SoundFiAudioSession Class Reference

Inherits from	NSObject
Conforms to	CLLocationManagerDelegate
Declared in	SoundFiAudioSession.h SoundFiAudioSession.m

Overview

SoundFiAudioSession is the audio Engine of the SoundFi technologie. This class include all the differrent mode that SoundFi provide : messaging, locating and paiement

The SoundFiAudioSession mainly use Apple API provided for audio low level management. You will find in there some reference to AudioUnit and AndioGraph. If you'r not at ease with this part of Apple API please take a look as those link :

- Constructing Audio Unit App
- Using Specific Audio Unit

I'll try to synthetise how does the engine work. First of all, this engine work in real time, that's why, we get at each moment an audio sample that we will analyse immediatly (ideally before the next one ^^). How can we do that ??? With the callBack my dear ! Every time an audio unit will require a sample, they will call a function (a callback function). It's in this function that we will do our task, analysing.

The analyse is done with FFT (Fast Fourrier Transform), that is able to transform a temporal sample to a frequency sample and détect the dominant frequency. In the code, you will see 2 FFT procesing : - A light one that use low CPU ressources and use for the background processing (low accuracy :/) - A bigger one that do good work in foreground and can give the frequency close to 1Hz in good condition. (http://www.dspdimension.com/))

This this is global principle. Now, invite you to start reading this doc :).

For user : SoundFi use hight level abstraction to make your life simple, in this way, you will only need 2 or 3 methods to make the technologie working, we will see later witch one.

For SoundFiDev : Welcom to low level, have fun, and hang on. This documenation give you information for the function purpose, if you want to know more about how they processing, you can find a lot of comment in the code that detail the working process.

> **Warning:** This documentation is not ended yet. Documentation v1.00.
>
> All the class function are here, but some C function come upon this code, you could find there documentation directly in the code.

Tasks

Other Methods

`delegate` *property*

Start/Stop engine methods

- `startAudioUnit:::`
- `stopProcessingAudio`
- `relaunchReception`

Emission methods

- `emissionSampleCalcul:::`
- `getASCIIFrequency`

TimeOut methods

- `checkTimeOut`
- `checkProcessTimeOut`

Deprecated methods

- `switchBackgroundChanged:`

Reception methods

- `sampleTreatment:`
- `geolocalisationReceptionSampleTreatment`
- `messagingReceptionSampleTreatment`
- `paiementReceptionSampleTreatment`

Engine informations methods

- `localisationModeIsEnable`
- `messagingModeIsEnable`
- `paiementModeIsEnable`
- `backgroundIsEnable`
- `engineIsRunning`

Engine control methods

- `enableBackground`
- `desableBackground`
- `activateSoundFiLocalisation`
- `activateSoundFiMessaging`
- `activateSoundFiPaiement`
- `desactivateSoundFiLocalisation`
- `desactivateSoundFiMessaging`
- `desactivateSoundFiPaiement`

Paiement methods

- startpaiementProcessing
- transactionUpdate:
- alertView:clickedButtonAtIndex:
- endPaiementProcess

Volume control methods

- changeMinimumVolume:
- volumeControl

Initialisation methods

- init
- initPaiement
- initGeoloc
- initAudioStreams
- fftSetup
- emissionSetup
- setupCallback
- initAudioSession

Geolocalisation methods

- zoneDetection:
- locationManager:didUpdateToLocation:fromLocation:
- changeLocationManagerAccuracy
- changeGeolockTimer:

Audio Session interruption detection methods

- interruptionDetected:

Analysis methods

- analysisPhase1
- analysisPhase2
- analysisPhase3
- analysisPhase4
- analysisPhase5
- analysisPhase6
- startAnalysis

Background and foreground management methods

- enteredBackground
- enteredForeground

Properties

delegate

```
@property (nonatomic, strong) id delegate
```

Instance Methods

activateSoundFiLocalisation

Activate the location mode

```
- (void)activateSoundFiLocalisation
```

See Also

- desactivateSoundFiLocalisation
- localisationModeIsEnable

Declared In

SoundFiAudioSession.m

activateSoundFiMessaging

Activate the messaging mode

```
- (void)activateSoundFiMessaging
```

See Also

- desactivateSoundFiMessaging
- messagingModeIsEnable

Declared In

SoundFiAudioSession.m

activateSoundFiPaiement

Activate the paiement mode

```
- (void)activateSoundFiPaiement
```

See Also

- desactivateSoundFiPaiement
- paiementModeIsEnable

Declared In

SoundFiAudioSession.m

alertView:clickedButtonAtIndex:

```
- (void)alertView:(UIAlertView *)alertView clickedButtonAtIndex:
(NSInteger)buttonIndex
```

analysisPhase1

This is the first step of the analysis

```
- (void)analysisPhase1
```

Discussion

The purpose of this method is to remove init dans stop string that can be place in the message that is send. Actually you have to manually change it if you want. The default init and stop string are :

- init:
- :stop

See Also

- startAnalysis

Declared In

SoundFiAudioSession.m

analysisPhase2

Second step of the analysis phase

```
- (void)analysisPhase2
```

Discussion

The purpose of the phase is analysing the string and remove some pattern. We are looking for substring like “aba”, and considère that “b” is an error and should be a “a”, because each caracter are repeated 4 times. The difference in the ASCII table must be less than 1 to proced to the correction. (wont work with “bkb”)

See Also

- startAnalysis

Declared In

SoundFiAudioSession.m

analysisPhase3

Third step of the analysis phase

```
- (void)analysisPhase3
```

Discussion

The purpose of the phase is analysing the string and remove some pattern. We are looking

for substring like “bacb”, and considère that “ac” is an error and should be “bb”, because each caracter are repeated 4 times. The difference in the ASCII table must be less than 1 to proced to the correction. (wont work with “bjkb”)

See Also

- startAnalysis

Declared In

SoundFiAudioSession.m

analysisPhase4

Fourth step of the analysis phase

```
- (void)analysisPhase4
```

Discussion

The purpose of the phase is analysing the string and remove some pattern. We are looking for substring like “fgg”, and considère that “f” is an error and should be “g”, because each caracter are repeated 4 times. The difference in the ASCII table must be less than 1 to proced to the correction. (wont work with “bcc”)

This function is similar to analysisPhase2.

See Also

- startAnalysis
- analysisPhase2

Declared In

SoundFiAudioSession.m

analysisPhase5

Fifth step of the analysis phase

```
- (void)analysisPhase5
```

Discussion

The purpose of the phase is analysing the string and deduct the good caracter. In the string, we consider that every caracter that is repeated 2 times is a valid caracter. And if it’s repeated more than 5 times, it’s a double letter.

Following this logic if we have this cases :

- “aa” -> a
- “abhgcc” -> c
- “aaaaaa” -> aa

See Also

- startAnalysis

Declared In

SoundFiAudioSession.m

analysisPhase6

Sixth step of the analysis phase

```
- (void)analysisPhase6
```

Discussion

The purpose of the phase is analysing the string and correct the wrong word. This function proceed by analysing each word of the final text and check if it match with a word in the dictionnary.

In this way, a word like “Helo” would be correct to “Hello”.

Note : Be carefull, this phase could lead to error, for example, it don’t work on url (don"t worry it’s design to ignor URL). Morevover this phase is optional and can be disable by changing the #define SPELLCHECKER to 0.

See Also

- startAnalysis

Declared In

SoundFiAudioSession.m

backgroundIsEnable

Check if the background is enable

```
- (BOOL)backgroundIsEnable
```

Return Value

TRUE if the background is enable

See Also

- enableBackground

Declared In

SoundFiAudioSession.m

changeGeolockTimer:

Permit to change the interval of the timer for user localisation.

```
- (void)changeGeolockTimer:(int)duree
```

Parameters

duree

The new value representing the time between to fire of the timer

Discussion

Currently can be called by everyone but may become a private method

Declared In

SoundFiAudioSession.m

changeLocationManagerAccuracy

Increse the accuracy of the GPS for 1 location.

```
- (void)changeLocationManagerAccuracy
```

Discussion

Call by the timer all the n seconds to get a precise location of the user.

Declared In

`SoundFiAudioSession.m`

changeMinimumVolume:

Allow you to set the minimum required volume for sending message

```
- (void)changeMinimumVolume:(float)newMinVolume
```

Parameters

newMinVolume

The new minimum volume you want to set

Discussion

The value must be between 0 and 1. It's higtly recommended to use a value between 0.6 and 0.9.

See Also

`- volumeControl`

Declared In

`SoundFiAudioSession.h`

checkProcessTimeOut

Check if there is TimeOut during one step of the paiement process.

```
- (void)checkProcessTimeOut
```

See Also

`- checkTimeOut`

Declared In

`SoundFiAudioSession.h`

checkTimeOut

Check if the comunication time out, use by all soundFi mode.

```
- (void)checkTimeOut
```

See Also

`- checkProcessTimeOut`

Declared In
`SoundFiAudioSession.h`

desableBackground

Avoir background processing

`- (void)desableBackground`

See Also
- `enableBackground`
- `backgroundIsEnable`

Declared In
`SoundFiAudioSession.m`

desactivateSoundFiLocalisation

Desactivate the location mode

`- (void)desactivateSoundFiLocalisation`

See Also
- `activateSoundFiLocalisation`

Declared In
`SoundFiAudioSession.m`

desactivateSoundFiMessaging

Desactivate messaging mode

`- (void)desactivateSoundFiMessaging`

See Also
- `desactivateSoundFiMessaging`
- `messagingModeIsEnable`

Declared In
`SoundFiAudioSession.m`

desactivateSoundFiPaiement

Desactivate the paiement mode

`- (void)desactivateSoundFiPaiement`

See Also
- `activateSoundFiPaiement`
- `paiementModeIsEnable`

Declared In

`SoundFiAudioSession.m`

emissionSampleCalcul:::

Create the audio wave with the required frequency for a given sample.

`- (void)emissionSampleCalcul:(int)`*`frequence`*` :`

Parameters

frequence

This is the desired frequency for this sample (int).

numFrames

The number of frame that required the audio hardware (int).

buffer

The audio sample, store as a Float32 array.

Discussion

This function will generate an audio sinusoidal wave for each audio sample needed. This function is called in the renderCallBack.

Declared In

`SoundFiAudioSession.h`

emissionSetup

Like an emissionInit, this function setup the audioUnit for emission

`- (void)emissionSetup`

Discussion

This method perform the initialisation in 4 steps :

- Create the component description
- Find the output component
- Create the ASBD (Audio Stream Basic Description)
- Assign the component to the AudioUnit

See Also

`- init`

Declared In

`SoundFiAudioSession.m`

enableBackground

Allow background processing

```
- (void)enableBackground
```

See Also

- desableBackground
- backgroundIsEnable

Declared In

SoundFiAudioSession.h

endPaiementProcess

Call at end of paiement

```
- (void)endPaiementProcess
```

Discussion

This method permit to stop processing a paiement, it disable the paiement mode and enable the other mode. Do stuff like reset the timer for geolock etc …

See Also

- startpaiementProcessing

Declared In

SoundFiAudioSession.m

engineIsRunning

Check if the engine is running

```
- (BOOL)engineIsRunning
```

Return Value

TRUE if the engine is running

Declared In

SoundFiAudioSession.m

enteredBackground

Call to perform background task

```
- (void)enteredBackground
```

Discussion

This function is called when the aplication is entering background. It does geolocalisation processing to determine if we have or not to stop the audioEngine in background

See Also

- enteredForeground

Declared In

SoundFiAudioSession.m

enteredForeground

Call to perform background task

```
- (void)enteredForeground
```

Discussion

This function is called when the aplication is entering foreground. It does geolocalisation processing to determine if we have or not to relaunch the audioSession when starting foreground processing.

See Also

- enteredBackground

Declared In

SoundFiAudioSession.m

fftSetup

Set up variable and array for the fft.

```
- (void)fftSetup
```

Discussion

This method simply init a lot of stuff to allow FFT process later.

See Also

- init

Declared In

SoundFiAudioSession.m

geolocalisationReceptionSampleTreatment

Treatment of geolocalisation frequency.

```
- (void)geolocalisationReceptionSampleTreatment
```

Declared In

SoundFiAudioSession.m

getASCIIFrequency

Coordinate the state of the emission and asign a frequency to a caracter.

```
- (int)getASCIIFrequency
```

Return Value

Return the frequency associate with the caracter or the init/stop frequency

Discussion

This function make the link between the audio and the string to send. For each

audioSample needed, this function will tell what frequency we need.

Declared In

`SoundFiAudioSession.h`

init

This is the SoundFiAudioSession init method, this method init every mode (messaging,paiemement and localisation).

```
- (SoundFiAudioSession *)init
```

Return Value

Return an instance of SoundFiAudioSession.

Discussion

This function init all the variables of the engine. By default, the messaging and localisation mode are enable, the engine is configure to allow background tasking by default (that can be change later by the user). This fonction will call every sub init methods.

- initGeoloc
- initAudioSession
- setupCallback
- fftSetup
- initAudioStreams

Note that every sub function (initGeoloc,initAudioSession ...), would be in the init method, but to simplify the code they have been spitted.

See Also

- `initGeoloc`
- `initAudioSession`
- `setupCallback`
- `fftSetup`
- `initAudioStreams`

Declared In

`SoundFiAudioSession.m`

initAudioSession

Init AudioSession's parameters

```
- (int)initAudioSession
```

Discussion

This function set the type of audioSession to Play&Record, and init some parameters like : rate, duration, interruptionListener.

See Also

- init

Declared In

SoundFiAudioSession.m

initAudioStreams

This method deal with the initilisation of the audioStream, mainly the AudioGraph

- (int)initAudioStreams

Return Value

1 un case of error, else 0

Discussion

This method represent mainly the initialisation of the reception. It set all the parameters of stream including IO and mixer and the graph. This function proceed in 6 step :

- Define the ASBD (Audio Stream Basic Description)
- Define the component description (IO and Mixer)
- Create graph's node
- Associate AudioUnit with node
- Configure AudioUnit (including callback setup)
- Initialize graph

NOTE : The mixer is not really use here but implement for futur feature.

Warning: Here some error that can be raised by the function

- NewAUGraph error
- AUGraphAddNode error
- AUGraphOpen error
- AUGraphNodeInfo error
- AUGraphSetNodeInputCallback error
- AUGraphInitialize error

See Also

- init

Declared In

SoundFiAudioSession.m

initGeoloc

This method deal with the initilisation of the audioEngine's localisation

- (void)initGeoloc

Discussion

Init geolocalisation variable like the LocationManager and configure the NSTimer for a periodic update of the user location. By Default, the user considered out of a soundFi covered spot.

See Also

- init

Declared In

SoundFiAudioSession.m

initPaiement

This method deal with the initilisation of the paiement variables

- (void)initPaiement

See Also

- init

Declared In

SoundFiAudioSession.m

interruptionDetected:

Detect the interruption flag of the audioSession.

- (void)interruptionDetected:(NSNotification *)*notification*

Parameters

notification

The NSNotification that was raised by the interruption

Discussion

This function handle any NSNotifiaction corresponding to an interruption (corresponding to a AVAudioSessionInterruptionNotification). And have the value AVAudioSessionInterruptionTypeKey.

Declared In

SoundFiAudioSession.m

localisationModeIsEnable

Check if the localisation mode is enable

- (BOOL)localisationModeIsEnable

Return Value

TRUE if the localisation mode is enable

See Also

- activateSoundFiLocalisation

- desactivateSoundFiLocalisation

Declared In

SoundFiAudioSession.h

locationManager:didUpdateToLocation:fromLocation:

Delegate method for LocationManager to update user location.

- (void)locationManager:(CLLocationManager *)*manager* didUpdateToLocation:(CLLocation *)*newLocation* fromLocation:(CLLocation *)*oldLocation*

Discussion

For more detail, take a look at locationManaerUpdate

Declared In

SoundFiAudioSession.m

messagingModeIsEnable

Check if the messaging mode is enable

- (BOOL)messagingModeIsEnable

Return Value

TRUE if the messaging mode is enable

See Also

- activateSoundFiMessaging

- desactivateSoundFiMessaging

Declared In

SoundFiAudioSession.m

messagingReceptionSampleTreatment

Treatment of simple messenging frequency

- (void)messagingReceptionSampleTreatment

Declared In

SoundFiAudioSession.m

paiementModeIsEnable

Check if the paiement mode is enable

- (BOOL)paiementModeIsEnable

Return Value

TRUE if the paiement mode is enable

See Also

- activateSoundFiPaiement
- desactivateSoundFiPaiement

Declared In

SoundFiAudioSession.m

paiementReceptionSampleTreatment

Treatment if paiement frequency (very similar to messaging frequency)

- (void)paiementReceptionSampleTreatment

Declared In

SoundFiAudioSession.m

relaunchReception

This function is use after finishing a message sending

- (void)relaunchReception

Discussion

Permit to restart the listening and put in waiting state for a message. It will proceed to a usleep to avoid lldb due to audio still processing on sending.

Declared In

SoundFiAudioSession.m

sampleTreatment:

This function deal with the recepetion state, for background and foreground.

- (void)sampleTreatment:(int)*numFrames*

Parameters

numFrames

The number of frame (int) that the FFT must perform.

Discussion

It perform the FFT method according to the UIApplication state. It will call three other function geolocalisationReceptionSampleTreatment, messagingReceptionSampleTreatment and paiementReceptionSampleTreatment.

NOTE: The FFT for background is less accurate than the other but use only 2%CPU

See Also

- geolocalisationReceptionSampleTreatment
- messagingReceptionSampleTreatment

- paiementReceptionSampleTreatment

Declared In

SoundFiAudioSession.h

setupCallback

This function init some variables use in the callback methods

- (void)setupCallback

See Also

- init

Declared In

SoundFiAudioSession.m

startAnalysis

Analysis of the message receive during the transaction

- (void)startAnalysis

Discussion

This function is the one you have to use if you want to analyse a string send by soundFi. It will manage all the step from 1 to 6

```
[self analysisPhase1];
[self analysisPhase2];
[self analysisPhase3];
[self analysisPhase4];
[self analysisPhase5];

#if SPELLCHECKER
[self analysisPhase6];
#endif
```

See Also

- analysisPhase1
- analysisPhase2
- analysisPhase3
- analysisPhase4
- analysisPhase5
- analysisPhase6

Declared In

SoundFiAudioSession.m

startAudioUnit:::

Allow you to start SoundFi engine for receiving or sending function.

`- (int)startAudioUnit:(SFMessagingMode)mode :`

Parameters

mode

The mode that you want to use, SFReceivingMode or SFSendingMode

message

The string to send (only if you use SFSendingMode, otherwise put nil)

Return Value

Return 1 if every thing is ok, or 0 in the other case.

Discussion

This function start the audio unit for send of receiving, and proceed to a sound check in case of sendingMode is use.

> **Warning:** Here some error that can be raised by the function
>
> - AUGraphStart error

Declared In

`SoundFiAudioSession.h`

startpaiementProcessing

Call at start of paiement

`- (void)startpaiementProcessing`

Discussion

This method permit to start processing a paiement, it enable the paiement mode and disable the other mode. To resume, it prepare the battlefield.

See Also

`- endPaiementProcess`

Declared In

`SoundFiAudioSession.h`

stopProcessingAudio

This function allow you to stop listenning or sending audio

`- (int)stopProcessingAudio`

Return Value

Return 1 if every thing is ok

Discussion

> **Warning:** Here some error that can be raised by the function

- AUGraphStop error

Declared In

`SoundFiAudioSession.m`

switchBackgroundChanged:

Fonction Call to enable or disable background listenning. (**Deprecated:** Replace with : enableBackGround and disableBackground.)

```
- (void)switchBackgroundChanged:(id)sender
```

See Also

- `enableBackground`

Declared In

`SoundFiAudioSession.h`

transactionUpdate:

Call to perform background task

```
- (void)transactionUpdate:(NSString *)theMessage
```

Parameters

theMessage

The last message received by the cash register.

Discussion

Control state of the transaction and send message according to the state. This is the main paiement engine's method.

Warning: Although this method work, they could be some bug. Moreover, send a classic message during processing could pertubate the transaction.

Declared In

`SoundFiAudioSession.m`

volumeControl

Control the app volume for sending message

```
- (BOOL)volumeControl
```

Return Value

TRUE if volume is superior to the minimal require

Discussion

Limit can be configured with the changeMinimumVolume:(float) method.

Declared In

`SoundFiAudioSession.m`

zoneDetection:

Use to deal with the location of the user in function of the received frequency.

`- (void)zoneDetection:(int *)`*`data`*

Parameters

data

The array of frequency (int* 100)

Discussion

Made he average frequency of the last 100 frequency record, and then check the standart deviation to determine if the samples are concluding

NOTE:May use GPS localisation in futur implementation.

Exceptions

outRange

Can raise an NSExeption if the location is out range of the location's array

outZone

Raise if the user is not in a zone under soundFi technologie

See Also

`- geolocalisationReceptionSampleTreatment`

Declared In

`SoundFiAudioSession.m`

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