RASPBERRY PI BASED SMART WALKING STICK

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Abstract. People with walking disabilities or visually impaired, find it very difficult to function without any support and this makes them feel emotionally down leading to increased stress. The proposed work is an attempt to design and develop a walking stick which helps them to function independently and thereby increasing their morale. The main contribution of this work is to help a person in identifying the presence of an obstacle and take appropriate decision to bypass it. The stick is interfaced with a technology, consisting of a camera, voice recorder, speaker and Raspberry Pi, for making it intelligent. This stick can be of great help even for visually impaired.

1. Introduction

Visually disabled individuals are the entities whose good eyes make it impossible to comprehend the slightest detail. Many with 6/60 or the optical range have less than or equal to 20 degrees, or have the longitudinal range both with eyes wide open. These individuals are known to be blind. People who are visually impaired are living a life contingent on other people. Individuals with sensory disability are people that find it impossible to distinguish with healthy persons the slightest information. Those of 6/60 or the optical range have less than or equal with 20 degrees, or have the lateral scope with both eyes wide open. They are called blind. According to World Health Organizations, Global data on visual impairment states that; the number of visually impaired people, of all ages, is estimated to be 285 million, of whom 39 million are blind. 80% of the people above 50 years of age are blind.

The major causes of visual impairment are uncorrected refractive errors (43%) and cataract (33%); the first cause of blindness is cataract (51%). Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. People with those afflictions are facing a lot of pain to live a normal life. They are mentally isolated and accept neglect with themselves. This dysfunction with them plays a major part in their livelihood. It forms as a malady in their mind and makes them lose hope of themselves. So, this made us to invent a system for the people with those ailments. In recent times a lot of inventors fabricated devices to serve as an aid to visually impaired people. There are also drawbacks characterised by the traditional and oldest accessibility aids for visually disabled individuals. Some innovations often include a special supply or navigator, which enables the user to hold it in a pocket while travelling al fresco. This voluminous designs are likely to complicate the consumer. Various attempts were made to develop blind guard or obstacle-measuring systems using small amount of applicants of elements.

Therefore, it is proposed to design and develop a walking stick with all these features such as real time object recognition, voice guidance, navigation etc., and cost effective to all the people who are in need of help.

2. Proposed work and Methodology
The proposed walking stick is designed such that it has the following features.

2.1. Navigation:
The alternative suggested is modest expenditure assistance for visually disabled individuals. For the location, it may provide precise information, through GPS, for the position of the blind in the event of a failure. The figure 1, shown below is a model for global positioning system.

![Figure 1: Global Positioning System](image1.png)

2.2. Real time object recognition:
The system can be used for real time object recognition. This is achieved by OpenCV and Python. The module can be accessed with a webcam/video stream in an efficient manner that is using an application (IP Webcam) and apply object detection to each frame. They voice guidance will transmit the output through speaker or earphone. The figure 2, shown below is a real time object detection output.

![Figure 2: Real time object detection of remote, cup and scissors.](image2.png)

2.3. Camera
Raspberry pi endures in its pride organize because of its significance in performing picture preparing applications. Constant picture preparing plans can be created utilizing a raspberry pi, as it underpins the webcam interface, and there by we can process the calculations for identification, acknowledgment, division and so forth the camera detects the obstacles. This can be achieved by Webcam or by using an application called IP Webcam. The figure 3, shown below is an outlook of the application.
2.4. ZIGBEE:
The XBee/XBee-PRO RF Modules are intended to work inside the ZigBee convention and bolster the special needs of ease, low-power remote sensor systems. The modules require negligible power and give dependable conveyance of information between remote gadgets. On XBee modules you can configure XBee / XBee-PRO ZB firmware release. The ZigBee 2007 specification is compliant with this firmware, although the ZNet 2.5 firmware is based on Ember’s patented ZigBee mesh stack (EmberZNet 2.5). ZB and ZNet 2.5, however are not over-the-air-compatible, are of the same type. ZNet 2.5 firmware devices can not communicate to ZB firmware devices. RASPBERRY PI:
Raspberry Pi is a little single-board Computer created in UK by Raspberry Pi establishment to advance the instructing of software engineering in schools and in creating countries. Original model become definitely more mainstream than foreseen fixing outside of its objective market, for utilizations, for example, robots. The processor at the core of the Raspberry Pi is a Broadcom BCM28XX. This is the Broadcom System on Chip (SOC) chip use in the Raspberry Pi. Raspberry Pick is the core processor of the smart walking stick. The GPIO pins are interfaced with the sensors and other attributes to function the system. The figure 4, shown below is a model of raspberry pi.

![Android application for real time object detection.](image)
2.5. GPS MODULE:
The Global Positioning System is a worldwide route satellite framework that gives geo area and time data to a GPS recipient anywhere on or approach the Earth where there is an unhindered view to at least four GPS satellites. Here the GPS utilized is SIM28ML. This GPS module will discover the area of the vehicle and the data brought by the GPS beneficiary is gotten through the directions and the got information is first send to arduino and the data is transmitted to the spared contact through GSM module. The figure 5, shown below is the interfacing of Global Positioning System with raspberry pi model.

2.6. ULTRASONIC SENSOR:
An ultrasonic sensor is an instrument that is able by sound waves to measure the isolation of a substance. It assigns distinction to a certain recurrence, sends a sound wave and tunes it to reverse this sound wave. The isolation of the sonar sensor and the object can be figured by measuring the time...
glipping back in between acoustic waves generated and the sound wave. The figure 6, shown below is the interfacing of ultrasonic sensor with raspberry pi.

![Interfacing of ultrasonic sensor with Raspberry Pi](image)

**Figure 6**: Ultrasonic sensor interfacing with Raspberry Pi

2.7. **ARDUINO UNO**:
The Arduino Uno is an on-the-spot microcontroller form ATmega328. It has 20 advanced input pins (such as 6 for PWM outputs and 6 for basic data sources), a 16 MHz resonator, a USB connection, a force port, an ICSP header and a reset button. It can be used to build a PWM device. It includes all the microcontroller would expect to do. It either connects to a device with a USB connexion or forces it to start with an AC to DC converter or battery.

The Uno is not available on the FTDI USB through-sequential operator chip from any previous board. It contains a USB to sequential adapter that is customised as an ATmega16U2. The helper gets its own microcontroller USB bootloader that helps customers to restore it.

2.8. **BUZZER**:
A Buzzer or beeper is a sound flagging gadget, which might be mechanical, electromechanical, or piezoelectric (piezo for short). Run of the mill employments of ringers and beepers incorporate caution gadgets, clocks, and affirmation of client info, for example, a mouse snap or keystroke.

How to utilize a Buzzer
A ring tone is just a little but powerful part of our business / structure to attach audio excerpts. It is incredibly compact and can then be used manually with a reduced 2-pin configuration. On circuit board, the Perf panel and even PCBs, which in most electrical devices makes this a commonly used section. Two kinds of signals are commonly available. The one that appeared here is a fundamental wing that makes a continuous beep if regulated. Sound, sound, sound. The second type is referred to as a ready-made ringer that looks more bulky and emits a Beep. Scripture. Scripture. Sound attributable to the internal circuit within it. Be that as it may, the one appeared here is most generally utilized in light of the fact that it tends to be redone with assistance of different circuits to fit effectively in our application.

This bell can be utilized by basically controlling it utilizing a DC power supply extending from 4V to 9V. A basic 9V battery can likewise be utilized, yet it is prescribed to utilize a managed +5V or +6V
DC supply. The bell is ordinarily connected with a changing circuit to kill ON or turn the signal at required time and require interrim. The figure 7 shown below is the buzzer interfacing with Arduino.

Right now, while a visually impaired individual strolls out and about by holding this strolling stick, when there is a hindrance, it is being caught utilizing a camera and that picture is passed to question distinguishing cloud and give cautioning about that object through ear cushion. Furthermore, the framework has an interface of RF collector with the strolling stick. RF transmitter is held by the Blind individual, on the off chance that they expected to lose their stick or on the off chance that it tumbled down, when they press the button 1 in the transmitter, signal sound will originate from the strolling stick. So they can ready to discover their strolling stick, on the off chance that client presses the button 2, at that point they can ready to realize the spots close to them. The figure 8, shown below is the block diagram of raspberry pi based smart walking stick.
Right now, acknowledgment is finished by the Pre-prepared model MobileNet for perceiving the article with over 95% exactness. The model is prepared with more than lakhs of pictures to perceive the item. An item, for example, Person, seats, TV Monitor, and so on. USB Camera is interfaced with the Raspberry Pi for this application. It should likewise be possible utilizing IP Webcam or Pi camera. In the proposed framework, profound learning is utilized. Among that Convolutional Neural Network is utilized with pre-prepared model MobileNet to perceive the article with more precision at continuous. Acknowledgment is constant.

Right now venture, the Pre-prepared model is utilized, Its exactness is over 90%. It can likewise be redone to perceive different items utilizing Transfer learning. This MobileNet is depth wise distinct convolution, lessens the quantity of parameters. It is increasingly appropriate for vision-based applications where there is less execution intensity of the system. Raspberry Pi is booted with the SD Card, with libraries introduced like Keras, Tensorflow backend, numpy, and so on. USB camera is interfaced with the Raspberry pi to make it as the ongoing article acknowledgment application. Raspberry pi is inserted with Walking stick at, which Ultrasonic sensor is interfaced with GPIO pins of Raspberry pi, simultaneously the camera ought to be associated with raspberry pi where both should look on a similar heading out and about. It ought to be associated with Network so that caught picture can be prepared for object location to imply which item is an obstruction as of now. RF transmitter is likewise associated with RPi. Each order is sent by squeezing the catch on the RF transmitter which is held by them. The figure 9, shown below is the circuit diagram of the system.

![Circuit Diagram](image_url)

**Figure 9**: Circuit Diagram

### 3. Results & Discussions

The developed model is tested with simulation and also as a real time model. The output of the designed prototype was tested with obstacle scenarios such as: concrete wall, human body, carton box and plastic. The alternative suggested is modest expenditure assistance for visually disabled individuals. The results of the test on the system indicates that it is efficient in its capability to specify the features. The figure 10., shown below is the prototype of raspberry pi based smart walking stick.
4. Conclusion

The versatility of the proposed architecture makes it easy for all to use while retaining low production costs. The proposed stick has low power consumption and is easy to work. Compared to traditional ones, it is also very inexpensive. The device is often secured by code, so that it does not circumvent its protection other than from the customer or supplier. This inexpensive and lightweight product will be designed to take the design of a plastic and compact product that can be entirely connected to the common blind stick or white cane. The Smart Stick offers the fundamental forum to allow the visually challenged to travel indoors and outside comfortably in the coming age of more helping technology. It is powerful and cheap. This leads to successful results as the barriers in the user’s way are found within three metres. A inexpensive, reliable, compact, low consumption of power and stable mapping solutions with a very fast dynamic response. The machine is hardwired, but it is lightweight with sensors and other parts.

5. Scope for Future Work:

Additional factors can be enhanced by the wireless networking of device components and the sensitivity of the ultrasonic sensor could be enhanced and an advancing speed development can still be applied. In all underdeveloped nations, blind and visually impaired individuals were a priority while working to develop a remedy of this kind. The computer designed in this work can only recognize objects in real time. This system or humidity can not find gaps. So it is possible to build a good machine. For ease of use and comfort, a convenient key can also be included. Even more improvements are to boost in the future.
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