



VSource interface C++ library

v1.1.0

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Overview

VSource C++ library provides standard interface as well defines data structures and rules for different video source classes (video capture classes). **VSource** interface class doesn't do anything, just provides interface. Also **VSource** class provides data structures for video source parameters. Different video source classes inherit interface from **VSource** C++ class. **VSource.h** file contains data structures **VSourceParams** class, **VSourceCommand** enum, **VSourceParam** enum and includes **VSource** class declaration. **VSourceParams** class contains video source params and includes methods to encode and decode video source params. **VSourceCommands** enum contains IDs of commands supported by **VSource** class. **VSourceParam** enum contains IDs of params supported by **VSource** class. All video sources should include params and commands listed in **VSource.h** file. VSource class dependency:

- [Frame](#) class which describes video frame structure and pixel formats.
- [ConfigReader](#) class which provides methods to work with JSON structures (read/write).

Versions

Table 1 - Library versions.

Version	Release date	What's new
1.0.0	13.06.2023	First version
1.0.2	20.06.2023	- Fixed bugs. - Documentation updated.
1.1.0	29.06.2023	- Added new parameters. - Documentation updated.

Video source interface class description

Class declaration

VSource interface class declared in **VSource.h** file. Class declaration:

```
namespace cr
{
    namespace video
    {
        /**
         * @brief video source interface class.
         */
        class VSource
        {
        public:
            /**
```

```

    * @brief Get string of current library version.
    * @return String of current library version.
    */
static std::string getVersion();
/**
    * @brief Open video source. All params will be set by default.
    * @param initString Init string. Format depends on implementation.
    * Default format: <video device or ID or file>;<width>;<height>;<fourcc>
    * @return TRUE if the video source open or FALSE if not.
    */
virtual bool openVSource(std::string& initString) = 0;
/**
    * @brief Init video source. All params will be set according to structure.
    * @param params Video source parameters structure.
    * @return TRUE if the video source init or FALSE if not.
    */
virtual bool initVSource(VSourceParams& params) = 0;
/**
    * @brief Get open status.
    * @return TRUE if video source open or FALSE if not.
    */
virtual bool isVSourceOpen() = 0;
/**
    * @brief Close video source.
    */
virtual void closeVSource() = 0;
/**
    * @brief Get new video frame.
    * @param frame Frame object to copy new data.
    * @param timeoutMsec Timeout to wait new frame data:
    * timeoutMs == -1 - Method will wait endlessly until new data arrive.
    * timeoutMs == 0 - Method will only check if new data exist.
    * timeoutMs > 0 - Method will wait new data specified time.
    * @return TRUE if new data exists and copied or FALSE if not.
    */
virtual bool getFrame(Frame& frame, int32_t timeoutMsec = 0) = 0;
/**
    * @brief Set video source param.
    * @param id Parameter ID.
    * @param value Parameter value to set.
    * @return TRUE if property was set or FALSE.
    */
virtual bool setParam(VSourceParam id, float value) = 0;
/**
    * @brief Get video source parameter value.
    * @param id Parameter ID according to camera specification.
    * @return Parameter value or -1.
    */
virtual float getParam(VSourceParam id) = 0;
/**
    * @brief Get video source params structure.
    * @return Video source parameters structure.
    */
virtual VSourceParams getParams() = 0;
/**
    * @brief Execute command.

```

```

    * @param id Command ID .
    * @return TRUE if the command accepted or FALSE if not.
    */
    virtual bool executeCommand(VSourceCommand id) = 0;
};
}
}

```

getVersion method

getVersion() method returns string of current version of **VSource** class. Particular video source class can have it's own **getVersion()** method. Method declaration:

```
static std::string getVersion();
```

Method can be used without **VSource** class instance:

```
std::cout << "VSource class version: " << VSource::getVersion() << std::endl;
```

Console output:

```
VSource class version: 1.1.0
```

Console output:

openVSource method

openVSource(...) method initializes video source. Instead of **openVSource(...)** method user can call **initVSource(...)**. Method declaration:

```
virtual bool openVSource(std::string& initString) = 0;
```

Parameter	Value
initString	Initialization string. Particular video source class can have specific format. Default format: [video device or ID or file];[width];[height];[fourcc]. Example: "/dev/video0;1920;1080;YUYV".

Returns: TRUE if the video source open or FALSE if not.

initVSource method

initVSource(...) method initialized video source. Instead of **initVSource(...)** method user can call **openVSource(...)**. Method declaration:

```
virtual bool initVSource(VSourceParams& params) = 0;
```

Parameter	Value
params	VSourceParams structure (see VSourceParams description). The video source should set parameters according to params structure. Particular video source can support not all parameters listed in VSourceParams structure.

Returns: TRUE if the video source open or FALSE if not.

isVSourceOpen method

isVSourceOpen() method returns video source initialization status. Initialization status also included in **VSourceParams** structure. Method declaration:

```
virtual bool isVSourceOpen() = 0;
```

Returns: TRUE if the video source open (initialized) or FALSE if not.

closeVSource method

closeVSource() method intended to close video source. Method declaration:

```
virtual void closeVSource() = 0;
```

getFrame method

getFrame(...) method intended to get input video frame. Method declaration:

```
virtual bool getFrame(Frame& frame, int32_t timeoutMsec = 0) = 0;
```

Parameter	Value
frame	Output video frame (see Frame class description). Video source class determines output pixel format. Pixel format can be set in initVSource(...) or openVSource(...) methods if particular video source supports it.
timeoutMsec	Timeout to wait new frame data: - timeoutMs == -1 - Method will wait endlessly until new data arrive. - timeoutMs == 0 - Method will only check if new data exist. - timeoutMs > 0 - Method will wait new data specified time. Each video source implementation must provide described behavior.

Returns: TRUE if new data exists and copied or FALSE if not.

setParam method

setParam(...) method designed to set new video source parameters value. Method declaration:

```
virtual bool setParam(VSourceParam id, float value) = 0;
```

Parameter	Description
id	Video source parameter ID according to VSourceParam enum.
value	Video source parameter value.

Returns: TRUE is the parameter was set or FALSE if not.

getParam method

getParam(...) method designed to obtain video source parameter value. Method declaration:

```
virtual float getParam(VSourceParam id) = 0;
```

Parameter	Description
id	Video source parameter ID according to VSourceParam enum.

Returns: parameter value or -1 of the parameters doesn't exist in particular video source class.

getParams method

getParams(...) method designed to obtain video source params structures. Method declaration:

```
virtual VSourceParams getParams() = 0;
```

Returns: video source parameters structure (see **VSourceParams** class description).

executeCommand method

executeCommand(...) method designed to execute video source command. Method declaration:

```
virtual bool executeCommand(VSourceCommand id) = 0;
```

Parameter	Description
id	Video source command ID according to VSourceCommand enum.

Returns: TRUE is the command was executed or FALSE if not.

Data structures

VSource.h file defines IDs for parameters (**VSourceParam** enum), IDs for commands (**VSourceCommand** enum) and **VSourceParams** class.

VSourceCommand enum

Enum declaration:

```
enum class VSourceCommand
{
    /// Restart.
    RESTART = 1
};
```

Table 2 - Video source commands description. Some commands maybe unsupported by particular video source class.

Command	Description
RESTART	Restart video source (close and open again).

VSourceParam enum

Enum declaration:

```
enum class VSourceParam
{
    /// [read/write] Log level:
    /// 0 - Disable, 1 - Console, 2 - File, 3 - Console and file.
    LOG_LEVEL = 1,
    /// [read/write] Frame width.
    WIDTH,
    /// [read/write] Frame height.
    HEIGHT,
    /// [read/write] Gain mode. Depends on implementation.
    /// Default: 0 - Manual, 1 - Auto.
    GAIN_MODE,
    /// [read/write] Gain value in case manual gain mode.
    /// value: 0(min) - 65535(max).
    GAIN,
    /// [read/write] Exposure mode. Depends on implementation.
    /// Default: 0 - Manual, 1 - Auto.
    EXPOSURE_MODE,
    /// [read/write] Exposure value in case manual exposure mode.
    /// value: 0(min) - 65535(max).
    EXPOSURE,
    /// [read/write] Focus mode. Depends on implementation.
```

```

    /// Default: 0 - Manual, 1 - Auto.
    FOCUS_MODE,
    /// [read/write] Focus position.
    /// Value: 0(full near) - 65535(full far).
    FOCUS_POS,
    /// [read only] Cycle processing time microseconds.
    CYCLE_TIME_MKS,
    /// [read/write] FPS. 0 - will be set automatically.
    FPS,
    /// Open flag. 0 - not open, 1 - open.
    IS_OPEN,
    /// Custom parameter. Depends on implementation.
    CUSTOM_1,
    /// Custom parameter. Depends on implementation.
    CUSTOM_2,
    /// Custom parameter. Depends on implementation.
    CUSTOM_3
};

```

Table 3 - Video source params description. Some params maybe unsupported by particular video source class.

Parameter	Access	Description
LOG_LEVEL	read / write	Logging mode. Default values: 0 - Disable. 1 - Only file. 2 - Only terminal. 3 - File and terminal.
WIDTH	read / write	Frame width. User can set frame width before initialization or after. Some video source classes may set width automatically.
HEIGHT	read / write	Frame height. User can set frame height before initialization or after. Some video source classes may set height automatically.
GAIN_MODE	read / write	Gain mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
GAIN	read / write	Gain value. Value: 0(min for particular video source class) - 65535(max for particular video source class).
EXPOSURE_MODE	read / write	Exposure mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
EXPOSURE	read / write	Exposure value. Value: 0(min for particular video source class) - 65535(max for particular video source class).
FOCUS_MODE	read / write	Focus mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
FOCUS_POS	read / write	Focus position. Value: 0(full near) - 65535(full far).

Parameter	Access	Description
CYCLE_TIME_MKS	read only	Video capture cycle time. VSource class sets this value automatically.
FPS	read / write	FPS. User can set frame FPS before initialization or after. Some video source classes may set FPS automatically.
IS_OPEN	read only	Open flag. 0 - not open, 1 - open.
CUSTOM_1	read / write	Custom parameter. Depends on implementation.
CUSTOM_2	read / write	Custom parameter. Depends on implementation.
CUSTOM_3	read / write	Custom parameter. Depends on implementation.

VSourceParams class

VSourceParams class used for video source initialization (**initVSource(...)** method) or to get all actual params (**getParams()** method). Also **VSourceParams** provide structure to write/read params from JSON files (**JSON_READABLE** macro, see [ConfigReader](#) class description) and provide methods to encode and decode params. Class declaration:

```
class VSourceParams
{
public:
    /// Log level: 0 - Disable, 1 - Console, 2 - File, 3 - Console and file.
    int logLevel{0};
    /// Video source name.
    std::string source{"/dev/video0"};
    /// FOURCC: RGB24, BGR24, YUYV, UYVY, GRAY, YUV24, NV12, NV21, YU12, YV12.
    std::string fourcc{"YUYV"};
    /// Frame width. 0 - will be set automatically.
    int width{1920};
    /// Frame height. 0 - will be set automatically.
    int height{1080};
    /// Gain mode. Depends on implementation. Default: 0 - Manual, 1 - Auto.
    int gainMode{1};
    /// Gain value in case manual gain mode. Value: 0(min) - 65535(max).
    int gain{0};
    /// Exposure mode. Depends on implementation. Default: 0 - Manual, 1 - Auto.
    int exposureMode{1};
    /// Exposure value in case manual exposure mode. Value: 0(min) - 65535(max).
    int exposure{1};
    /// Focus mode. Depends on implementation. Default: 0 - Manual, 1 - Auto.
    int focusMode{1};
    /// Focus position. Value: 0(full near) - 65535(full far).
    int focusPos{0};
    /// Cycle processing time microseconds.
```

```

int cycleTimeMks{0};
/// FPS. 0 - will be set automatically.
float fps{0};
/// Open flag.
bool isOpen{false};
/// Custom param 1. Depends on implementation.
float custom1{0.0f};
/// Custom param 2. Depends on implementation.
float custom2{0.0f};
/// Custom param 3. Depends on implementation.
float custom3{0.0f};

JSON_READABLE(VSourceParams,
               LogLevel,
               source,
               fourcc,
               width,
               height,
               gainMode,
               gain,
               exposureMode,
               exposure,
               focusMode,
               focusPos,
               fps,
               custom1,
               custom2,
               custom3);

/**
 * @brief operator =
 * @param src Source object.
 * @return VSourceParams object.
 */
VSourceParams& operator= (const VSourceParams& src);
/**
 * @brief Encode params. The method doesn't encode params:
 * source and fourcc.
 * @param data Pointer to data buffer.
 * @param size Size of data.
 */
void encode(uint8_t* data, int& size);
/**
 * @brief Decode params. The method doesn't decode params:
 * source and fourcc.
 * @param data Pointer to data.
 * @return TRUE is params decoded or FALSE if not.
 */
bool decode(uint8_t* data, int size);
};

```

Table 4 - VSourceParams class fields description.

Field	type	Description
logLevel	int	Logging mode. Default values: 0 - Disable printing log info. 1 - Only printing in file. 2 - Only printing in terminal. 3 - File and terminal printing.
source	string	Video device name (depends on OS), video source or file. Format depends on particular video source class.
fourcc	string	FOURCC: RGB24, BGR24, YUYV, UYVY, GRAY, YUV24, NV12, NV21, YU12, YV12. Value says to video source class which pixel format preferable for output video frame. Particular video source class can ignore this params during initialization. Parameters should be set before initialization.
width	int	Frame width. User can set frame width before initialization or after. Some video source classes may set width automatically.
height	int	Frame height. User can set frame height before initialization or after. Some video source classes may set height automatically.
gainMode	int	Gain mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
gain	int	Gain value. Value: 0(min for particular video source class) - 65535(max for particular video source class).
exposureMode	int	Exposure mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
exposure	int	Exposure value. Value: 0(min for particular video source class) - 65535(max for particular video source class).
focusMode	int	Focus mode. Value depends on implementation. Default values: 0 - Manual control, 1 - Auto.
focusPos	int	Focus position. Value: 0(full near) - 65535(full far).
cycleTimeMks	int	Video capture cycle time. VSource class sets this value automatically.
fps	float	FPS. User can set frame FPS before initialization or after. Some video source classes may set FPS automatically.
isOpen	bool	Open flag. FLASE - video source not open, TRUE - video source open.
custom1	float	Custom parameter. Depends on implementation.
custom2	float	Custom parameter. Depends on implementation.
custom3	float	Custom parameter. Depends on implementation.

None: *VSourceParams* class fields listed in Table 4 **must** reflect params set/get by methods *setParam(...)* and *getParam(...)*.

Encode video source params

VSourceParams class provides method **encode(...)** to serialize video source params (fields of *VSourceParams* class, see Table 4). Serialization of video source params necessary in case when you need to send video source params via communication channels. Method doesn't encode fields: **source** and **fourcc**. Method declaration:

```
void encode(uint8_t* data, int& size);
```

Parameter	Value
data	Pointer to data buffer. Buffer size should be at least 43 bytes.
size	Size of encoded data. 43 bytes by default.

Example:

```
// Prepare random params.
VSourceParams in;
in.source = "alsfghljb";
in.fourcc = "skdfjhvk";
in.logLevel = "dsglbjlkfjwjgre";
in.cycleTimeMks = rand() % 255;
in.exposure = rand() % 255;
in.exposureMode = rand() % 255;
in.gainMode = rand() % 255;
in.gain = rand() % 255;
in.focusMode = rand() % 255;
in.focusPos = rand() % 255;
in.fps = rand() % 255;
in.width = rand() % 255;
in.height = rand() % 255;
in.isOpen = true;

// Encode data.
uint8_t data[1024];
int size = 0;
in.encode(data, size);

cout << "Encoded data size: " << size << " bytes" << endl;
```

Decode video source params

VSourceParams class provides method **decode(...)** to deserialize video source params (fields of **VSourceParams** class, see Table 4). Deserialization of video source params necessary in case when you need to receive video source params via communication channels. Method doesn't decode fields: **source** and **fourcc**. Method declaration:

```
bool decode(uint8_t* data, int size);
```

Parameter	Value
data	Pointer to encode data buffer. Data size should be at least 43 bytes.
size	Size of encoded data. 43 bytes by default.

Returns: TRUE if data decoded (deserialized) or FALSE if not.

Example:

```
// Encode data.
VSourceParams in;
uint8_t data[1024];
int size = 0;
in.encode(data, size);

cout << "Encoded data size: " << size << " bytes" << endl;

// Decode data.
VSourceParams out;
if (!out.decode(data, size))
    cout << "Can't decode data" << endl;
```

Build and connect to your project

Typical commands to build **VSource** library:

```
git clone https://github.com/ConstantRobotics-Ltd/VSource.git
cd VSource
git submodule update --init --recursive
mkdir build
cd build
cmake ..
make
```

If you want connect **VSource** library to your CMake project as source code you can make follow. For example, if your repository has structure:

```
CMakeLists.txt
src
    CMakeList.txt
    yourLib.h
    yourLib.cpp
```

You can add repository **VSource** as submodule by commands:

```
cd <your repository folder>
git submodule add https://github.com/ConstantRobotics-Ltd/VSource.git
3rdparty/VSource
git submodule update --init --recursive
```

In you repository folder will be created folder **3rdparty/VSource** which contains files of **VSource** repository with subrepositories **Frame** and **ConfigReader**. New structure of your repository:

```
CMakeLists.txt
src
    CMakeList.txt
    yourLib.h
    yourLib.cpp
3rdparty
    VSource
```

Create CMakeLists.txt file in **3rdparty** folder. CMakeLists.txt should contain:

```
cmake_minimum_required(VERSION 3.13)

#####
## 3RD-PARTY
## dependencies for the project
#####
project(3rdparty LANGUAGES CXX)

#####
## SETTINGS
## basic 3rd-party settings before use
#####
# To inherit the top-level architecture when the project is used as a submodule.
SET(PARENT ${PARENT}_YOUR_PROJECT_3RDPARTY)
# Disable self-overwriting of parameters inside included subdirectories.
SET(${PARENT}_SUBMODULE_CACHE_OVERWRITE OFF CACHE BOOL "" FORCE)

#####
## CONFIGURATION
## 3rd-party submodules configuration
#####
SET(${PARENT}_SUBMODULE_VSOURCE ON CACHE BOOL "" FORCE)
if (${PARENT}_SUBMODULE_VSOURCE)
    SET(${PARENT}_VSOURCE ON CACHE BOOL "" FORCE)
    SET(${PARENT}_VSOURCE_PARAMS_TEST OFF CACHE BOOL "" FORCE)
endif()
```

```
#####
## INCLUDING SUBDIRECTORIES
## Adding subdirectories according to the 3rd-party configuration
#####
if (${PARENT}_SUBMODULE_VSOURCE)
    add_subdirectory(VSource)
endif()
```

File **3rdparty/CMakeLists.txt** adds folder **VSource** to your project and excludes test application (VSource class test applications) from compiling. Your repository new structure will be:

```
CMakeLists.txt
src
    CMakeList.txt
    yourLib.h
    yourLib.cpp
3rdparty
    CMakeLists.txt
    VSource
```

Next you need include folder 3rdparty in main **CMakeLists.txt** file of your repository. Add string at the end of your main **CMakeLists.txt**:

```
add_subdirectory(3rdparty)
```

Next you have to include VSource library in your **src/CMakeLists.txt** file:

```
target_link_libraries(${PROJECT_NAME} VSource)
```

Done!