LOKII

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Chapter 1

LOKII Arduino library

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1.1 Introduction

This LOKII Arduino library provides the library for use by GLAST developers.

There are examples to demonstrate LOKII basic functions :

- Face detection demo (demonstrate the use of face detection function)
  examples/faceDetection/faceDetection.ino

- Color detection demo (demonstrate the use of color object tracking function)
  examples/colorDetection/colorDetection.ino

- Speech Recognition demo (demonstrate the speaker independent speech dictation recognition)
  examples/speechRecognition/speechRecognition.ino

- Text To Speech demo (demonstrate english text to speech function)
  examples/Text-To-Speech/Text-To-Speech.ino

- SD_Create (create speaker dependent speech dictation group for speech recongition)
  examples/SD_Create/SD_Create.ino

- songnote (demonstrate music note playback for three songs)
  examples/songnote/songnote.ino

- music Tone (demonstrate music note playback for a single song)
  examples/musicTone/musicTone.ino

- babyMonitor (A simple baby monitor using face detection and text-to-speech function)
  examples/babyMonitor/babyMonitor.ino

- tts_red_little_riding_hood (A simple storytelling demo with multiple characters using text-to-speech function)
  examples/tts_red_little_riding_hood/tts_red_little_riding_hood.ino

- arduno BLE Car (A showcase for robotic car using Arduino BLE board)
  examples/arduinoBLECar/arduinoBLECar.ino

- armTest using 6 external servo motors
  examples/armTest/armTest.ino

- smartDeviceTest (control 4 proprietary smart LEDs and 4 proprietary smart servo motors)
  examples/smartDeviceTest/smartDeviceTest.ino

- writeSmartID (write smart ID to the single smart device attached to LOKII Arduino board)
  examples/writeSmartID/writeSmartID.ino
  For latest LOKII news, please check `LOKII website`

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 3

Class Documentation

3.1 LOKII Class Reference

Public Member Functions

- void connect ()

  Init the LOKII system.
- void setCameraMode (int cameraState)

  Set LOKII camera running mode for image processing function.
- int waitForFaceResult (int faceState)

  Wait for face detected result.
- int getFaceResult (int atributeType)

  Get face detected region attribute.
- int waitForBlobResult (bool isBlocking=true)

  Wait (check) for color blob detection result.
- void registerColor ()

  Register a custom color for color detection.
- int getBlobResult (int blobIndex, int atributeType)

  Get color blob detected region attribute.
- int getBlobCount ()

  Get color blob detected count.
- int recordVideo (String filename)

  Start recording video from camera.
- int stopRecordVideo ()

  Stop the video recording from camera.
- int playVideo (String filename)

  Play video from TF card.
- int stopPlayVideo ()

  Stop the video playback on screen.
- int takePhoto (String filename)

  Take photo.
- int displayPhoto (String filename)

  Display the jpeg photo.
- void startSpeechRecognize (int wordgroupIndex)

  Start/Stop speech recognition

- int waitForSpeechResult ()

  Wait for the recognized speech keywords index (BLOCKING)
- int getSpeechResult ()

  Get recognized speech keywords index (NON-BLOCKING)
- int createSDGroup (int groupIndex, int numKeywords)

  Create a Speaker Dependent (SD) custom speech recognition keyword groups.
- int trainSDkeyword (int groupIndex, int keywordsIndex)

  Train a Speaker Dependent (SD) keyword
- int checkSDComplete (int groupIndex)

  Check if Speaker Dependent training complete
- void setVolume (int vol)

  Set audio output volume level of LOKII.
- void playTTS (String text, int voiceType, int speed, int pitch, int emotion)

  Speak english text string.
- void playSoundFile (String filename, bool isBlocking)

  Play sound file.
- void stopSound ()

  Stop audio playback.
- int checkAudioStatus ()

  Check audio status.
- int recAudio (String filename)

  Start audio recording.
- int stopRecAudio (void)

  stop audio recording
- int playMIDI (int note)

  Play MIDI note.
- void setMIDIBPM (int bpmIn)

  Set MIDI BPM duration.
- void setSmartDeviceAdress (int id) int getSmartDeviceCount(void)

  Set the smart device id.
- void setMotorPower (int motorid, int state)

  Turn ON/OFF a motor power (hardware exclusive function)
- void moveMotor (int motorid, int speed, int position, int direction)

  Move motor (hardware exclusive function)
- int readMotorPosition (int motorid)

  Read motor position (hardware exclusive function)
- void recordMotor (int numSeconds)

  Record motors' position (hardware exclusive function)
- void playbackMotor ()

  Playback motors' position (hardware exclusive function)
- int stopRecordMotor (void)

  Stop motor's position recording (hardware exclusive function)
- void setRGB (int motorid, int r, int g, int b)

  Set smart LED color (hardware exclusive function)
- int setRCServo (int motorid, int speed, int position)

  Move RC servo (hardware exclusive function)
- int setDCMotor (int motorid, int speed, int direction)

  Move DC motor (hardware exclusive function)

Public Attributes

- from requests import **Request**
- from requests import Session from requests exceptions import **ConnectionError**
- from requests import Session from requests exceptions import **Timeout**

3.1.1 Member Function Documentation

3.1.1.1 checkAudioStatus()

```
int LOKII::checkAudioStatus ( )
```

Check audio status.

Check the audio playback status of LOKII system

Returns

the audio status: 1 = audio is playing , 0 = no audio is playing, -1 = system busy, user should check the status again

3.1.1.2 checkSDComplete()

```
int LOKII::checkSDComplete (
            int groupIndex )
```

Check if Speaker Dependent training complete

Check if Speaker Dependent (SD) keyword group training is complete
i.e. all the keywordsIndex audio training is completed in the SD keyword group

Parameters

groupIndex	the index for training word groups (11-20 inclusively)

Returns

result 1 - complete (All keywords are wel-trained) , 0 - incomplete (need more training samples)

3.1.1.3 connect()

```
void LOKII::connect ( )
```

Init the LOKII system.

Init the LOKII system with the SPI bus

3.1.1.4 createSDGroup()

```
int LOKII::createSDGroup (
            int groupIndex,
            int numKeywords )
```

Create a Speaker Dependent (SD) custom speech recognition keyword groups.

Create a speech recognition on specified keyword groups index (This speech recognition is speaker dependent for the training data)

Parameters

groupIndex	the index for training word groups (11-20 inclusively)
numKeywords	the number of keywords want to trained (1-5 inclusively)

Returns

result 1 - success , 0 - fail

3.1.1.5 displayPhoto()

```
int LOKII::displayPhoto (
            String filename )
```

Display the jpeg photo.

Display the jpeg photo stored in LOKII TF card to the LCD Screen.

Parameters

filename	the jpeg photo filename, for example, a.jpg

Returns

result 1 for success, other for error

3.1.1.6 getBlobCount()

```
int LOKII::getBlobCount ( )
```

Get color blob detected count.

Get number of color blob detected result from the cache after issuing waitForBlobResult(isBlocking) function:

Returns

count the number of color blob in the cache

3.1.1.7 getBlobResult()

```
int LOKII::getBlobResult (
            int blobIndex,
            int atributeType )
```

Get color blob detected region attribute.

Get the color blob detected result from the cache after issuing waitForBlobResult(isBlocking) function:

Parameters

blobIndex	the zero-based index for the color blob (The index should be smaller than the total color object detected)
atributeType	Following atributeType can be specified: L_XPOS - x coordinate of the color blob centre L_YPOS - y coordinate of the colob blob centre L_WIDTH - width of the color blob boundary L_HEIGHT - height of the color blob centre L_COLOR - color of the color blob , such as L_RED_COLOR ,L_GREEN_COLOR, L_BLUE_COLOR, L_CUSTOM_COLOR

All the above color atributeType are based on the LCD screen coordinate system with 320 x 240 pixel

Returns

result the color attribute result

3.1.1.8 getFaceResult()

```
int LOKII::getFaceResult (
            int atributeType )
```

Get face detected region attribute.

Get the face detected result from the cache after issuing waitForFaceResult(faceState) function

Parameters

atributeType	Following atributeType can be specified: L_XPOS - x coordinate of the face centre L_YPOS - y coordinate of the face centre L_WIDTH - width of the face boundary L_HEIGHT - height of the face centre All the above face detected atributeType are based on the LCD screen coordinate system with 320 x 240 pixel

Returns

result the face detected attribute result

3.1.1.9 getSpeechResult()

```
int LOKII::getSpeechResult ( )
```

Get recognized speech keywords index (NON-BLOCKING)

Get the recongnized speech keywords index used in "startSpeechRecognize" functions if no recognized keywords, it will return -1

Returns

result the zero-based index of the recognized keywords or -1 for no speech recognized

3.1.1.10 moveMotor()

```
void LOKII::moveMotor (
            int motorid,
            int speed,
            int position,
            int direction )
```

Move motor (hardware exclusive function)

Move a smart servo (with 100 degree freedom) to target position under specified speed control

Parameters

motorid	the motor id
speed	the movement completion time in millsecond (100 -2000)
position	the target moving degree (1 -100)
direction	1

3.1.1.11 playbackMotor()

```
void LOKII::playbackMotor ( )
```

Playback motors' position (hardware exclusive function)

Playback smart servo motors positions which is previously recorded by recordMotor(int numSeconds) function

3.1.1.12 playMIDI()

```
int LOKII::playMIDI (
            int note )
```

Play MIDI note.

Play MIDI note (0 - 59) for a second For example: NOTE_C1 0 NOTE_C1S 1 NOTE_D1 2 NOTE_E1b 3 NOTE_E1 4 NOTE_F1 5 NOTE_F1S 6 NOTE_G1 7 NOTE_G1S 8 NOTE_A2 9 NOTE_B2b 10 NOTE_B2 11 if the note value is negative, LOKII will play a silence

Parameters

note	the MIDI integer value

3.1.1.13 playSoundFile()

```
void LOKII::playSoundFile (
            String filename,
            bool isBlocking )
```

Play sound file.

Play MP3 sound file by specified the sound filename stored in LOKII TF card

Parameters

filename	sound file stored in TF card
isBlocking	0 - non-blocking, 1 - blocking until the sound file playback completed

3.1.1.14 playTTS()

```
void LOKII::playTTS (
            String text,
            int voiceType,
            int speed,
```

```
            int pitch,
            int emotion )
```

Speak english text string.

Speak english text using specified voice, speed, pitch, emotion setting using LOKII buit-in text-to-speech engine

voice can be one of following value: L_DEFAULT 0 L_MAN 1 L_OLDMAN 2 L_OLDWOMAN 3 L_BOY 4 L_YOU↩ NGGIRL 5 L_ROBOT 6 L_GIANT 7 L_DWARF 8 L_ALIENT 9

emotion can be one of following value: E_NATURAL 0 E_FRIENDLY 1 E_ANGRY 2 E_FURIOUS 3 E_DRILL 4 E_SCARED 5 E_EMOTIONAL 6 E_WEEPY 7 E_EXCITED 8 E_SURPRISED 9 E_SAD 10 E_DISGUSTED 11 E_WHISPER 12

Parameters

text	english text script
voiceType	voice can be 0 - 9 inclusivley
speed	speed can be 1 - 10 inclusivley
pitch	pitch can be 1 - 10 inclusively
emotion	emotion can be 0 - 12 inclusivley

3.1.1.15 playVideo()

```
int LOKII::playVideo (
            String filename )
```

Play video from TF card.

Play MPEG-4 video file from LOKII TF card

Returns

result 1 for success, 0 for error

3.1.1.16 readMotorPosition()

```
int LOKII::readMotorPosition (
            int motorid )
```

Read motor position (hardware exclusive function)

Read a smart servo current position

Parameters

motorid	the motor id

Returns

position moro postion in degree (1 -100)

3.1.1.17 recAudio()

```
int LOKII::recAudio (
            String filename )
```

Start audio recording.

Start audio recording in mp3 format and save it to the TF card

Parameters

filename	filename for recording audio

Returns

result 0 - fail, 1 - success

3.1.1.18 recordMotor()

```
void LOKII::recordMotor (
            int numSeconds )
```

Record motors' position (hardware exclusive function)

Record all smart servo motor position for specified numSeconds duration

Parameters

numSeconds	the duration in seconds (1- 30)

3.1.1.19 recordVideo()

```
int LOKII::recordVideo (
            String filename )
```

Start recording video from camera.

Start MPEG-4 video recording and save to internal TF card

Returns

result 1 - success , 0 - fail

3.1.1.20 registerColor()

```
void LOKII::registerColor ( )
```

Register a custom color for color detection.

Train LOKII to recognize a custom color object which is posited at the centre of the LCD screen region The trained custom color can then be recognized by setCameraMode(L_CAM_RECOGNIZE_CUSTOM) function To have a good training process, make sure : 1) the color object is not reflective 2) the color object size is around 30

3.1.1.21 setCameraMode()

```
void LOKII::setCameraMode (
            int cameraState )
```

Set LOKII camera running mode for image processing function.

Set LOKII camera to perform image processing functions.

Parameters

cameraState	define the image processing function L_CAM_RECOGNIZE_RGB - perform Red/Green/Blue color detection in camera live stream L_CAM_RECOGNIZE_CUSTOM - perform self-trained color detection in camera live stream L_CAM_FACE_DETECT - perform frontal face detection in camera live stream L_CAM_PREVIEW - set camera to preview mode, no image processing is performed

3.1.1.22 setDCMotor()

```
int LOKII::setDCMotor (
            int motorid,
            int speed,
            int direction )
```

Move DC motor (hardware exclusive function)

Move a DC motor connected on a LOKII smart motor control board

Parameters

motorid	the motor id
speed	green color channel brigtness (0-31, 0 - stop motor, 1-slowest , 31 - fastest PWM speed)
direction	0 - clockwise, 1 - anti-clockwise

Returns

0 - success , other value - fail

3.1.1.23 setMIDIBPM()

```
void LOKII::setMIDIBPM (
            int bpmIn )
```

Set MIDI BPM duration.

Set MIDI Beat Per Minute (BPM) setting between 30 - 100

Parameters

bpmIn	the BPM value

3.1.1.24 setMotorPower()

```
void LOKII::setMotorPower (
            int motorid,
            int state )
```

Turn ON/OFF a motor power (hardware exclusive function)

Set a smart motor power state, either turn on the motor or turn off the motor

Parameters

motorid	the motor smart device id
state	the power state, 0 - OFF, 1 - ON

3.1.1.25 setRCServo()

```
int LOKII::setRCServo (
            int motorid,
            int speed,
            int position )
```

Move RC servo (hardware exclusive function)

Move a RC servo motor attached on LOKII smart motor board (For example, MG90S, MG996R)

Parameters

motorid	the motor id
speed	speed (0 1-20)
position	blue color channel brigtness (1-200)

Returns

0 - success , other value - fail

3.1.1.26 setRGB()

```
void LOKII::setRGB (
            int motorid,
            int r,
            int g,
            int b )
```

Set smart LED color (hardware exclusive function)

Set a smart LED color using primitive Red, Green, Blue color settting

Parameters

motorid	the motor id
r	red color channel brigtness (0-255)
g	green color channel brigtness (0-255)
b	blue color channel brigtness (0-255)

3.1.1.27 setSmartDeviceAdress()

```
void LOKII::setSmartDeviceAdress (
            int id )
```

Set the smart device id.

Set the smart device id (address) In order to set the smart device id, make use only single smart device is attached in the LOKII smart device bus physically.

Parameters

id	the smart device id ranged between 0 - 100 inclusively

Returns

Get smart devices count

Get the number of smart devices attached in the LOKII system.

Returns

The number of smart device

3.1.1.28 setVolume()

```
void LOKII::setVolume (
            int vol )
```

Set audio output volume level of LOKII.

Set audio output volume level between 0 -10 inclusively 0 = silence 10 = max sound level

Parameters

vol	volume level (0 -10)

3.1.1.29 startSpeechRecognize()

```
void LOKII::startSpeechRecognize (
            int wordgroupIndex )
```

Start/Stop speech recognition

Start speech recognition for trained word groups in Speaker Independent mode (SI) (index can be 1, 2, 3, 4) index 1 is number group for "0", "1", "2", "3", "4", "5", "6", "7", "8", "9", "10"
2 is action group for "Action", "Move", "Turn", "Run", "Look", "Attack", "Stop", "Hello" 3 is movement group for "Turn Left", "Turn Right", "Move Up", "Move Down", "Go Forward", "Go Backward" 4 is command group for "Tell me a joke", "play me a song", "stop the music", "take a photo", "show me a photo", "track my face", "follow the ball", "recrod motor motion", "playback motor", "list commands"

if index specified is 11 -20 inclusively, it will start speech recognition in custom trainning data (Speaker Dependent)

if index = 0, it means STOP the speech recognition

Parameters

wordgroupIndex	the index for word groups, either 0 , 1, 2, 3,4

3.1.1.30 stopPlayVideo()

```
int LOKII::stopPlayVideo ( )
```

Stop the video playback on screen.

Stop the video playback

Returns

result 0 for success

3.1.1.31 stopRecAudio()

```
int LOKII::stopRecAudio (
            void  )
```

stop audio recording

Returns

result 0

3.1.1.32 stopRecordMotor()

```
int LOKII::stopRecordMotor (
            void  )
```

Stop motor's position recording (hardware exclusive function)

Stop smart servo motors positions recording which is trigged by recordMotor(int numSeconds) function

3.1.1.33 stopRecordVideo()

```
int LOKII::stopRecordVideo ( )
```

Stop the video recording from camera.

Stop the video recording and save it into internal TF card

Returns

result 0 for success

3.1.1.34 stopSound()

```
void LOKII::stopSound ( )
```

Stop audio playback.

Stop the audio playback from playSoundFile() function in non-blocking mode.

3.1.1.35 takePhoto()

```
int LOKII::takePhoto (
            String filename )
```

Take photo.

Take a photo from camera live stream and stored it in LOKII TF card.

Parameters

filename	the jpeg photo filename, for example, a.jpg

Returns

result 1 for success, other for error

3.1.1.36 trainSDkeyword()

```
int LOKII::trainSDkeyword (
            int groupIndex,
            int keywordsIndex )
```

Train a Speaker Dependent (SD) keyword

Train a speaker dependent audio on a specified index group using LOKII built-in microphone (This speech recognition is speaker dependent for the training data)

For each keyword audio, it is recommended to train for at least 3 audio samples to get a better training result.

Parameters

groupIndex	the index for training word groups (11-20 inclusively)
keywordsIndex	the index for the keywords want to trained (1-5 inclusively)

Returns

result 1 - complete , 0 - incomplete (require more training samples)

3.1.1.37 waitForBlobResult()

```
int LOKII::waitForBlobResult (
            bool isBlocking = true )
```

Wait (check) for color blob detection result.

Wait or check for color blob detection result after issuing setCameraMode(L_CAM_RECOGNIZE_RGB) or set↩ CameraMode(L_CAM_RECOGNIZE_CUSTOM) After this function call, a copy of the color result will be cached

Parameters

isBlocking	define the color blob detection behavior if isBlocking = L_OFF, this function will return immediately regardless of color blob detected (NON-BLOCKING) if isBlocking = L_ON, this function will hold until at least one color objected is detected. (BLOCKING)

Returns

result number of color object detected

3.1.1.38 waitForFaceResult()

```
int LOKII::waitForFaceResult (
            int faceState )
```

Wait for face detected result.

Wait or check for face detected result after issuing setCameraMode(L_CAM_FACE_DETECT) After this function call, a copy of the face result will be cached

Parameters

faceState	define the face detection behavior

if faceState = L_OFF, this function will return immediately regardless of face detected (NON-BLOCKING)
if faceState = L_ON, this function will hold until a face is detected. (BLOCKING)

Returns

result 1 - face detected , 0 - face not detected (in NON-BLOCKING mode only)

3.1.1.39 waitForSpeechResult()

```
int LOKII::waitForSpeechResult ( )
```

Wait for the recognized speech keywords index (BLOCKING)

Wait for the recongnized speech keywords index used in "startSpeechRecognize" functions

Returns

result the zero-based index of the recognized keywords

The documentation for this class was generated from the following file:

- LOKII.h