EHD Project Proposal

Safari Pokedex- An Animal Sound Identification System

Group Members Team 46:

Karnav Kikani 201401067
Aditya Joglekar 201401086
Anusha Phadnis 201401098
Parth Kanakiya 201401100
Rajdeep Pinge 201401103

Introduction:

This is the era of the 'Internet of Things'. We want to develop an application in this domain which would involve our hobby and will be useful.

We have grown up watching wildlife videos on Animal Planet and the likes. Most of us have taken a wild safari. It is an exhilarating experience to lose yourself in the jungle for a few hours, and to encounter beautiful animals and birds!

An animal's sound, arguably, is one of its most distinctive characteristic. Humans have an innate ability to easily recognize sounds. In a safari, often we are alerted of an animal's presence because of its calls. We started wondering …. "Is it possible to create an intelligent embedded system which would serve as our ears?". Concretely, could we use an embedded system which will monitor the surroundings for an animal's call, recognise it and then alert the tourists?

We see this as an opportunity to combine our wildlife interests, machine learning enthusiasm and our knowledge with regards embedded systems to create a Safari Pokedex[1].

Problem Statement:

To determine the animal in proximity to the sensor, based on the sound recorded by the system and broadcast information regarding the animal using a communication module to the tourists. The goal is to automate the work of a safari guide and provide a rich, informative, real time experience to the tourists.

[1] A fictional device from the famous anime 'Pokemon' which serves as the inspiration for the proposed system. It can identify the creatures from visual and sound cues.

Our Solution:

The safari car will house the proposed module. A microphone will constantly monitor the surroundings for an sound signal. If a likely signal is received (something other than noise), the input will be forwarded to the raspberry pi. The pi will execute a machine learning script and try to classify the sound signal. If an animal already in the database is detected, then a broadcast will be sent to the tourists' handheld devices connected to the LAN created by the wifi module attached to microcontroller.

The classification will be done using a machine learning algorithm stored as a script on the raspberry pi. Note that the training will be done beforehand as the pi has limited computational resources. So, the module will not learn anything new, it will try to classify the signal into a limited number of known classes.

We plan to create a local server and access point (wifi hotspot) on the raspberry pi to connect the pi and the tourists' mobile phones so that information can be broadcast. The tourists will access the server using Wifi. In short when an animal is identified the pi will notify the user's mobile phones to display relevant information about it.

At the same time an entry will be made in the safari log. This information can be useful to the organizers to plan routes and gauge the success of a safari.
Thus, the users will get precise, real time information which will certainly enrich their safari experience.

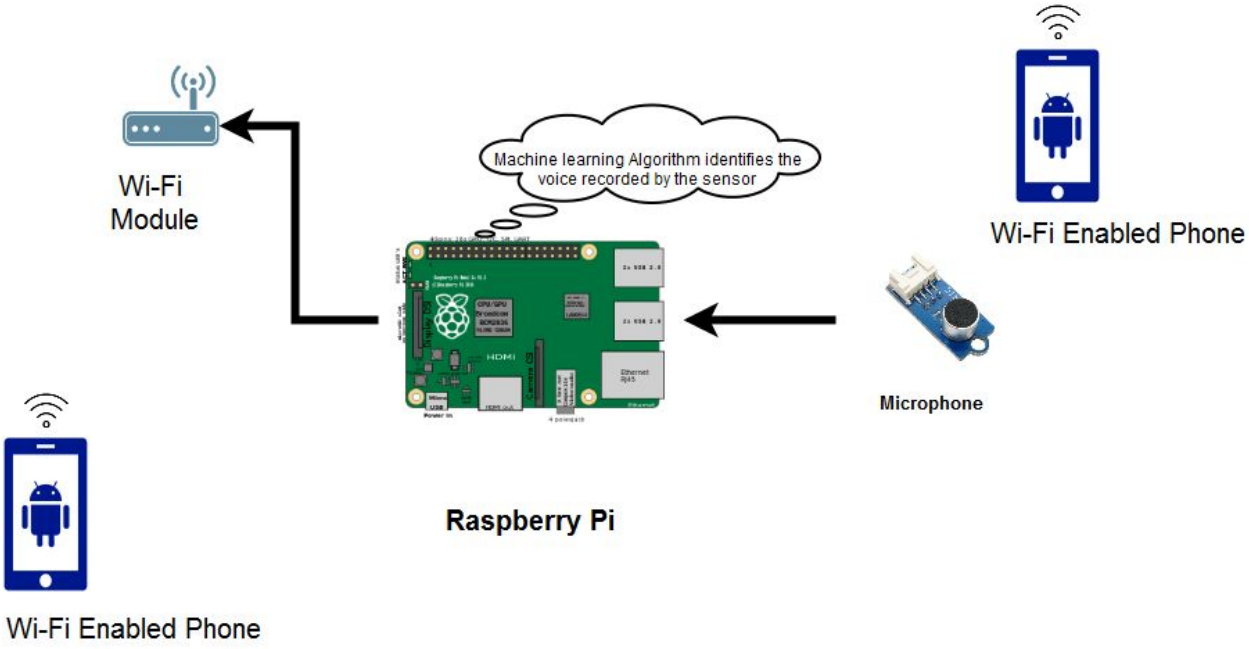
Requirements:	Cost
● Raspberry Pi	~ Rs 3500
● A microphone	~ Rs 200
● Wi-Fi module for Raspberry Pi	~ Rs 500
● Smartphones	~ No additional cost

Reasons for using the above devices-

Our problem needs machine learning. This is a computationally intensive algorithm. We needed a board which will have the necessary computational chops. So arduino was out of the reckoning. We chose the raspberry pi because it can run Python scripts. Python has an extensive library for machine learning, audio processing, and communication. We want to store the trained model on the embedded platform so that the time required for the identification process be minimized. This will make the module independent and it need not rely on any other device.
The system will be used in forested areas. We cannot hope for internet access. Hence we will create a local server and connect the user's devices to it. Hence we need a Wi-fi module.

Nowadays, most of us have smartphones, so it is reasonable to use it to provide information to the users.

Block Diagrams:



Limitations:

Since this is a very new idea, we expect to have some glitches as we progress ahead. So we have limited the scope of the project. We expect the following to be the limitations of the project.

1. The sounds of some animals, especially birds are similar and the algorithm that we are using to identify the sound may not be able to detect this as accurately as possible.This might be due to the microphone not being sensitive enough or our training algorithm might not be able to generalize properly. We can improve our analysis of identifying the birds correctly if a large dataset and a decent microphone is used.
2. There might be some noise in the received sound when we actually go in the field which might hamper the accuracy of the device.
3. If there are two or more voices simultaneously then we can only differentiate them if both have large frequency gap. Hence if noise and original required sound signal has small frequency gap then we cannot get accuracy.

Future Scope and Possible Extensions:

This project largely comes under the domain of sound recognition and processing based on Machine Learning which is an emerging and developing field. Coupling it with the recent boom of embedded hardware under the name of IoT provides tremendous scope for development in this project.

- A large database can be constructed and the region-wise mapping of wild animals and birds can be done.
- We can also use our algorithm further to identify the insect sounds which could have research applications.
- To increase the accuracy of the device, band-pass filters can be introduced in the device which would filter out unwanted noise.
- An android app providing detailed scientific and historical information about the detected animal to the tourist on his/her smartphone for a user friendly experience.