TK 3 - Project:
Guidance system for the visually impaired

Motivation:

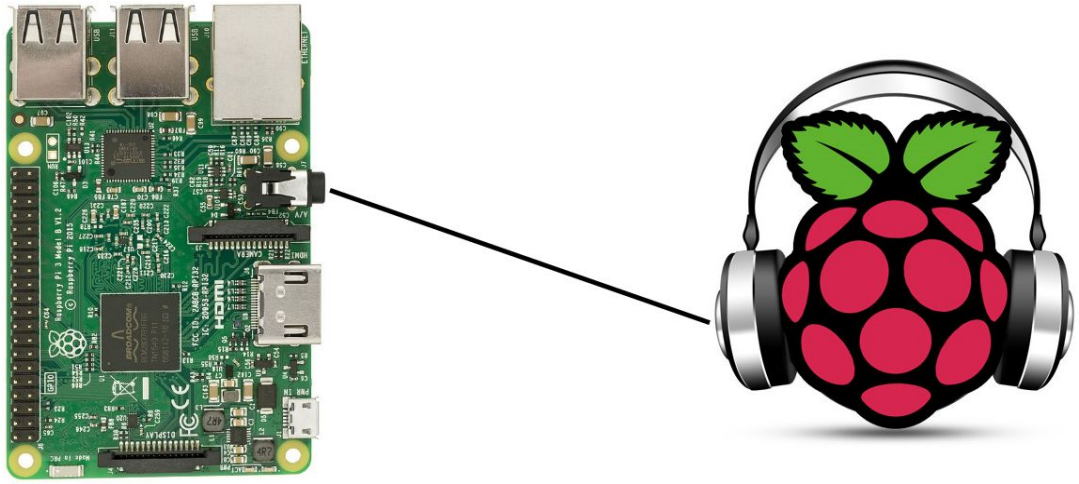
Despite advances in medical research for the treatment of visual impairments or even complete blindness it is still no prospect for the majority of the afflicted population. Because most of the treatments are only applicable for a subset of visual impairments and in addition often times very expensive. Therefore it is important to think about an interim solution which not only helps a big part of the suffering population in their daily life, but is also has to be affordable for most if not all people. For this purpose we developed our guidance system which focuses on helping the visually impaired in an indoor environment, be it their home or a public space..

Idea:

The guidance system is based on a simple idea. A normal cane is enhanced with sensors as well as interpreting hard and software, which provides feedback to its user about the environment. The currently used prototype supports two main functionalities. Foremost is the name giving guidance features, which enables the cane to give an audio feedback to the holder when its tip leaves a white tape on the ground. This makes it possible to navigate even in unfamiliar environments, similar to the orientation system for blind people found at train stations, while having the advantage of being adjustable on the fly, as only white tape is required. Additional the stick is enhanced with sensors which provide further information about the environment, which are then told to the holder using a text-to-speech software. This allows the user to make informed decisions in response to a given situation.

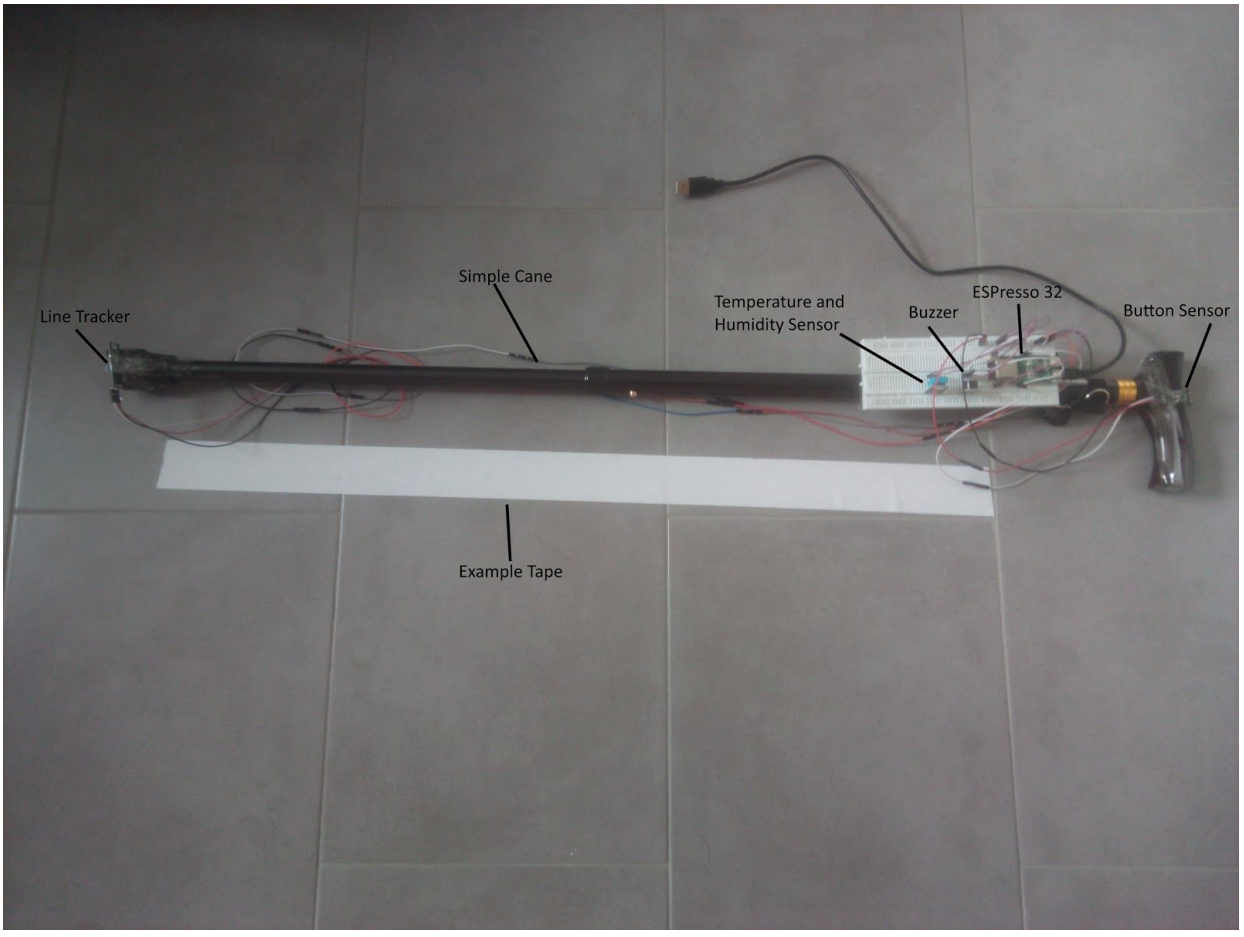
Implementation:

As mentioned in the idea section the base for our project is a simple cane. To enhance it with the intended functionality a breadboard is fixated on its side. The breadboard is then used to connect the ESPresso 32 Arduino device with intended sensors for our prototype. The ESPresso 32 is connected to a Raspberry Pi 3 via wifi using mqtt. In addition a pair of headphones is connected to the Raspberry Pi audio jack(alternatively loudspeakers can be used).



A line tracking sensor is mounted on the tip of the cane to guarantee close proximity to the leading white tape. If the tip/sensor now leaves the white tape a buzzer, which is mounted directly on the breadboard, will go off, warning the cane holder.

A button sensor is fixated on the top of the cane a which, when pressed, triggers a read of the values of the temperature and humidity sensor, which are directly mounted on the breadboard. The sensor values are then sent to the Raspberry Pi, which runs a python script, to be read out loud using the text-to-speech functionality of the festival-lite speech synthesizer.



Configuration/Installation:

Boot up a rpi3 and follow these steps:

1. Stay up to date

sudo apt-get update
sudo apt-get upgrade

2.You'll want to install flite - (festival-lite) speech synthesizer.

sudo apt-get install flite

2.1 Once installed give it a test and make sure you hear the audio.

flite -t "Hello World"

2.2 For volume and other sound specifics,make use of ALSA mixer

sudo apt-get install alsa-utils

3.Install MQTT

sudo apt-get install mosquitto mosquitto-clients python-mosquitto

4.Install paho-mqtt clients

pip install paho-mqtt

5. Install the given "say.py" script using nano text editor

6.Test it

python say.py

7. Run the source code along with the assembled hardware.

Take care to change connection specifics (like wifi login details) in the source code.
The tpic is hardcoded as "Say"

Sources/Credits

Festival Lite: *http://www.festvox.org/flite/*

Speech Synth Source code:
https://gist.github.com/kd8bxp/6520a4dcda1a43834a6cda402fa441d2