WALKİNG STİCK THAT RECOGNIZE THE COLORS FOR VISUALLY IMPAIRED PEOPLE

[1]Emre Selçuk DEMİR, [2]Rüştü GÜNTÜRKÜN, [3]Mustafa TOSUN

[2,3]Department of Electrical and Electronics Engineering, Faculty of Technology, Dumlupinar University, Simav/ Kutahya, Turkey rustu.gunturkun@dpu.edu.tr, mustafa.tosun@dpu.edu.tr

ABSTRACT: *In this study, the design and implementation of a system consisting of software and hardware that facilitates the daily life of the visually impaired, enabling the visually impaired to follow the yellow lines prepared for the visually impaired without needing the help of others. For this purpose, a sensor that detects the color of the tip of a cane is installed for the blind. The sensor can detect yellow, red, blue, green and colorless. If the visually impaired yellow line goes outside the boundaries, the system gives an oral warning. A headset was used to prevent disturbance of the spoken word by others.*
Key words*: Stick, Sensor, Arduino, Sampling, Headset*

I.   Introduction

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The count of visually impaired people rises every year. The 2011 statistics by the World Health Organization (WHO) estimates that there are 285 billion people in world with visual impairment, 39 billion of which are blind and 246 with low vision [1]. This system presents a concept to provide a smart electronic aid for blind people, both in public and private space. The system is intended to provide overall measures artificial vision and object detection, real time assistance via global positioning system (GPS) [2]. The microcontroller used is PIC microcontroller. The microcontroller circuit is on the outside of the stick but is protected with a code so its security cannot be breached. The only feedback given to the user is through the vibration motor. In [3], three sensors are used viz. In [4], the stick has a ping sonar sensor to sense the distant objects. It also has a wet detector to detect the water. The microcontroller used is PIC microcontroller. Along with the developing technology, the use of devices such as Arduino is rapidly spreading. The simplicity of Arduino programming makes it more cost-effective to use it with a lot of additional parts. Arduino can be used not only for those with high level programming skills, but also for people of all age groups and those with any level programming knowledge. According to 2012 data, 1.559.222 people in Turkey have various obstacles due to various reasons. Approximately 213,077 people in our country have blindness. This corresponds to 14% of persons with general disabilities [5]. This rate is 284 million worldwide. 80% of the hindrances are treatable or preventable [6]. The paper[7] Sensor assisted stick for the blind people describes about a wearable equipment which consists of a light weight blind stick and the obstacle detection circuit is based on a sensor. In the paper[8] Obstacle Detection and location finding For Blind People the author describes a device which is used for guiding the person who is blind or partially sighted. The biggest problem of visually impaired people today is finding the roads and directions in the streets. Measures are taken with the yellow embossed roads that the municipalities apply to the paving stones. However, this method is often insufficient. In the paper [9] multitasking stick for indicating safe path to visually disable people it describes a micro-controller based automated hardware that allows a blind to detect obstacles in front of her or him. The paper [10] ultrasonic blind walking stick describes an innovative stick which is designed for the visually disabled people for their easy navigation.

This study aims to make it easier to follow the yellow path on the ground with the color detection sensor in order to find the roads of visually impaired people more comfortable

II. Materials and methods

2.1. Adafruit TCS34725 RGB Color Sensor IR Filter and White Led

Thanks to the color light sensor, your electronic circuits will be sensitive to dazzling colors. We used the TCS34725, the best color sensor on the market, in the mod. This sensor has RGB and Clear Light sensing elements. Thanks to the IR blocking filter, integrated onchip and color sensitive photodiodes, the incoming light blocks the IR band, allowing color measurements to be done more accurately. With this filter you can read colors more accurately than most sensors. Because the human eye is not sensitive to IR light. The sensor has an amazing dynamic range of 3800000: 1, the value reading integration time is adjustable so that it is possible to read after darkened glass.

On the module there is a 3.3V regulator as a supporting circuit, so you can operate the module safely between 3-5V. At the same time, there are level modifiers for I2C pins, which can work with 3.3V or 5V logic. Finally, you can illuminate the object you will read the color with a natural light LED with a 4150 ° K color temperature and its onboard MOSFET drive. This light can easily be turned on and off logically
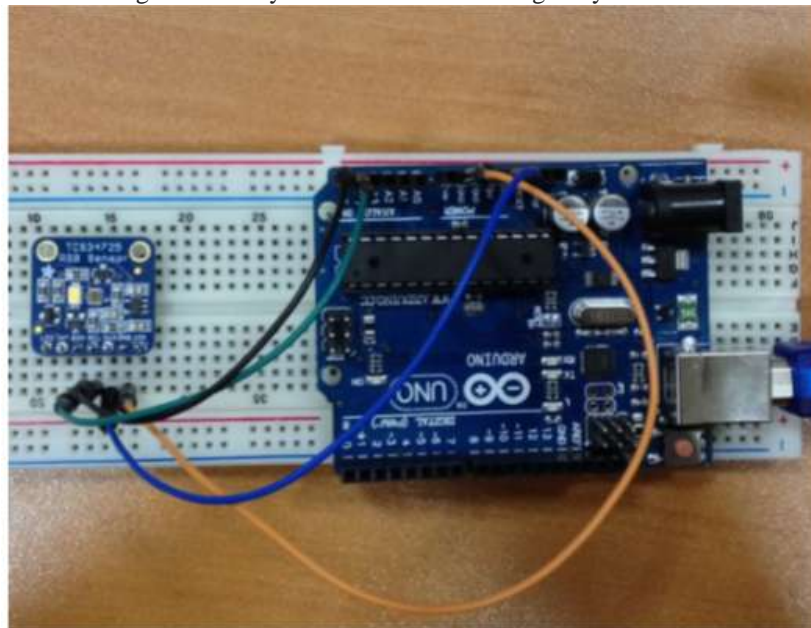
Figure 1: Arduino RGB sensor connection

2.2. SD Card Module

This is a wonderful little SD card interface module. It is easily interfaced as a peripheral to your module. Through programming, you can read and write to the SD card. SD card module is a module that you can read and write to SD cards with SPI protocol. Since the module has 3.3 V voltage regulator, 5 V supply can be connected. It should be noted that when using other SPI protocol modules, we do not select the CS pin joint [11].
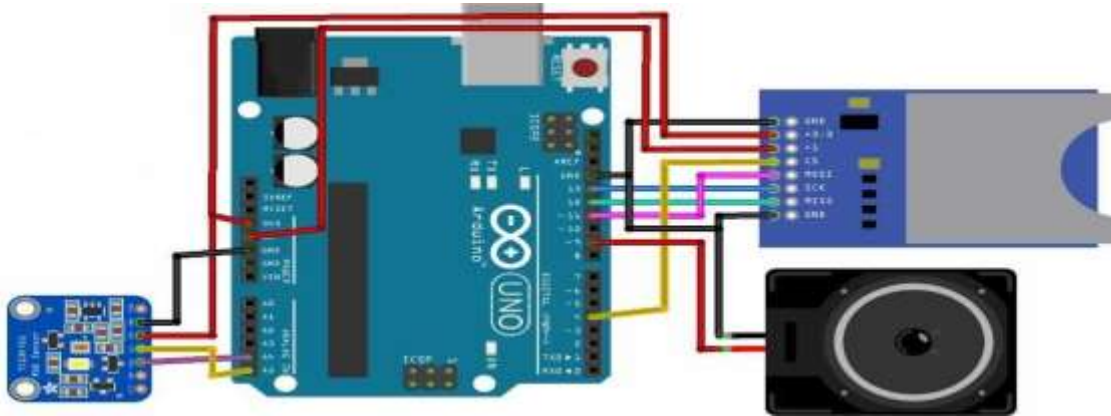

Figure2. Micro SD ve SD Card Module

Figure 3: SD Card Module Connection

III. ARDUINO IDE

3.1. What is Arduino IDE
Arduino IDE developed for Arduino kits; Is a software development platform that allows you to write commands, perform compilation, and finally load the compiled code directly into the Arduino kite (connected to the USB port of the computer).

3.2. Adding Library to Arduino IDE Program
In order to work with the code we wrote in this project, we need to add the necessary libraries to the Arduino IDE program. If we do not add the program will not compile and will not work. The first thing we need to do to add a library is to go to the Add library from the draft section in the top menu. From here, we need to click on the Add ZIP Library button in the menu. It is shown in Figure 4.
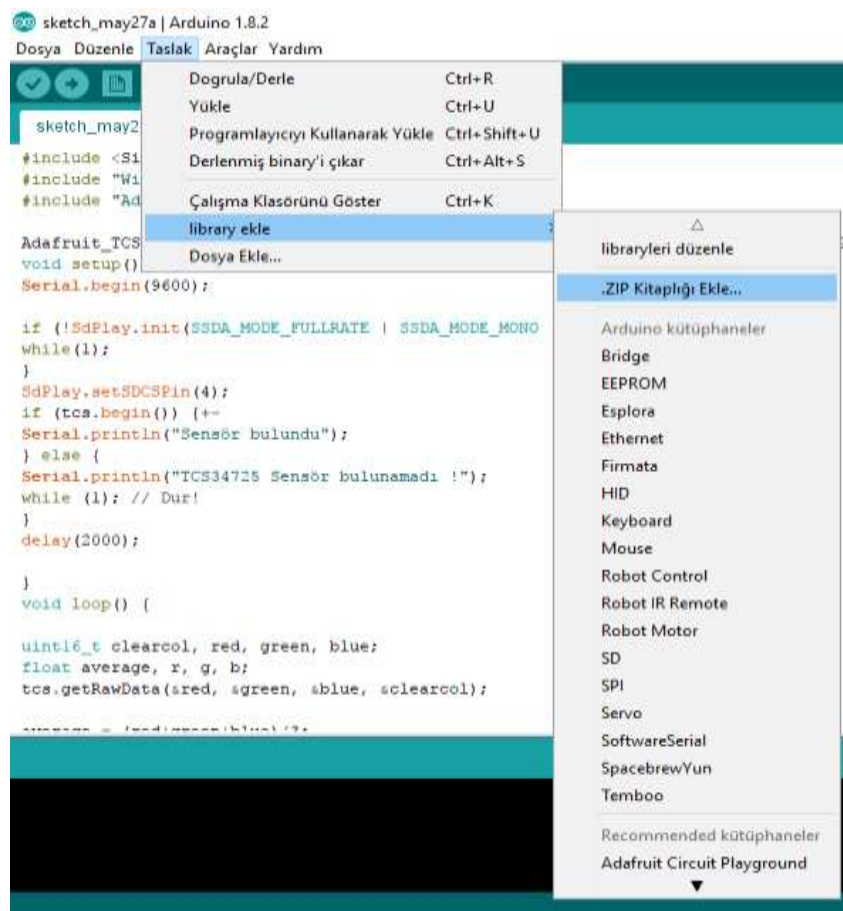

Figure 4. Adding to the Library

Then a screen opens as shown in figure 5 and figure 3.3 and we need to select the library to which we add this screen. First, the library SimpeSDAudio.zip is added as shown in figure 5. This library provides the introduction of the SD card to Arduino and allows for the use of communication. Secondly, it is necessary to add the data of the TCS24725 RGB color sensor to the library. In the same way, add library from draft section and add TCS34725-master.zip file shown in figure 6 and add to library.
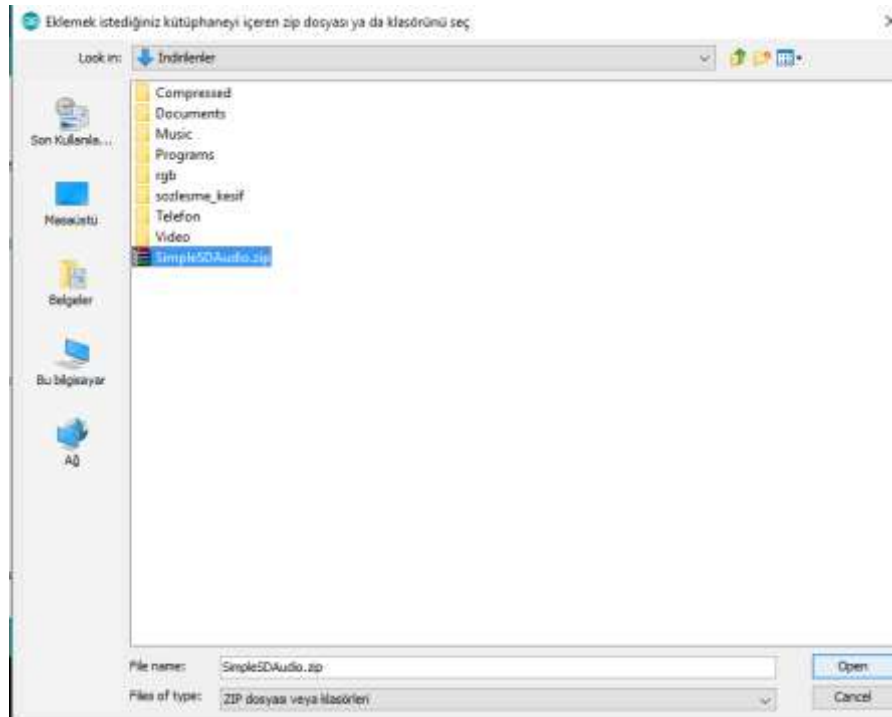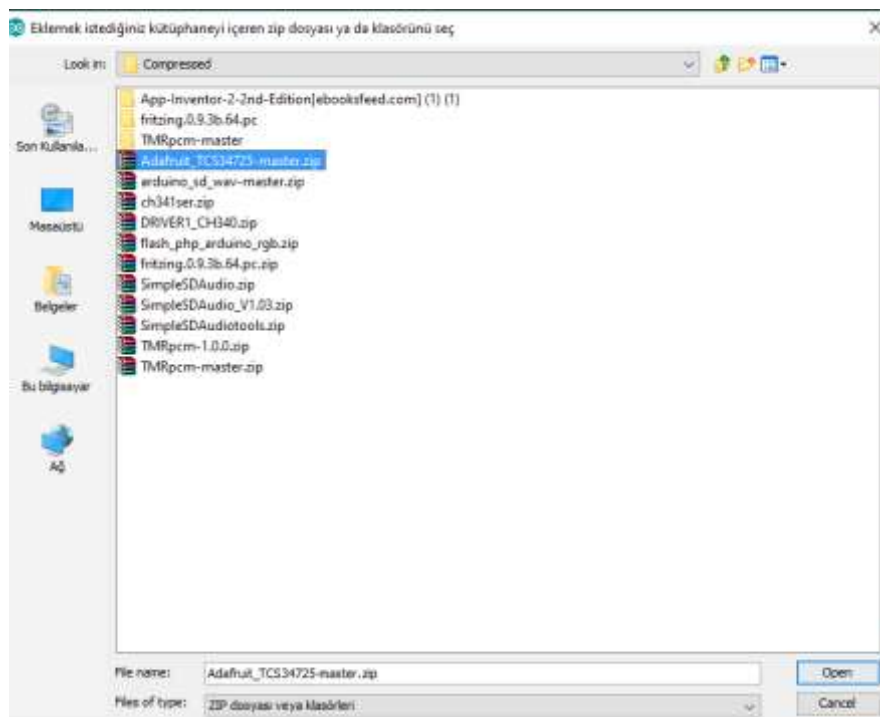

Figure 5. Simple SD Audio.zip Adding to the Library

Figure 6. Adafruit_TCS34725-master zip Adding to the Library

IV. Circuit Design

This section uses the TCS34725 RGB color sensing sensor and SD card module to design the Arduino circuit and transfer sound to the headphone.

There is an SD card module and 3.5mm headphone connection on the circuit board. The TCS34725 RGB color sensor is connected to the circuit board via cable. Arduino codes written in the Arduino IDE program were tested on the breadboard before the circuit printing took place. After reading the color value through the color detection sensor, it was tested to transmit the matching color tone from the sound files stored on the SD card to the headphone

4.1. TCS34725 RGB Color Sensing Sensor Arduino Connection
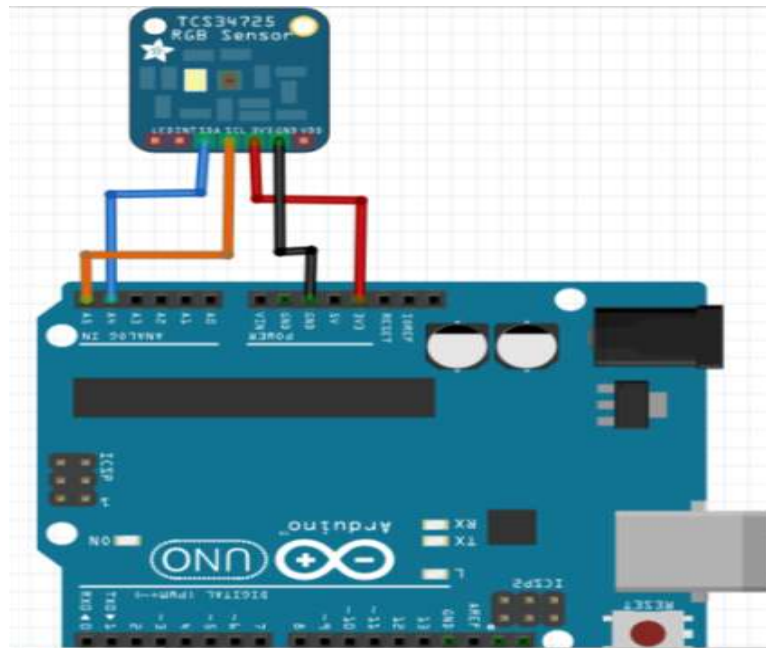

Figure 7. TCS34725 Arduino Connection

The TCS3472 device provides a digital return of red, green, blue (RGB), and clear light sensing values. An IR blocking filter, integrated on-chip and localized to the color sensing photodiodes, minimizes the IR spectral component of the incoming light and allows color measurements to be made accurately. The high sensitivity, wide dynamic range, and IR blocking filter make the TCS3472 an ideal color sensor solution for use under varying lighting conditions and through attenuating materials[12]. The TCS34725 has 7 nappies. Two of these are used for supply voltage and ground. SDA and SCL are used for analogue connection.;Number 3: A4; Number 4: A5; Number 5: 3.3V; Number 6: Ground (GND)
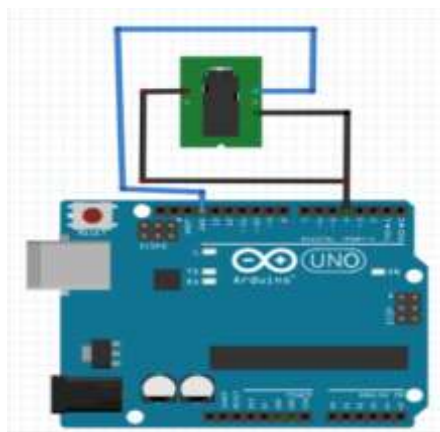
4.1.2. Headphone Connection

Figure 8. 3.5 mm headphone output Arduino connection

The 3.5 mm headphone jack has 3 connection points. The middle end is for GND connection. The remaining connecting points to the right and left are for the 9th pine connection from Arduino unodan. Since mono audio is used in this application, the right and left headphone connections are connected and connected

4.2. Additional Programs Used
4.2.1. Bandicam

Bandicam is a screen recording program that helps computer users record game videos and record screen videos, as well as extra useful features such as screen capture. It is easy to select which part of the screen to record with the program that allows to record all activities to be performed on the desktop as video. The internal area presented to the user can be quickly identified by using a transparent window.

The purpose of using the Bandicam application is to get the necessary audio files. The recording interface of the Bandicam application is shown figure 9.
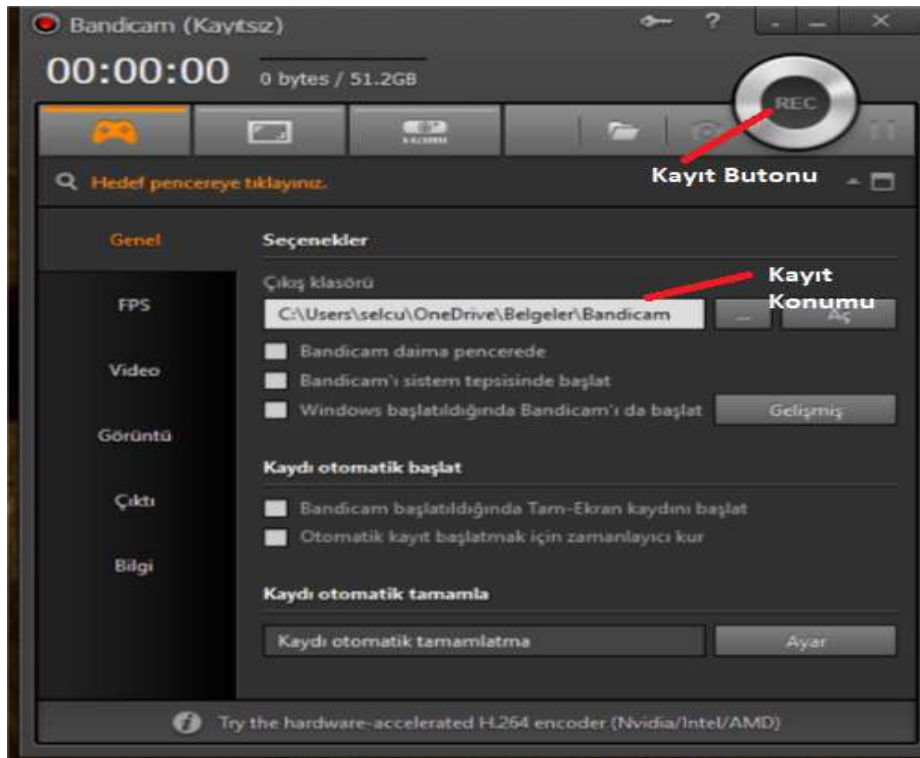

Figure 9. Bandicam Record Interface

A voice file is required to read the colors in voice. These audio files are obtained through the voice reading assistant on the translation site. This is a video with colors and a sound file in .wav format. It is shown in Figures 10 and 11.
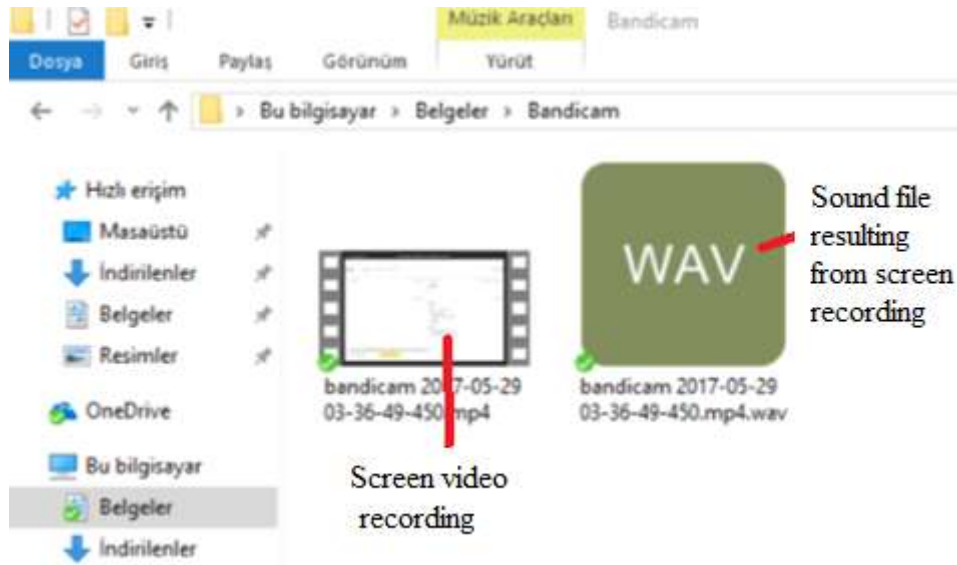

Figure 10. Record of Audio File

Figure 11. Audio File Required After Recording

4.2.3. Changing Bit and Sampling Rate of Audio File

Since Arduino uno has 8 bit PWM output, the audio files have to be changed to 8 bit 32000 Hz.wav format. For this, a sound output site has been taken using a site that can convert online via internet.
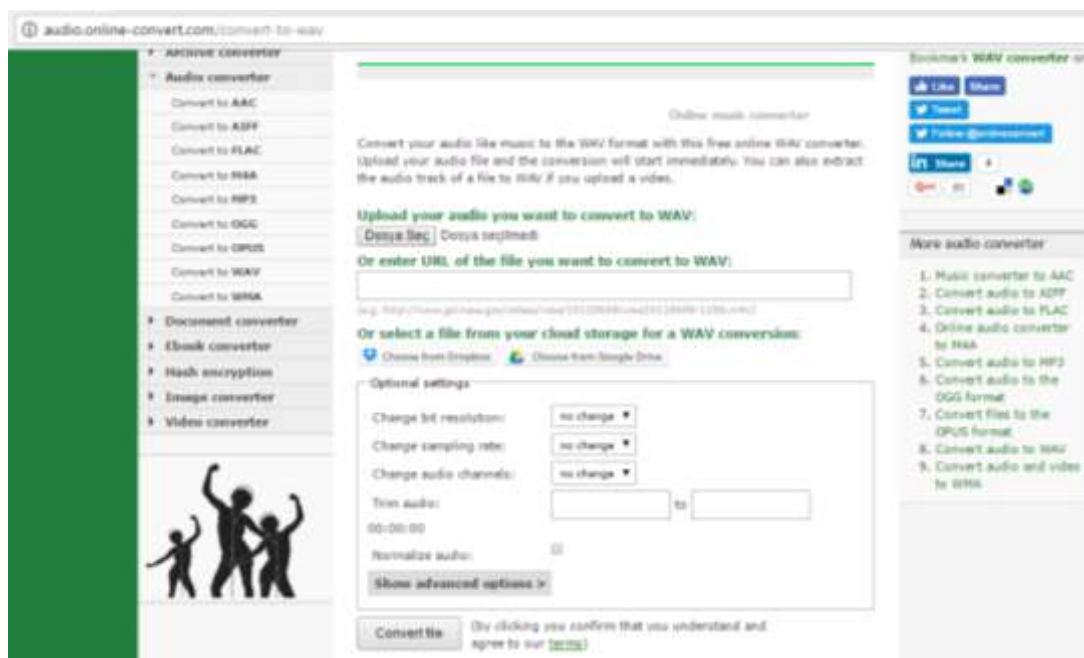

Figure 12. Audio File Bit and Sampling Rate Change Interface

As shown in Figure 12, the bit rate is 8 bits, the sampling rate is 32000 Hz, and mono in the audio channel. The reason for using Mono is that Arduino is a pin that will receive 1 sound output. Stereo audio output is available with a second pin, depending on demand. But in this project, the 9th pin of the 3.5mm headphone jack will be connected to the # 2 pin, so the same sound will come from both the right and left headphones and you will not have to use stereo.

Figure 13. Selected Bit of Audio Bit and Sampling Rate

Now the file to be converted is selected and then the convert file is downloaded by pressing the convert file button. The downloaded audio file has been re-edited to a maximum of 5 characters and dropped into the SD card [10].

5. Result and discussion

In this study, the design and implementation of a system consisting of software and hardware that facilitates the daily life of the visually impaired, enabling the visually impaired to follow the yellow lines prepared for the visually impaired without needing the help of others.

As seen in Figure 14. yellow line is made for visually impaired people with a cane that recognizes colors. If the yellow line goes out, the system alerts you. To prevent disturbance of others, the headphones are used to transmit visual impairment. This work can be used for blindness and we are in a position to reduce their dependence on others.

Figure 14. Follow the yellow line with talking cane

By adding a distance sensor to the talking bastion, the visually impaired person is protected from the obstacles encountered.

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