Abstract

In this project report, we propose the development of an electronic device for obstacle detection in the path of visually impaired people. This device helps a user to walk without colliding with any obstacles in his/her path. It is a proposed device in the form of a bot having a wide scope of application for visually impaired people in real life. The model has infrared sensors and raspberry pi installed on it. This device detects obstacles around the user up to 5-10 cm in front direction using a combination of two IR sensors (i.e., for immediate left and immediate right collision detection). These infrared sensors are connected to raspberry pi that receives signals from these sensors for further processing. The algorithm running in raspberry pi detects an obstacle and changes the path of the bot so that it moves in the opposite direction of that of the present obstacle. This proposed design is beneficial in terms of its portability, low cost, low power consumption (5 V) and the fact that neither the user nor the device requires any initial training.

Contents

1 INTRODUCTION 6

2 RELATED WORKS 7

3 PRELIMINARIES AND DEFINITIONS 8

3.1 INFRARED SENSOR

3.2 RASPBERRY PI

3.3 MOTOR DRIVER MODULE

4 PROBLEM DEFINITION 12

5 PROPOSED APPROACH 13

6 WORKING MODEL 14

7 CIRCUIT DIAGRAM 15

8 CONCLUSIONS

9 REFERENCES

1 INTRODUCTION

Commuting in a crowded environment is a challenge for visually impaired people. Visually impaired people are at a disadvantage because they do not have access to any contextual and spatial information around them. A WHO report from 2010 states that there were as many as 285 million visually impaired people worldwide, out of which 39 million were blind. In this project we propose the development of a cost effective application system for visually impaired people so that they can move freely in known or unknown environment.

In today's fast paced world, the daily lives of people has been affected by the aid and support offered by technology. People, who are differently abled, now have the option of many devices, which can help them in their day-to-day activities. A lot of devices have been created in this field, however, most of them are either not in use or require a lot of training.

Most of the projects that have created in this domain require an internet connection, i.e. there is a need to maintain continuous connectivity, which is not only difficult to get access to in certain areas, but also adds the additional cost of data usage. In terms of sensors, these projects use proximity, infrared sensors, light emitting diodes, etc. which are affected by external atmospheric factors such as sunlight, rain, dust and may not function properly in an outdoor environment. Moreover, the end products that were created are difficult to carry, non-portable and are sometimes very costly, making them out of reach for common people.

These reasons mentioned above motivate us to try and develop a collision detecting device which is portable and cost-effective to make a visually impaired person aware of the objectives in an easier way.

2 RELATED WORKS

Some of the works done in this field are explained in the following paragraphs.

DRISHTI is a wireless pedestrian navigation system for the visually impaired and differently abled. It emphasizes on enhancing the navigation experience of visually impaired people by focusing on contextual awareness. However, a lot of effort took in integrating this technology, thus, the components were not fully optimized.

NAVBELT is a guidance system that used a mobile robot obstacle avoidance system. The prototype consisted of ultrasonic range sensors, a computer and earphones. The disadvantage of this system was that it exclusively used audio feedback and was also very bulky for its users. Moreover, the users also required extensive training to operate this system.

TYFLOS system focused on integrating different navigation technologies such as wireless computer, cameras, natural language processor, microphone, range sensors, GPS sensors, text-to-speech device, etc., and methodologies such as region based segmentation, fusion, range data conversion, etc. to allow more independence during navigation and reading. The drawback of this system was that it was not tested on blind people and hence, it did not have any feedback to improve on its hardware and software integration.

3 PRELIMINARIES AND DEFINITIONS

3.1 Infrared Sensor

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. Infrared sensors work on the principle of infrared radiation theory.

Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000μm.

The wavelength region which ranges from 0.75 to 3μm is known as the near infrared regions. The region between 3 and 6μm is known as the mid-infrared and infrared radiation which has a wavelength higher than 6μm is known as far infrared.

The key benefits of infrared sensor include their low power requirements, their simple circuitry and their portable features. That is why they find application in many everyday products.

There are broadly two types of infrared sensors:

1) **Thermal Infrared Sensors:** These sensors use infrared energy as heat. Their photo sensitivity is independent of the wavelength being detected. Thermal detectors do not require cooling but do have slow response times and low detection capabilities.

2) **Quantum Infrared Sensors:** These sensors provide higher detection performance and faster response speed. Their photo sensitivity is dependent on wavelength. Quantum detectors have to be cooled in order to obtain accurate measurements.

3.2 Raspberry Pi

Raspberry Pi is a credit card sized single board, low cost computer. It takes input from the GPIO pins, which can be attached to LEDs, switches, analog signals and other devices. For our proposed design, we connect the GPIO pins to the infrared sensors. It requires a power source of 5V to be operational and we have to insert a Micro SD memory card in it, which acts as its permanent memory. For our design Raspberry Pi 3 Model B is used. It contains 4 USB ports, a HDMI port, an audio jack port and an Ethernet port. The Ethernet port helps the device connect to the Internet and install required driver APIs. It has a 1.2 GHz single core processor and supports programming languages such as Python, C, etc. We work on a nano-editor for writing the code and pre-installed python compiler for compilation and execution.

This mini-computer runs our algorithm, which helps to detect the obstacle and change the path of the bot based on the input it receives from the infrared sensors.

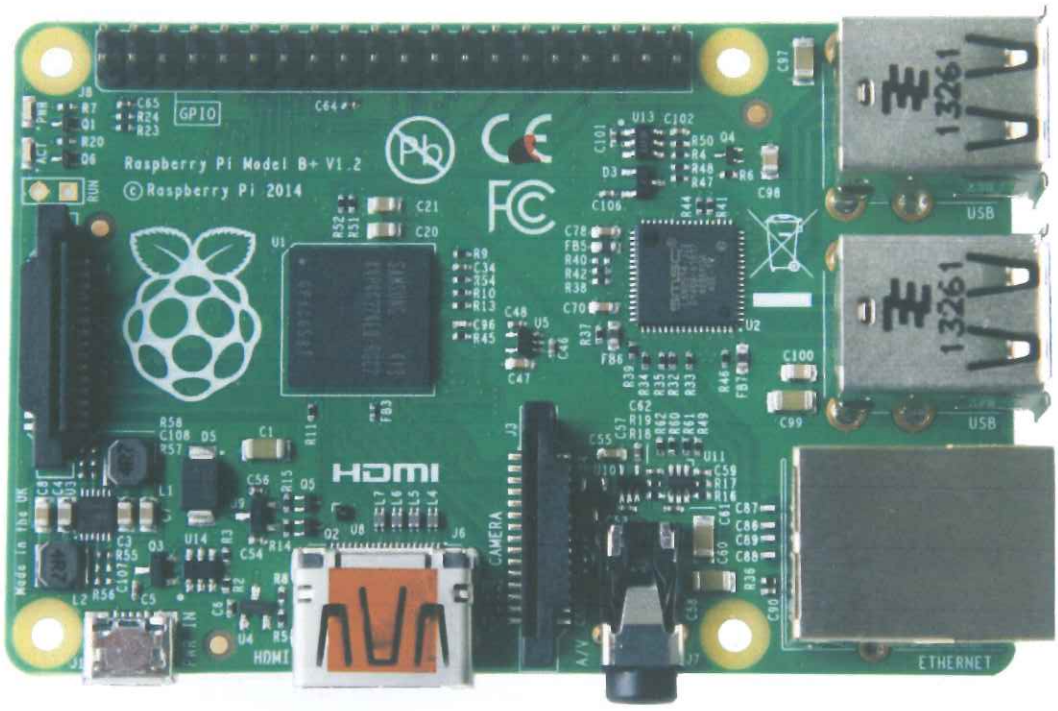

Figure 3.2: Raspberry Pi 3 Model B