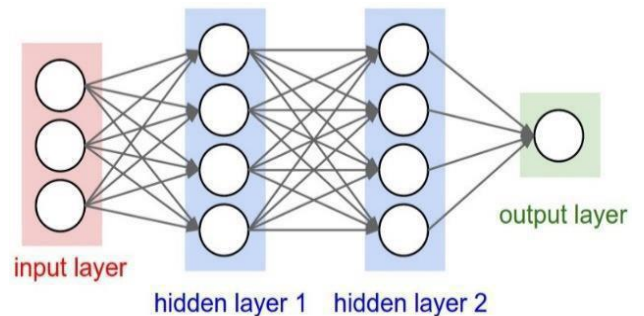

Fig 1

A convolution neural community is a neural community algorithm this is used in photo getting to know and photo class. A convolution layer performs a convolution operation for the given enter and passes the output to the subsequent layer. In wellknown, different neural network set of rules requires quite a few parameters and a whole lot of neurons due to very massive enter sizes related with pix. The Convolution Neural network allows in fixing this problem by means of permitting every layer to be deeper and also with very fewer range of parameters. From each cluster of neurons layer, the Pooling operation combines the output right into a unmarried neuron at the following layer. for example, max pooling operation uses the maximum price at that specific layer. The platform used to put in force this version Jupyter notebook the usage of that uses python. The library used is Keras which permits faster and effective prototyping that runs over each CPU and GPU. TensorFlow runs over the keras background. TensorFlow is an open source library. It allows builders to create huge neural networks with many layers. TensorFlow is especially used for: classification, know-how, Prediction and introduction. [5] Dropout parameter used inside the CNN version helps in avoiding over becoming. basically, in this implementation, we've got taken into consideration four instructions (desk, Tree, Human, Stone) the machine is educated with every elegance having 250 pix. The abovementioned categories are thought of because it can facilitate the blind man to check what object is gift before of them. this idea are often integrated within the good blind stick that uses raspberry pi three board. The goal is to own several categories supported the common objects that are employed in day to day life just like the higher than mentioned four categories.

VII. EXPERIMENTAL RESULTS

A. Outputs

Developed a model that may verify barriers and conjointly give knowledge on a navigation system based mostly inaudible device for barrier detection .Developed a model for visually impaired to maneuver before alright ,as well as safely navigate. created it obtainable at less expensive costs while not compromising with the functionalities. decreased its maintenance and expense. Build a model that gives blind and visually impaired communities a wise device that provides them freelance personal quality outside the house. created a wise blind stick that is innovative high-tech stick that may facilitate visually impaired individuals to discover obstacles close to them and navigate their manner.

➤ Model are often used for each indoor and out of doors navigation.

B. Result Screenshots

➤ *Machine Learning Outputs*

Fig 2:- Console Showing implementation of Tensorflow having Keras background

Fig 3:- Implementing CNN

Fig 4:- Console showing classes

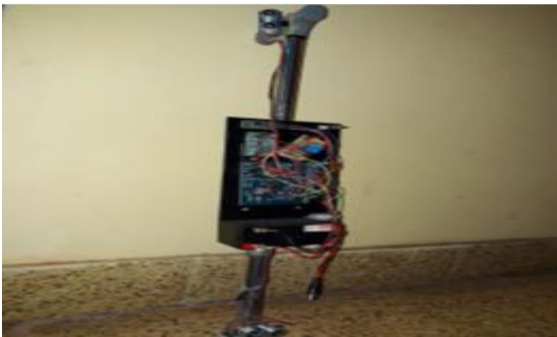*C. Snapshots of Smart Blindstick*

Fig 5:- Full view of Smart Stick

Fig 6:- Middle view and Microcontroller view of Stick

Fig 7:- Top view of Sensor Orientation

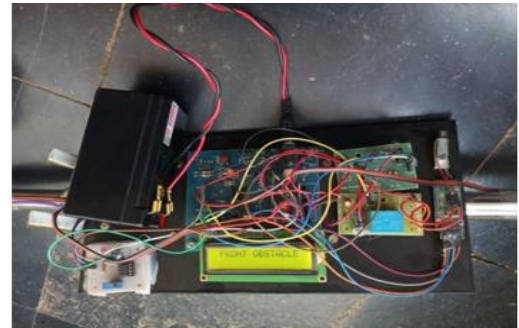

Fig 8:- Detectiion Of Top Obstacle

Fig 9:- Front Obstacle Detected

Fig 10:- High Water Level Detected

➢ *Screenshot of the App*

Fig 11:- welcome screen of the blind navigation Bluetooth application

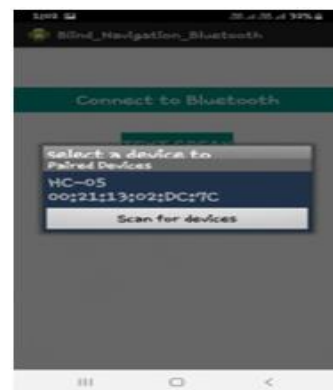Fig 12:- connecting the application to the device through Bluetooth

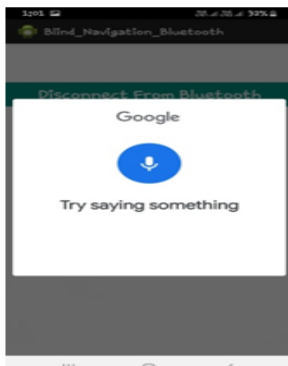Fig 13:- Connection Established Between The Device And The Smart Phone

Fig 14:- Text To Speak For Giving The Input

Fig 15:- Given Input

Fig 16:- Emergency MessagSend

Fig 17:- Water Detected

VIII. CONCLUSION

It is necessary that visually impaired folks get access to AN economical and comfortable object so as to measure their way of life well. in an exceedingly developing country like India, there's a desire for a value effective resolution so most of the folks will have an effective product in hand. thus exploitation such good technology we tend to aim to assist visually impaired folks for his or her profit. The project analyzed the present electronic aids for blind folks and supported the constraints in existing aids, this project proposes AN enhanced helping electronic aid exploitation latest technology like supersonic waves, GPS, GSM .Hence our project aims to form lives higher for the visually impaired human kind Future Enhancements A wall-following perform is superimposed so the user will walk straight on a corridor in an internal atmosphere. Head level obstacle detection can even be implemented. Programmable wheels might even be accustomed steer the stick off from the obstacles and additionally leading the visually handicapped person towards the destination. Some more applications like vehicle detection, slippery floor and fireplace or fire alarm can even be included.

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