Video and Audio Recording Using Raspberry Pi

EL 213: Analog Circuit

Group 26

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Abstract

This project is a small version of a bigger complex project on accident detection. In this project, we aim to record audio and 360° video of the surrounding using a rotating camera immediately after the event is triggered.

Acknowledgment

We would like to thank our institute - Dhirubhai Ambani Institute of Information and Communication Technology - for including this subject of Analog Circuits as a part of our course structure.

We'd sincerely like to thank Professor Rutu Parekh for tutoring this subject and providing us with such a brilliant opportunity to work on this project which is a component of the bigger model of accident detection.

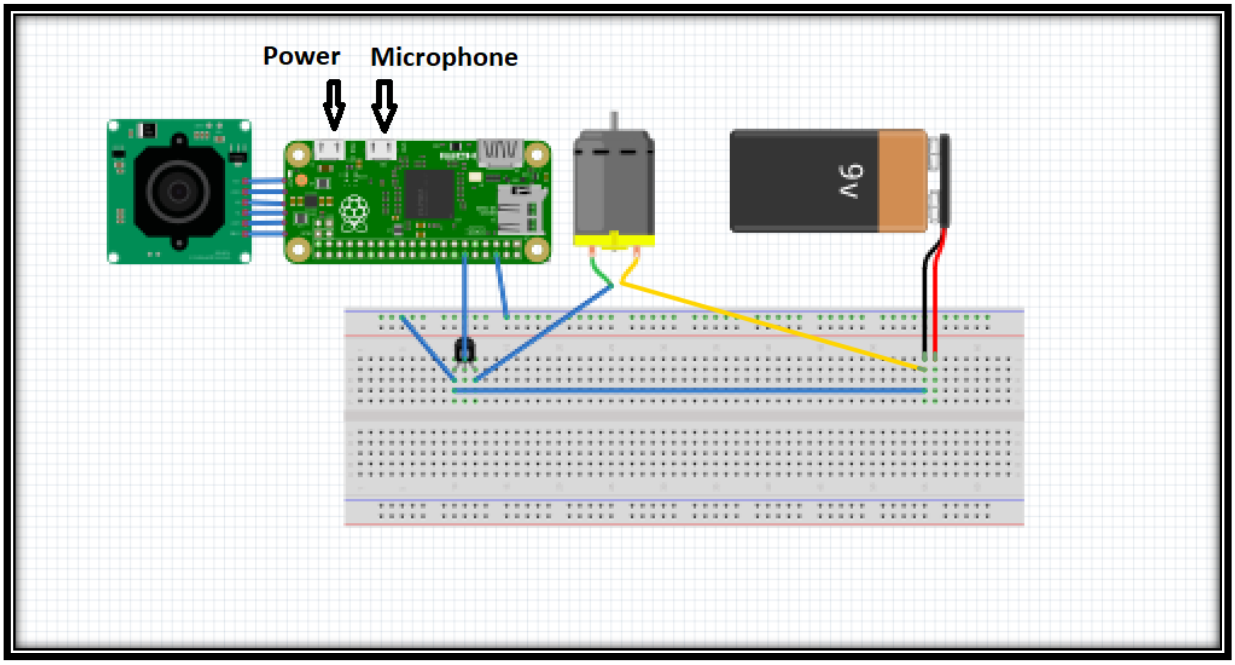
We would like to express our earnest gratitude to our teaching assistant, Mihir Parmar for his perpetual guidance and support.

At last, we would like to thank all our colleagues and seniors who assisted us in all the ways possible. We appreciate their valuable time.

Project Objective

Using raspberry pi, save audio from the microphone for 5 minutes and video for 2 minutes from a rotating camera in memory when an event is triggered (like LED is ON/OFF). Name the file with day and time.

Circuit Diagram



Components Used

Raspberry pi 0w

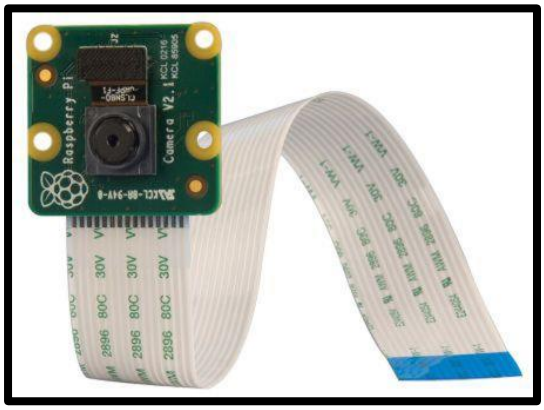
Having built-in WiFi and Bluetooth makes the Raspberry Pi Zero W versatile and flexible. The possible uses and projects for the Zero W are endless and it lends itself well to Internet-of-Things projects. Sensor data gathering (via the GPIO ports), plus a 1 GHz 32-bit processor, plus wireless connectivity equals a winning formula.

Microphone with USB Port

- Plug and play.
- Filter out background noises
- USB interface
- No external power supply needed
- Flexible neck to adjust your convenient direction for talking.

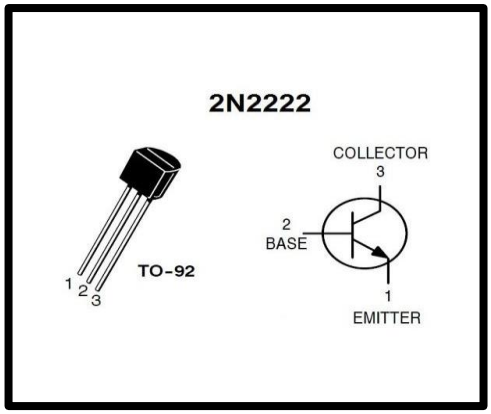
Pi Camera

The Raspberry Pi Camera v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It's capable of 3280 x 2464 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video. It attaches to Pi by way of one of the small sockets on the board upper surface and uses the dedicated CSI interface, designed especially for interfacing to cameras. It connects to Raspberry Pi by way of a short ribbon cable.



2N2222 Transistor

The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds.



Some Other Components

- Micro USB to USB converter
- DC 12V - Motor
- 9V Battery
- Breadboard
- SD Card

Description

As soon as the event is triggered, the Raspberry PI receives the signal to provide power supply to the motor which finally rotates the whole circuitry mounted on the surface above it. At the same instant, the Pi-camera and microphone are also provided with the power supply to operate. Thus Pi-camera starts recording the video and the microphone starts recording the audio.

The configuration works for 24 seconds and then the Raspberry pi stops providing power to the motor. The Pi-camera stops after recording for 12 seconds while microphone records for a whole 24 seconds. The recorded audio and video files are then saved to the server.

Code explanation

```
import picamera
import datetime
camera = picamera.PiCamera()
camera.resolution = (640, 480)
import time
import RPi.GPIO as GPIO
import pyaudio
import wave
GPIO.setmode(GPIO.BOARD)
GPIO.setup(12,GPIO.OUT)
```

This section of the code imports all the libraries required for the execution. The "camera" library is used to communicate with the Pi-camera. Similarly, the "RPI.GPIO" library is imported to configure the Raspberry PI input-output pins. Here we have used the 12th GPIO pin as the power supply for the motor.

```
form_1 = pyaudio.paInt16
chans = 1
samp_rate = 44100 # 44.1kHz sampling rate
```

```
chunk = 4096
record_secs= 2
wav_output_filename = datetime.datetime.now().strftime('%d-%m-%Y%H-
%M-%S')+'.wav' # name of .wav file
audio = pyaudio.PyAudio()
```

Here are some variables declared, which are used for configuration of an audio file from microphone module. The “form1” variable stores the size of each sample and the variable “chunk” stores the value of a number of channel per buffer.

```
print("Audio  + Video recording")
frames = []
t = 0
camera.start_recording(datetime.datetime.now().strftime('%d-%m-
%Y%H:%M:%S')+'.h264')
c = time.time()
f = 1
while True:
  t = t + 1
        for ii in range(0,int((samp_rate/chunk)*record_secs)):
        data = stream.read(chunk, False)
        frames.append(data)
        if ii<1:
        print('Motor running')
        GPIO.output(12, True)
        else:
        GPIO.output(12, False)
        if t > 10:
        break
camera.stop_recording()
print('Finished video recording')
```

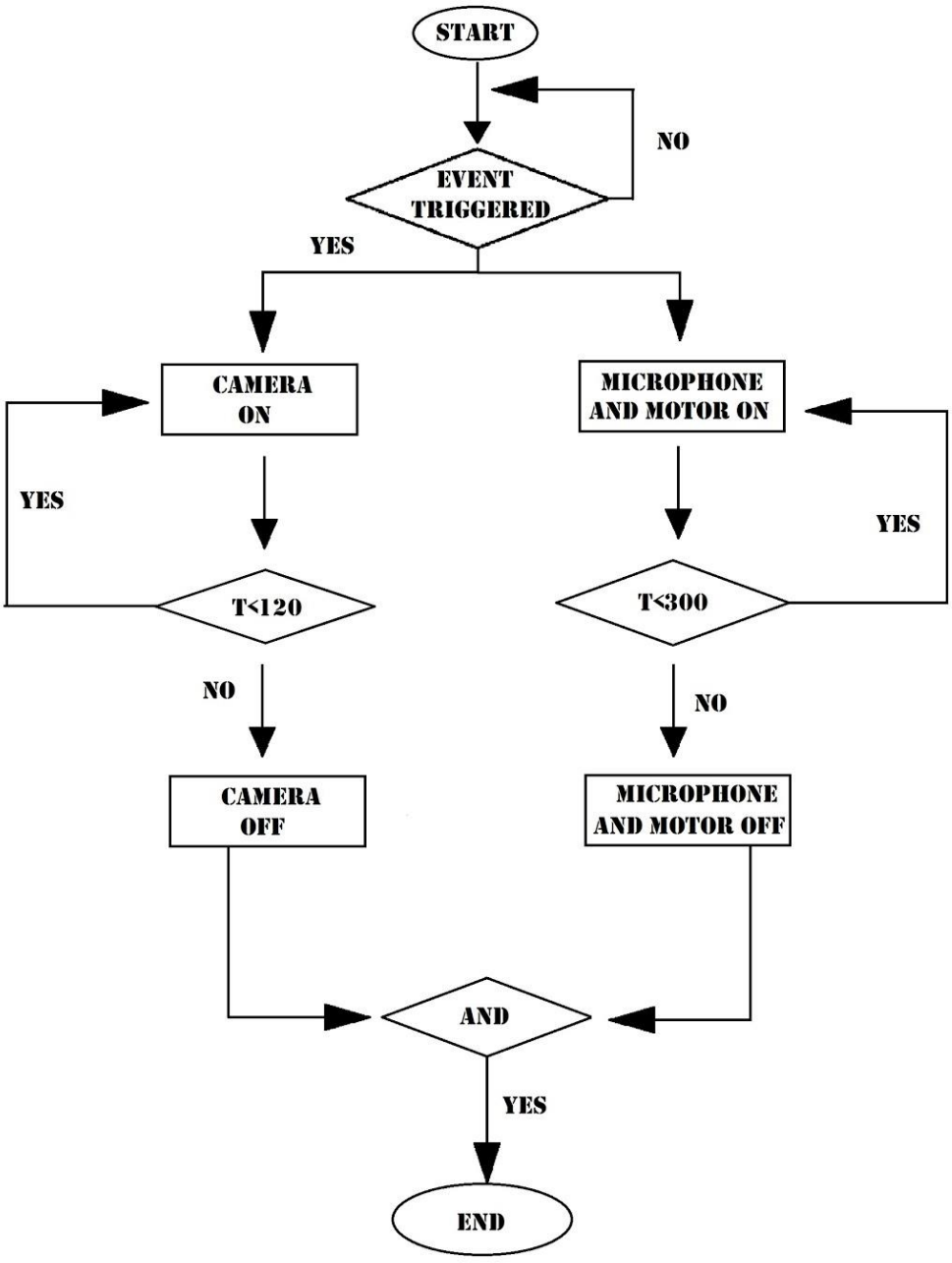
The above lines of code are used to start the audio and video recording. Here, we are rotating the motor for one-tenth part of the second which is controlled by the while loop here. The working can be easily understood by reading the above code once. Using the above code, we have run the motor for 12 seconds and thus, the

PI-CAMERA stops recording. The second while loop is for the remaining of the 12 seconds for the microphone to record the audio.

```
stream.stop_stream()
stream.close()
audio.terminate()
# save the audio frames as .wav file
wavefile = wave.open(wav_output_filename,'wb')
wavefile.setnchannels(chans)
wavefile.setsampwidth(audio.get_sample_size(form_1))
wavefile.setframerate(samp_rate)
wavefile.writeframes(b''.join(frames))
wavefile.close()
GPIO.cleanup()
```

The “wave” library which we had earlier imported is used here to store the audio file recorded through the microphone.

Flowchart


START
NO
EVENT TRIGGERED
YES
CAMERA ON
MICROPHONE AND MOTOR ON
YES
YES
T<120
T<300
NO
NO
CAMERA OFF
MICROPHONE AND MOTOR OFF
AND
YES
END

Test Results

After the successful execution of our code for audio and video recording, we now want to check our recorded audio and video files. In order to check the results on the local server, use WinSCP free application which shows all the files and folders of raspberry pi on windows explorer mode.

Now, log in with the IP of the raspberry pi and provide username as pi and password as raspberry. You will see an audio file with the .wav file format and a video file with H264 file format. Hence, now the audio file has audio recorded for 5 minutes and video recorded for 2 minutes. Moreover, as per our code, the names of both the files will be the same as the day and time of recording. So, we have successfully tested both audios as well as video recordings and saved the file names as day and times. Hence, our objective is fulfilled.

Conclusion

So finally after completing all the tasks i.e coding, hardware designing and assembling all the components, we have our project ready which is capable of recording a video and audio whenever an event is triggered. This project can be implemented on a larger scale to handle some real-life situations like it can be used as a security camera at home or office, in this situation we can consider the opening of a gate as triggering of an event and turn on the camera whenever someone opens the gate.This will increase security. Similarly, it can be used at the time of the accident, here we can consider damage to the vehicle as triggering of an event and turn on the camera which will record everything at the site of the accident which can turn out to be valuable information or proof later. This project can also be used by the traffic police department for surveillance of traffic during a red light. Here we can start the camera when the signal is red and record everything like someone not wearing the helmet or seatbelt, someone breaking the signal, etc. We could even think of implementing this project outside our hostel rooms in order to overcome the problem of theft of our valuable belongings. So after completing the project successfully, we came to know how we can make different projects using raspberry pi which can have many real-life applications.

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