

# Suspicious Behavior Detection System

**VibraMid**

## Manual

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# CONTENT

<b>1. Introduction</b>	<b>3</b>
<b>1.1. Basic applications</b>	<b>3</b>
<b>1.2. Specifications</b>	<b>3</b>
1.2.1. Basic parameters	3
1.2.2. Digital (web) camera requirements	3
1.2.3. System requirements for local module computer	4
<b>1.3. Package contents</b>	<b>4</b>
<b>2. VibraMid software installation</b>	<b>5</b>
<b>2.1. VibraMid software activation</b>	<b>5</b>
2.1.1. Standard activation	6
2.1.2. DEMO activation	8
<b>2.2. Reinstallation of VibraMid</b>	<b>9</b>
<b>3. VibraMid. User's manual</b>	<b>14</b>
<b>3.1. Main window</b>	<b>16</b>
<b>3.2. Main menu</b>	<b>17</b>
3.2.1 Menu «File»	18
3.2.2 Menu «View»	19
3.2.3. Menu «Settings»	19
3.2.3.1 Submenu «Video»	20
3.2.4. Menu «Action»	22
3.2.5 Menu «Help»	22
<b>3.3. Toolbar</b>	<b>22</b>
<b>3.4. Information column</b>	<b>23</b>
3.4.1. Information column. VI mode	24
3.4.2. Information column. Mode of parameters settings	25
3.4.3. Information column. DB (data base) mode	29
<b>3.5. Save of measurements results</b>	<b>30</b>
3.5.1. Save of current images	31
3.5.2. Save of video file	31
3.5.3. Save of results and settings files	32
<b>4. Macro mode. Suspicious behavior detection in flow</b>	<b>33</b>
<b>4.1. Face detection mode</b>	<b>35</b>
<b>4.2. First start and settings determination</b>	<b>39</b>
<b>5. Warranty</b>	<b>41</b>
<b>5.1. Disclaimer of Warranties</b>	<b>41</b>
<b>5.2 Limitation of Liability</b>	<b>42</b>

# 1. Introduction

Welcome to the **VibraImage** World! Thank you for your purchase of **VibraMid** system. This Manual is written to help you enjoy **vibraimaging** and open new features in well-known objects!

**VibraImage** technology measures micromovement (micro motion, vibration) of person by standard digital, web or television cameras and image processing. Human head microvibration is linked with the vestibular-emotional reflex (VER) of a person and reflects emotion status and personality traits. **VibraMid** system detects human emotions by the control of three dimensional (3D) head-neck movements and fluctuations, accumulated as frame difference in several video frames.

## 1.1. Basic applications

**VibraMid** is designed for technical profiling and detection of suspicious behavior person. **VibraMid** solves the following aims:

- Suspicious behavior detection of person in flow;
- Passengers flow monitoring;
- Macro movements control.

## 1.2. Specifications

### 1.2.1. Basic parameters

- |   |            |
|---|------------|
| • Resolution, TVL, more than                | 400        |
| • Noise level of VibraImage, bit, less than | 0,1        |
| • Frame speed, frame/sec, more than         | 25         |
| • Frequency range, Hz, more than            | 0,1 ÷ 10,0 |

### 1.2.2. Digital (web) camera requirements

The camera is supplied upon customer's request.

- |                                 |                         |
|---------------------------------|-------------------------|
| • Sensor                        | CCD or CMOS Sensor      |
| • Resolution, pixel., more than | 640 x 480               |
| • USB and IP compatible         | USB 3.0.; USB 2.0.      |
| • Frame speed, f/s, more than   | 25                      |
| • Microphone                    | external                |
| • Exposition control            | auto and manual         |
| • Color mode                    | color and B/W switch    |
| • Flicker mode                  | Flicker 50 Hz and 60 Hz |

### 1.2.3. System requirements for local module computer

- |   |                      |   |
|---|----------------------|---|
| • | Operation System     | Windows XP Prof/Vista/7/8 with DirectX 9.0 or later |
| • | Processor            | Pentium Core Duo 2 2400 MHz or more                 |
| • | RAM                  | more than 1024 Mb                                   |
| • | HDD                  | more than 10 Gb                                     |
| • | USB port             | 1 free USB ports version USB 2.0                    |
| • | Installed software 1 | DirectX 9.0 or later                                |
| • | Installed software 2 | Windows Microsoft.NET Framework 1.1 or later        |
| • | Video capture        | WDM-compatible video device                         |

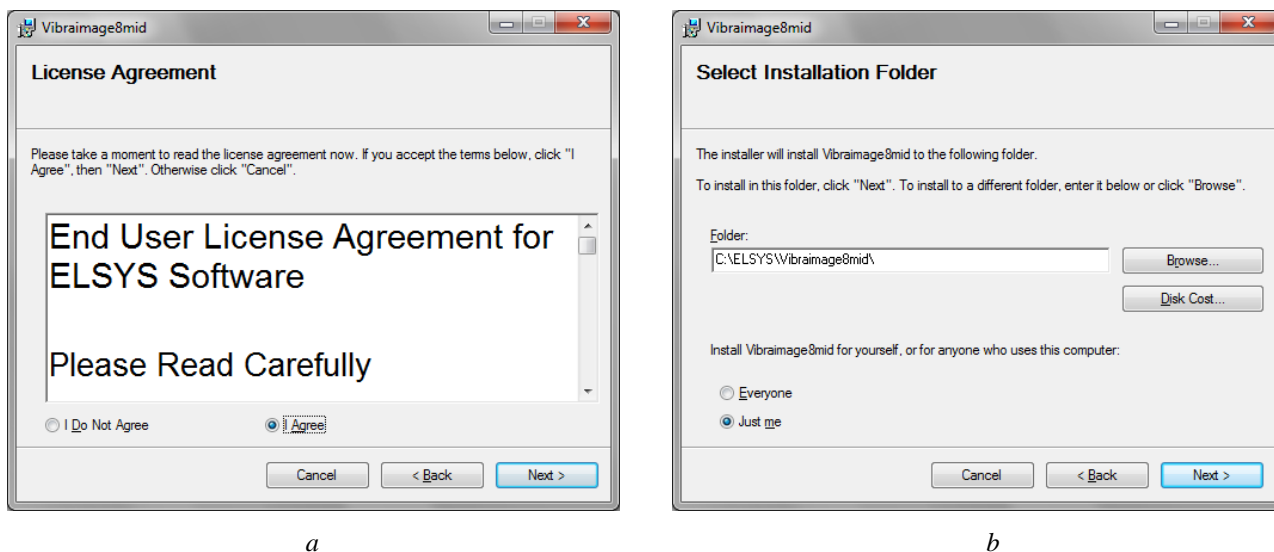
### 1.3. Package contents

- |    |                             |   |   |
|----|-----------------------------|---|---|
| 1. | <b>VibraMid</b> software    | - | 1 |
| 2. | Activation code             | - | 1 |
| 3. | User's manual               | - | 1 |
| 4. | Digital USB camera (option) | - | 1 |
| 5. | Microphone (option)         | - | 1 |
| 6. | Personal computer (option)  | - | 1 |

## 2. VibraMid software installation

To install VibraMid please follow steps below:

1. Go to Web page <http://www.psymaker.com/support/downloads/>
2. Load file Vibraimage8mid.exe <http://www.psymaker.com/downloads/Vibraimage8mid.exe>
3. Run file Vibraimage8mid.exe from archive file
4. Press button «Next» in the appeared window of the beginning installation.
5. Accept the license agreement and to press button «Next» in the appeared window (fig.2.1a).



*Fig.2.1a – the license agreement, b – the catalogue choice for record of the program*

6. In the appeared window specify a way to the catalogue where files of the program will be written down, then to press button «Next» (fig.2.1b).
7. Press button «Next» in the appeared window, allows installation of software files on your computer.
8. Press button «Finish» at the end of installation.
9. VibraMid program pictogram appears after the end of installation in system menu and on desktop of your computer.
10. To reboot a computer.

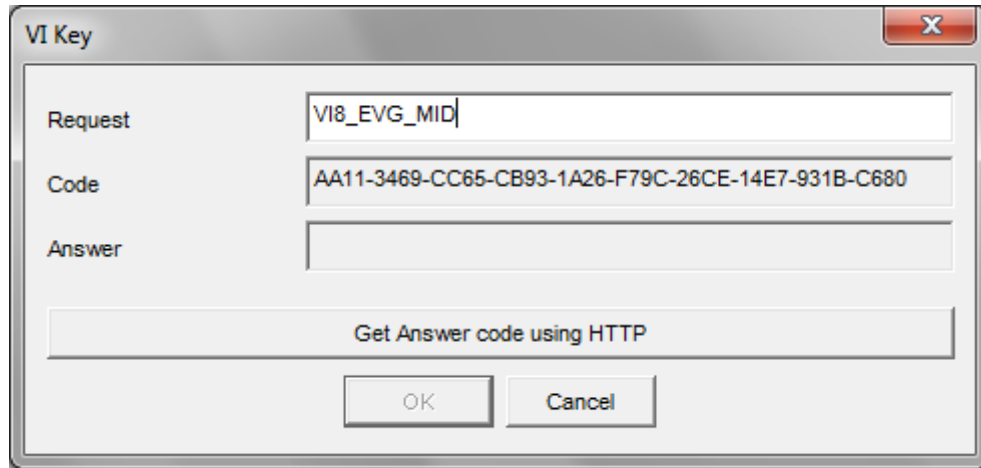
### 2.1. VibraMid software activation

#### Attention:

1. Procedure of activation is made once at the first start of the program.
2. Before the standard program activation is necessary to buy this modification of the program by online shop Psymaker <http://www.psymaker.com/store/>
3. Activation procedure requests access to the Internet for receiving answer code from server.
4. Activation code has the structure «VI8\_XXXXXX\_MID».

### 2.1.1. Standard activation

1. To start activation it is necessary to get starts the program **VibraMid**.
2. At the first start of the program the activation window will be displayed (fig.2.2).



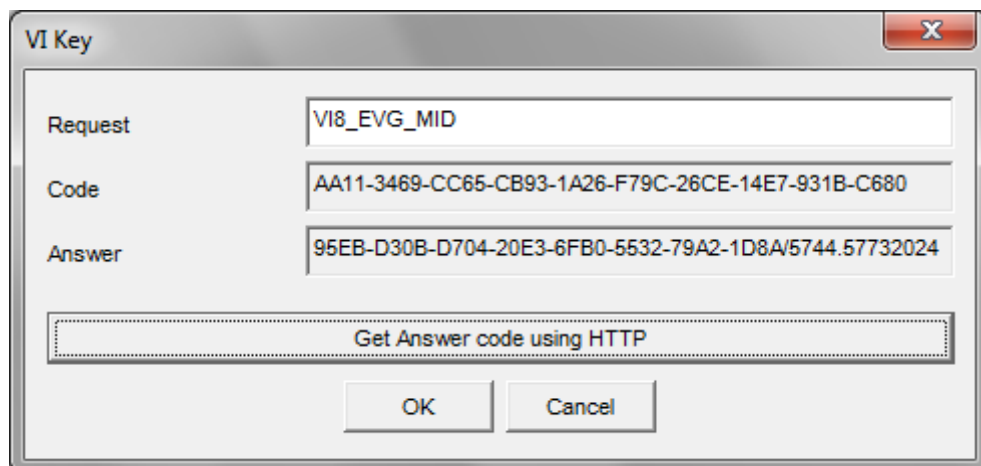
*Fig. 2.2. Activation window*

3. In the field «**Request**» it is necessary to enter the activation code received by e-mail or specified by the seller. After input of activation code to press the button «**Get Answer code using HTTP**».

**Attention!**

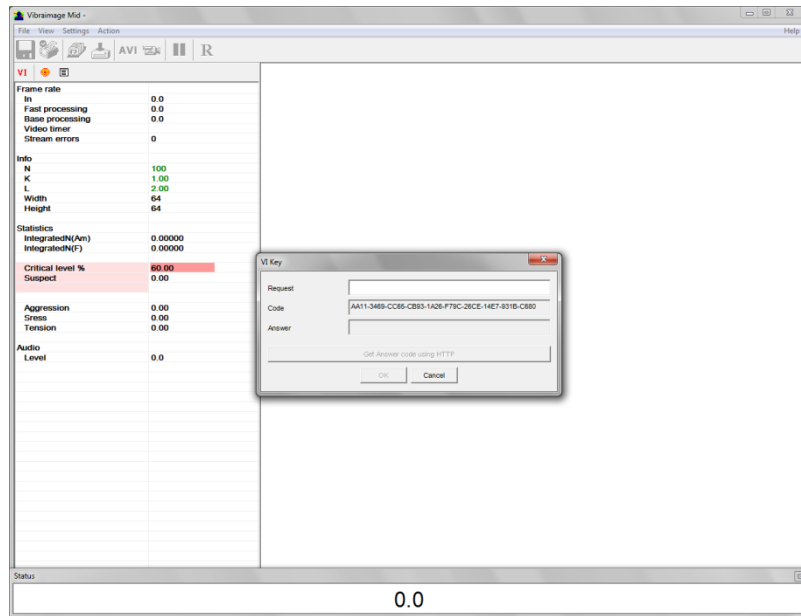
**Please, be careful and paste code without additional gaps!**

4. The activation code will be checked up through the Internet and, in case of successful end of activation procedure, the answer code will be sent (fig. 2.3).



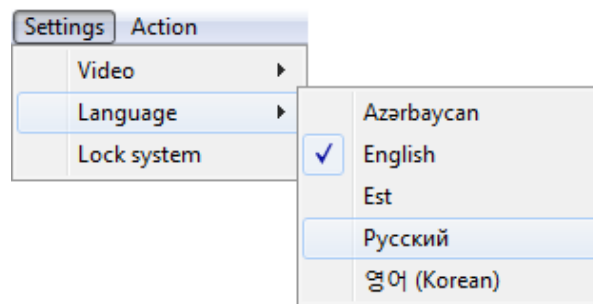
*Fig. 2.3. Successful activation*

5. Press button «**OK**». **VibraMed** will be automatically started. After starting program you will see white screen (fig. 2.4).



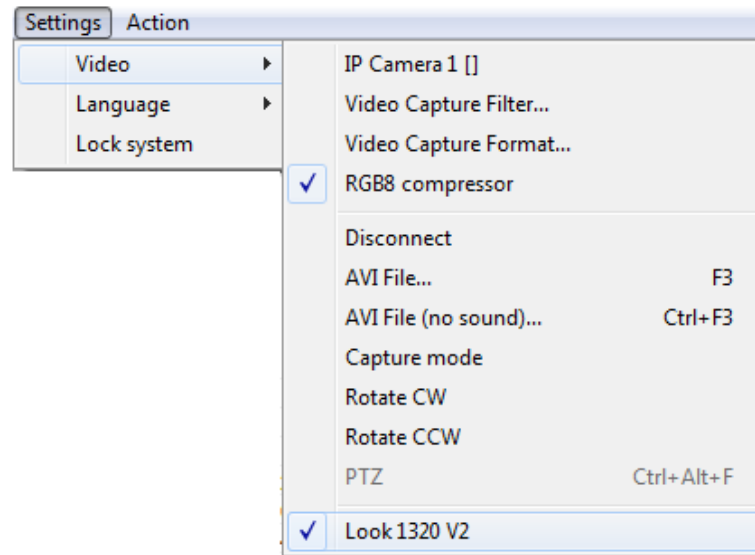
*Fig. 2.4. The first start of the program*

6. To select program language in the menu **«Settings»** => **«Language»** (fig. 2.5).



*Fig. 2.5. The choice of the program language*

7. After connecting to the computer the camera to select the camera for operation in the menu **«Settings»** => **«Video»** (fig. 2.6 – camera Look 1320 V2).



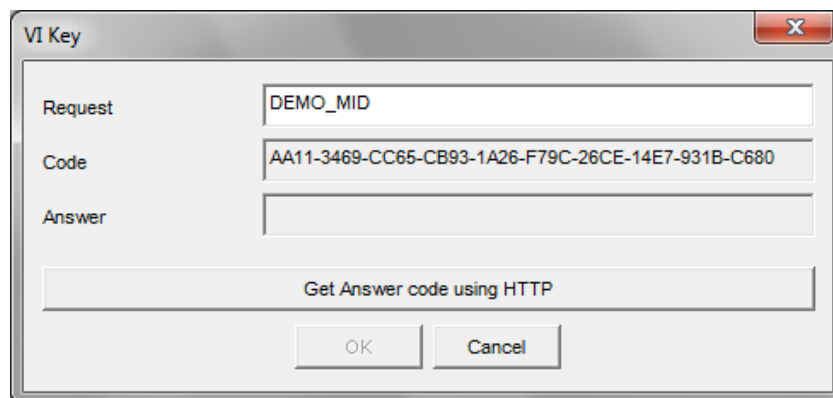
*Fig. 2.6. The camera connecting*

8. Start operation with system.

### 2.1.2. DEMO activation

**Note, for each modification you have a possibility of the program start in the DEMO mode only 5 times. Then the Internet code is required to be bought.**

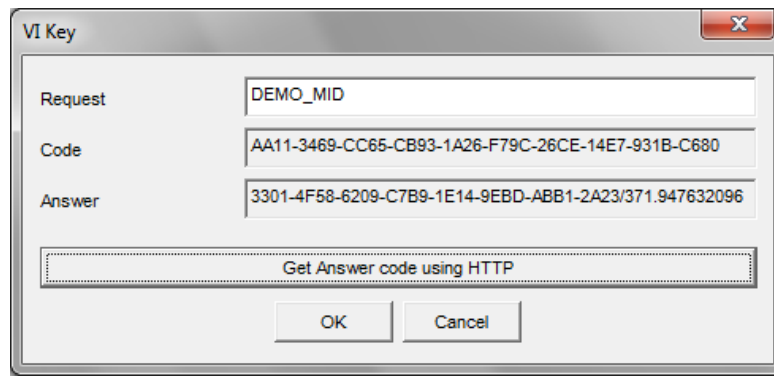
1. To start activation it is necessary to get starts the program **VibraMid**.
2. At the first start of the program the activation window will be displayed (fig. 2.7).



*Fig. 2.7. DEMO activation window*

3. In the field «**Request**» it is necessary to enter uppercase letters of «**DEMO\_MED**» (fig. 2.7). After input of a demo activation code to press the button «**Get Answer code using HTTP**».
4. The activation code will be checked up through the Internet and, in case of successful end of activation procedure, the answer code will be sent and will be appeared in the field «**Answer**» (fig.2.8).





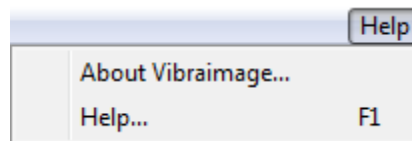
*Fig. 2.8. Successful DEMO activation*

5. Further items 5-8 as in case «**Standard activation**» (see section 2.1.1).

## 2.2. Reinstallation of **VibraMid**

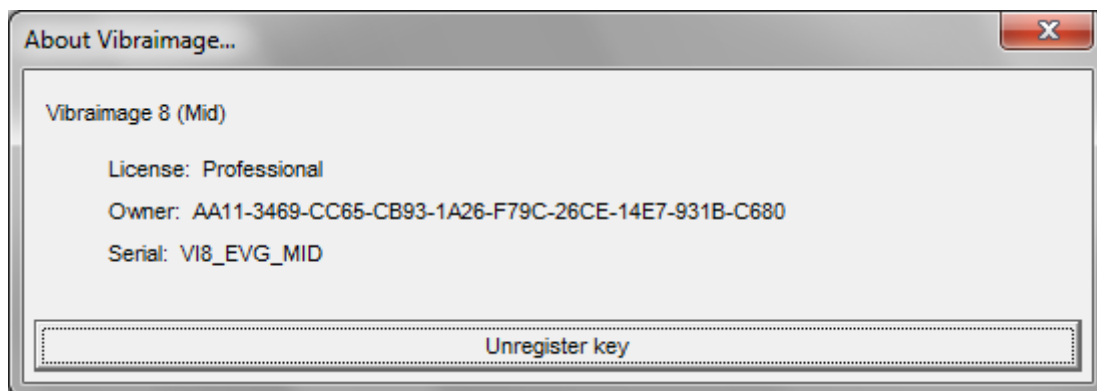
**Note**, the ability to reinstall chosen **VibraMid** on a new computer. This operation is also recommended before any upgrade SW or HW on PC. For this purpose it is necessary to execute the following actions:

1. To connect computer with **VibraMid** to the Internet.
2. To start **VibraMid**
3. In a program window, having pressed the mouse right button, to cause the menu and to choose item «About Vibraimage...» (fig.2.9).



*Fig. 2.9. Menu «Help»*

4. In the opened window to press the button «**Unregister key**» (fig.2.10).



*Fig. 2.10. Information about **VibraMid***

5. Close the program.

6. Connect a new computer to Internet.
7. On the new computer to install the chosen program modification and to make registration of an «old» modification activation code through the Internet, according to recommendations of section 2.1.
8. After successful program registration the given activation code will be fixed to the given computer.

## 2.3 Camera's setting

### 2.3.1 Video camera choice

It is necessary to select in the main menu «**Settings**» => «**Video**» => «**.../name used camera/...**». In figure 2.11 the process of selecting the camera «**Look 1320 V2**» is shown. If the camera is connected, selected and works, then the left of the name there will be an icon «**✓**» (fig. 2.12), and the menu will be extended with the «**Video capture filter...**» and «**Video capture format...**».

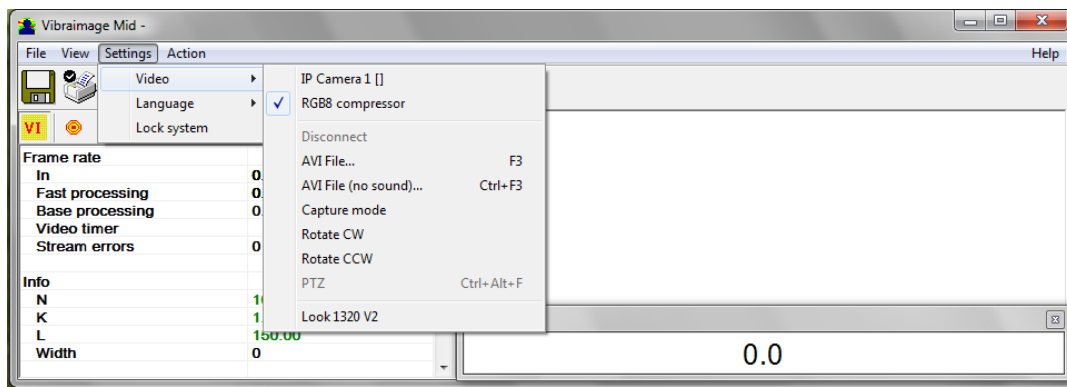


Fig. 2.11. Example of camera choice

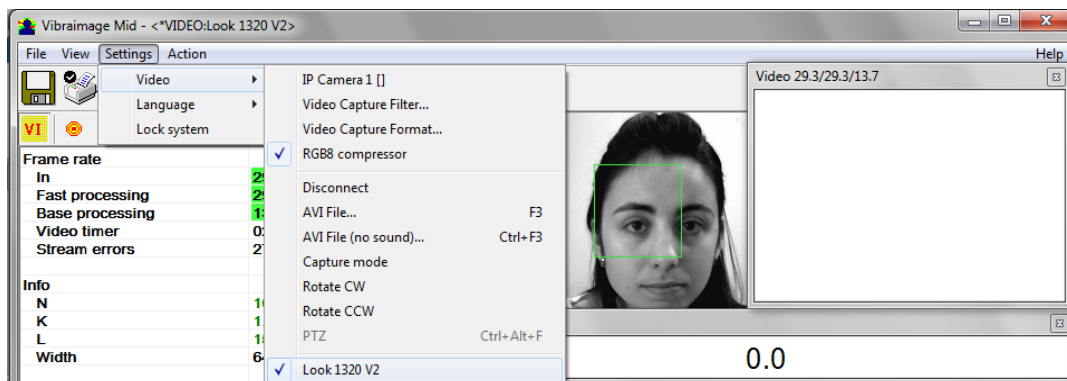


Fig. 2.12 The camera «Look 1320 V2» is selected

## 2.3.2 Video capture filter

To open the camera settings menu you should select «**Video capture filter.....**» in the submenu «**Video**» (fig. 2.13). Item «**Video capture filter...**» appears in the menu only in case of the correct installation of drivers of the camera and a choice of the working camera.

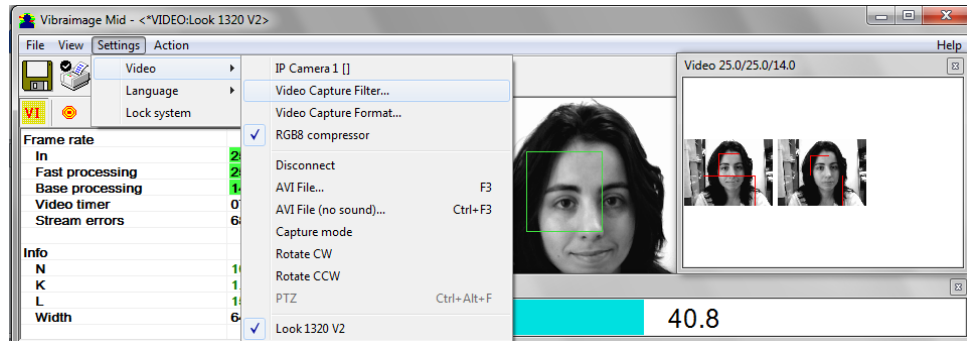


Fig. 2.13. Opening of the camera's settings menu («Video capture filter...»).

After a choice of the «**Video capture filter...**» the window «**Settings**» excellent at different cameras will open. The first tab of this window is usually devoted to the image setup (Brightness, Contrast, etc.). In a figure 2.14 the window «**Settings**» for the camera «Microsoft LifeCam Cinema», and in a figure 2.15 for the camera «Look 1320 V2» is shown. Camera Microsoft LifeCam Cinema has low noise level and is preferable for vibraimage applications among webcams.

«Brightness», «Contrast» and other parameters should be set up so that image of object has more contrast. Switching on/off flicker-effect from artificial lighting could be necessary for some illumination types.

Depending on the experimental conditions and light is necessary to select auto or manual settings «**Focus**», «**Exposure**». If the illumination is constant, then it is recommended to use manual configuration, if you change (for example, the illumination of an object depends on street lighting), it is better to use automatic configuration. The «**Scale**» (Zoom) is recommended to select based on two factors. Firstly you need to have maximum image size of control object and it is preferably to stand maximum zoom level. From the other side high level of electronic zoom in some cameras could go down the frame rate and it is necessary to control this parameter and fixed frame rate more than 25 f/s. So for webcam Microsoft LifeCam Cinema the optimal meaning of zoom for personal control is 4, see Fig. 2,14. For other cameras is possible to adjust other optimal zoom settings.

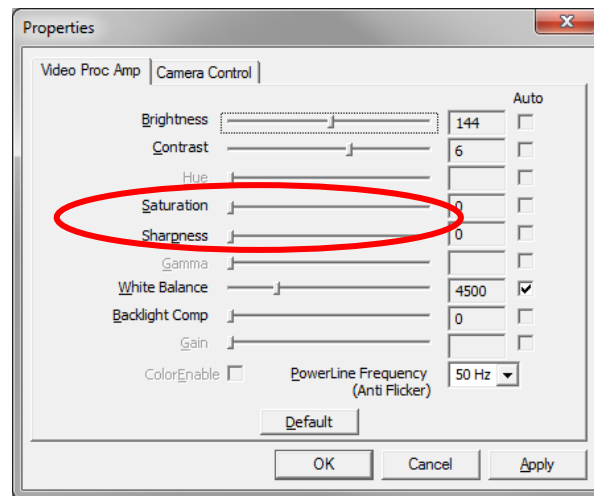


Fig. 2.14. Video setting, camera « Microsoft LifeCam Cinema»

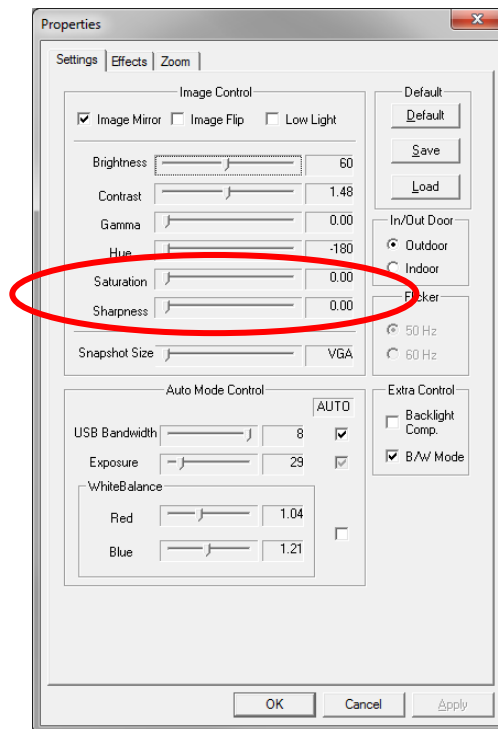


Fig. 2.15 Window «Settings», video setting, camera «Look 1320 V2»

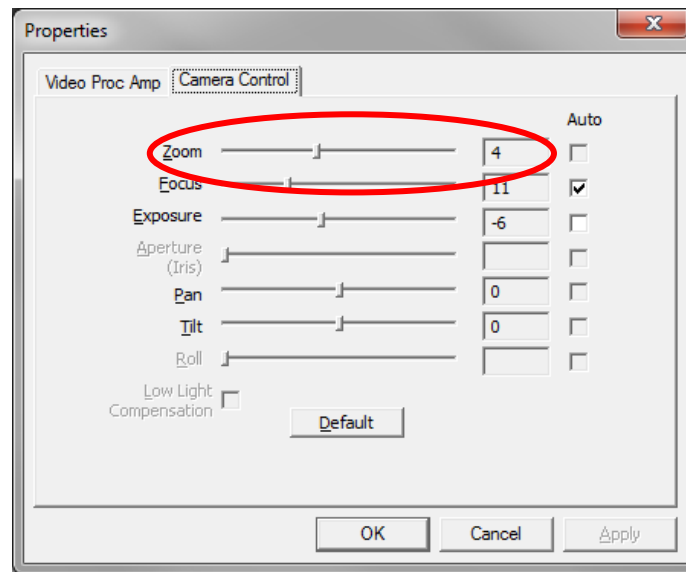


Fig. 2.16. Zoom setting, camera « Microsoft LifeCam Cinema»

### 2.3.3 Video capture format

Select «**Video capture filter...**» in the submenu «**Video**» (fig. 2.17) for open menu of the camera settings. Item «**Video capture format...**» appears in the menu only in case of the correct installation of drivers of the camera and a choice of the working camera. Frame rate is necessary to set 30 and the frame size to set ("Output Size") not less than 640 x 480 elements (fig. 2.18).

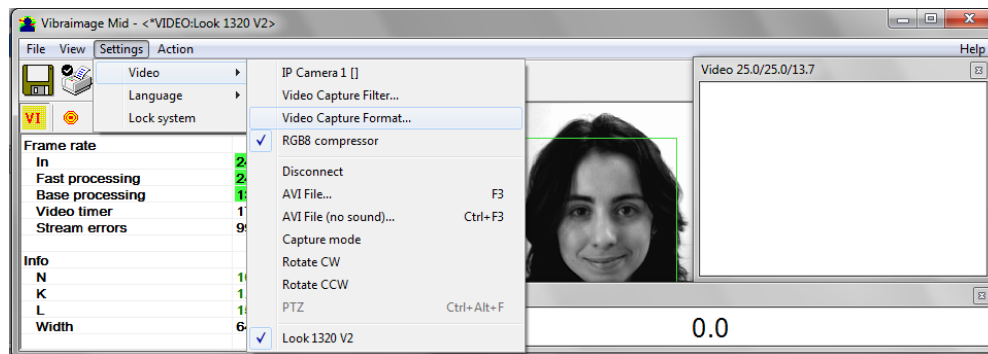


Fig. 2.17. Opening the settings window «Video capture format»

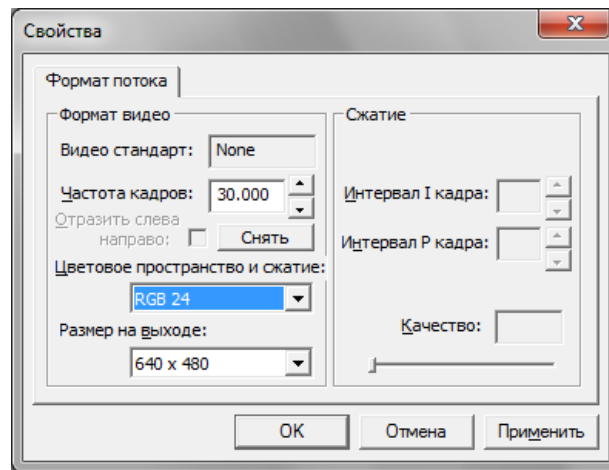


Fig. 2.18. Window «Video capture format»

**Note**, after changing camera settings in the program **VibraImage PRO** frame rate «In» must be in the range of 25 – 30 frames/s. The parameter IntegratedN (Am) indicating in main menu must be minimum and not exceeding 0.1. In other case the vibraimage processing could be wrong.

### 2.3.4 Checking the settings on the test table

During the first start of Vibraimage system and periodically it is recommended to test image quality by the test table. It is required to place a test pattern opposite to the camera so that the image of the table occupies the entire space of the frame. To achieve the optimal contrast range of object is need to stand in camera settings auto regulation of illumination in case of unstable illumination (fig. 2.19) and manual regulation of illumination in case of a constant illumination (fig. 2.20).

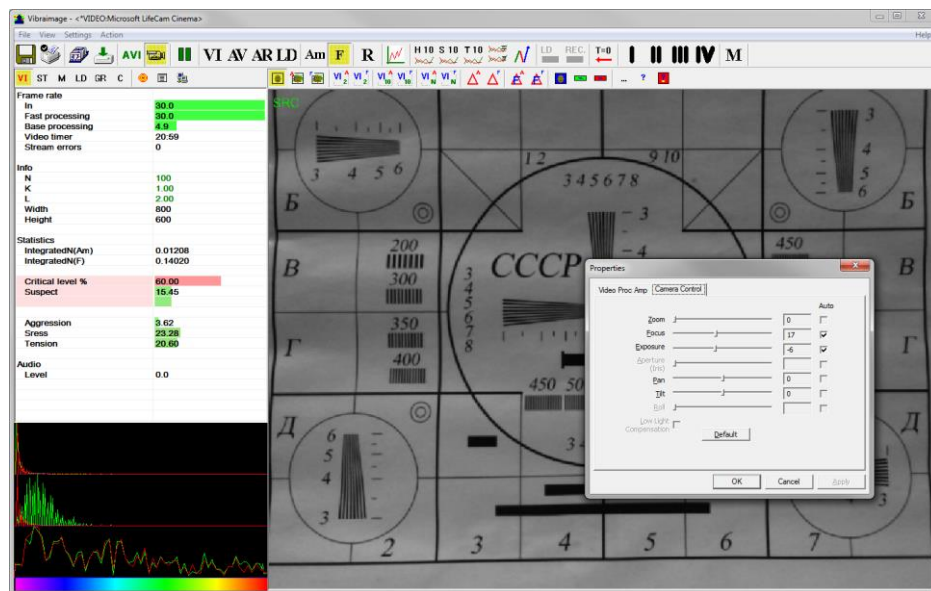


Fig. 2.19. Checking the camera settings on the test table, automatic regulation of the exposure (mode is recommended for unstable object illumination).

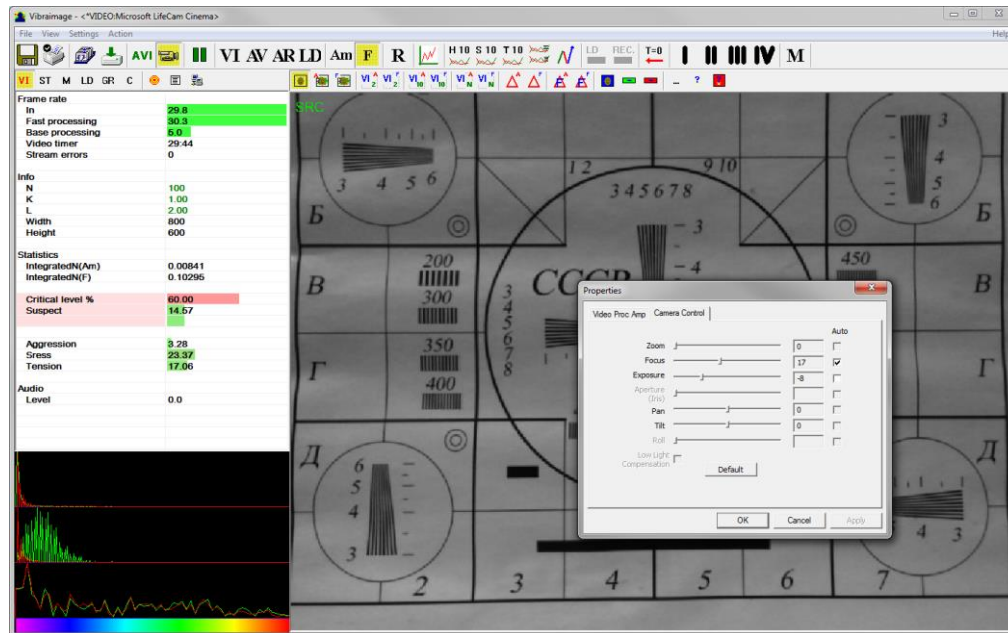


Fig. 2.20 Checking the camera settings on the test table, manual regulation of the exposure (mode is recommended for stable object illumination).

### 3. **VibraMid**. User's manual

The **VibraMid** software is based on vibraimage technology and intended for suspicious behavior detection, research of person macromovements and monitoring of abnormal behaviour in flow and crowd.

The **VibraMid** software allows controlling macro movements parameters as micro vibration. Controlled vibration range depends only from the camera lens angle, camera-object distance and movement amplitude of person. Head microvibration informatively expressed reflex movements (Vestibular-Emotional Reflex) but it's well known that human body macro movements expressed behavior and emotions, too. Macro movements control has powerful advantage compared with microvibrations, it permits flow and crowd control. Both of them are realized by Vibraimage system with different settings.

#### 3.1. Main window

Main window (fig. 3.1) consists of the following parts:

- image area;
- main menu;
- toolbar;
- panel of usage modes of information column;
- information column;
- the status window (switch on in the «View» menu);
- the video window (switch on in the «View» menu).

In an information column (at the left side on the screen) it is displayed, calculated by the program, values of person emotion level parameters.

In heading of the basic window the following information is indicated (fig. 3.1):

- type of video source: Video camera or AVI file;
- model of video source: Video camera model or AVI file name;
- name of program.



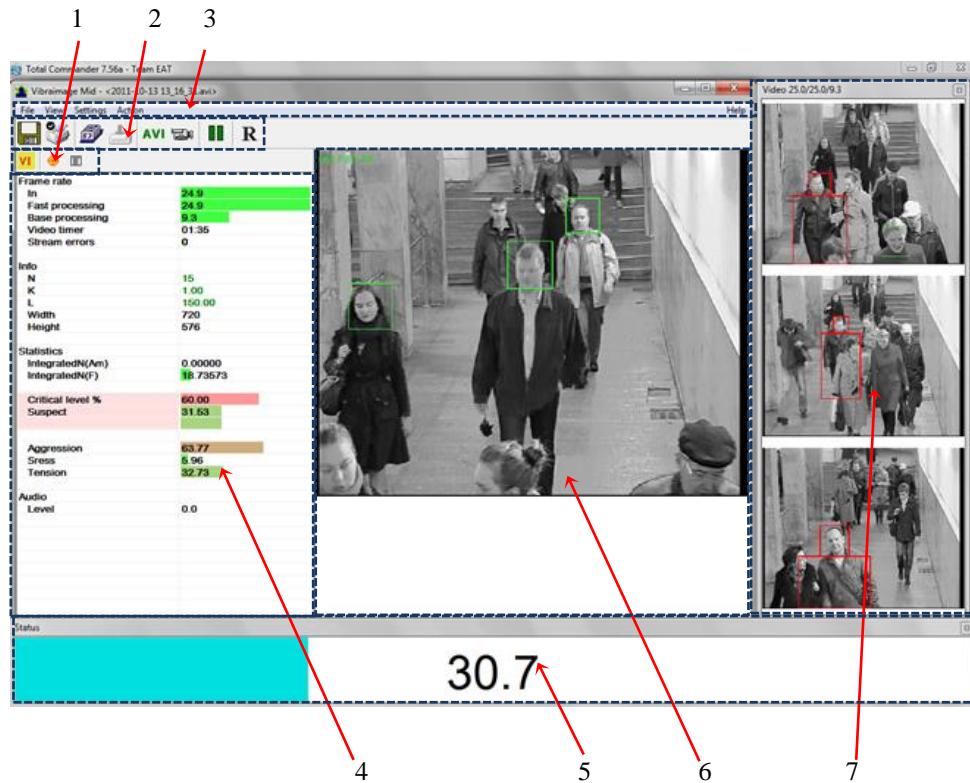


Fig. 3.1. Main window *VibraMid*. 1 – panel of usage modes of information column, 2 – toolbar, 3 – main menu, 4 – information column, 5 – status window, 6 – image area, 7 – video window.

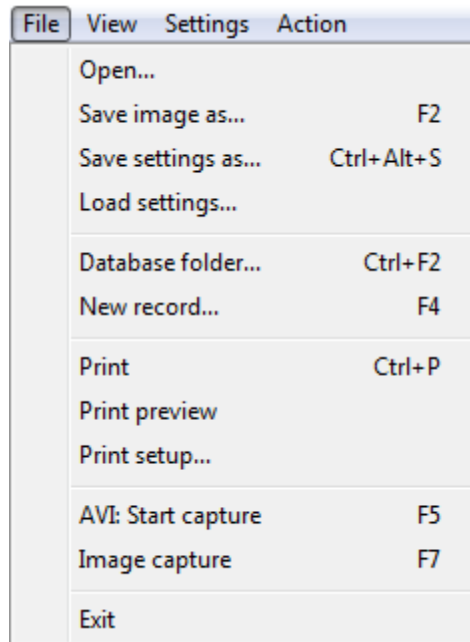
### 3.2. Main menu

The main menu contains the following items:

- «File»
- «View»
- «Settings»
- «Action»
- «Help»

### 3.2.1 Menu «File»

Menu «**File**» (fig. 3.2) contains following items:



*Fig. 3.2. Menu «File»*

Item «**Open...**» – for viewing and printing the saved file of XML format with parameters of system for the supervision interval.

Item «**Save image as...**» – saving the current frame of a window in BMP, JPG, PNG or GIF-file.

Item «**Save settings as ...**» it is intended for saving of the current system settings to the external file.

Item «**Load settings ...**» it is intended for loading before saved the system settings from an external file.

Item «**Database folder...**» – changing folder where archive data is kept. If the database folder is not specified, record of AVI or BMP files is blocked.

#### Note

Until you specify a folder to archive record of AVI and BMP files in the archive will be blocked.

Item «**New record...**» – create a new record in archive folder. Further saving of AVI and BMP files in archive will be made in the folder connected to a name of entered record.

Item «**Print**» – printing the current frame from image area.

Item «**Print Preview**» – printing preview of current frame from image area.

Item **Print Setup...**» – set printing options.

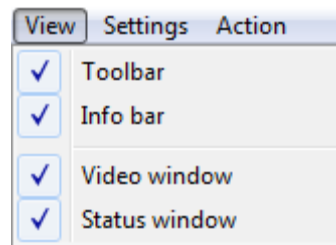
Item «**AVI: Start Capture**» – start record AVI-file. If the database folder is not specified, record of AVI files is blocked.

Item «**Image capture...**» – stop record AVI-file.

Item «**Exit**» – exit from program.

### 3.2.2 Menu «View»

Menu «View» (fig. 3.3) defines visible in the basic window information and contains the following items:



*Fig. 3.3. Menu «View»*

Item «**Toolbar**» – switch on/off the toolbar.

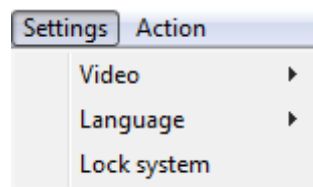
Item «**Info bar**» – switch on/off the information panel.

Item «**Video windows**» – switch on/off the small windows with real image (fig.3.1).

Item «**Status windows**» – switch on/off the windows with current suspect level (fig.3.1).

### 3.2.3. Menu «Settings»

Menu «Settings» (fig. 3.4) allows choosing language, locking system and contains the following items:



*Fig. 3.4. Menu «Settings»*

**VibraMid** allows to process «live» video signal coming from a video camera and video data recorded before and saved as AVI-file. On default the system works with a signal from a video camera.

### 3.2.3.1 Submenu «Video»

Submenu «**Video**» contains options of video modes. Its can differ depending on connected devices. For example this menu contains the following items (fig.3.5). You can choose as video source one from many installing in PC video-devices or load external video file.

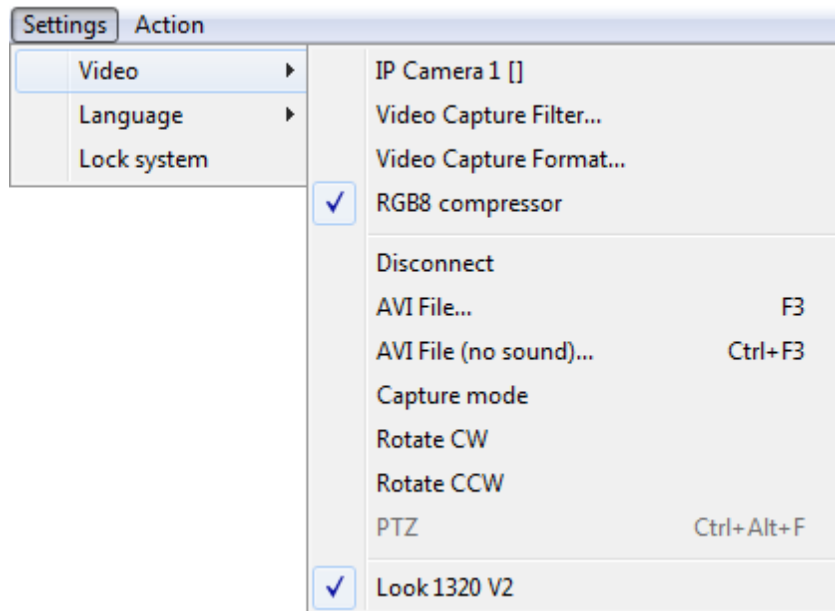
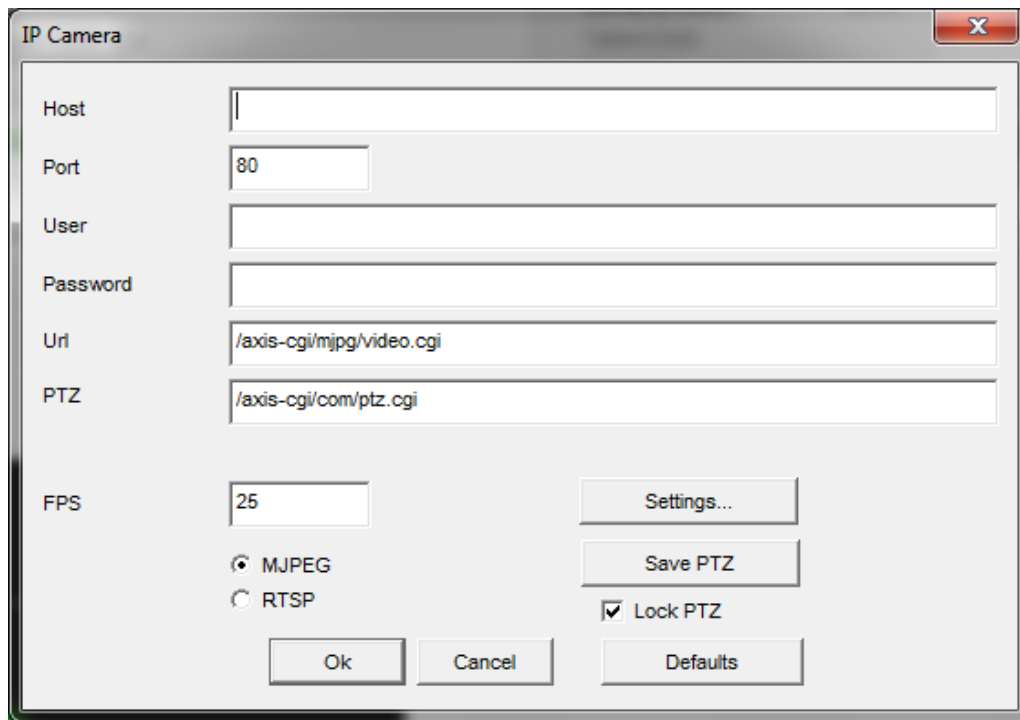


Fig. 3.5. Submenu «Video»

Subitem « **IP camera 1** » allows setting network parameters for access to IP camera. After setting up an IP camera in the submenu «**Video**» menu «**Settings**» there is an additional item to be set other IP camera.

#### Note

For network cameras from different manufacturers field contents may be vary. Value of parameters «**Host**», «**Port**», «**User**» and «**Password**» (fig.3.6) it is necessary to receive at the your local network administrator.



*Fig. 3.6. Settings window of the network IP camera*

Subitem «**Video Capture Filter...**» – by pressing the window of video device setting (contrast, exposition, brightness) opens. Each device has the especial window of settings.

Subitem «**Video Capture Format...**» – change video capture format.

Subitem «**RGB8 compressor**» are intended for management of a videofile record format. If this item is chosen, that, for economy of a space on a hard disk, the videofile saved in a black-and-white format.

Subitem «**Disconnect**» allows to disconnect all videocamera or videofile.

Subitems «**AVI File...**» and «**AVI File (no sound)...**» [AVI File (no sound)...] are intended for selecting for the analysis of an external video file.

Subitem «**Capture mode**» is intended for working with cameras in which driver support separate streams of video output on the screen and write to the file. When this mode delay set the camera to record video and back are minimal.

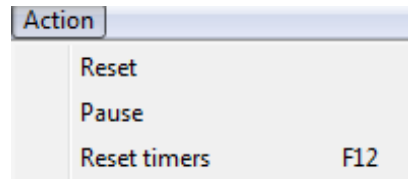
Subitems «**Rotate CW**» and «**Rotate CCW**» allow to make turn of an input video image on 90 and 270 degrees before its processing in the VibraMed.

Subitem «**PTZ**» is available to all IP cameras and allows to set up parameters of PTZ-cameras.

The bottom menu allows you to choose a used device video capture (as, for example, «Look 1320 V2») from multiple installed on this computer..

### 3.2.4. Menu «Action»

Menu «**Action**» (fig. 3.7) contains the following items:



*Fig.3.7. Menu «Action»*

Item «**Reset**» – reset all saved up information and statistics about frames and start new cycle collection of information.

Item «**Pause**» – stop last accepted frame of data in image area of windows.

Item «**Reset timer**» – reset to «0» all timers: video file timer, graph timer. The conclusion video and construction of graph begins all over again.

### 3.2.5 Menu «Help»

Menu «**Help**» (fig. 2.9) is in the main menu on the right side

Item « **About VibraMid...**» is intended to view the software version, the registered user name (Owner), the key number protection (Serial) and expiry date of the license (Limited) (fig. 2.10).

Use «**Help**» command to call the help system.

## 3.3. Toolbar

Toolbar of **VibraMid** shown on the fig. 3.8.



*Fig. 3.8. Toolbar of VibraMid*

Tools panel of **VibraMid** program includes functions corresponding to buttons on the Tools panel from left to right:



– saving current image;



– printing current image;



– image capture;



– AVI file - start record;



– loading AVI file;



– connection of operating video source, for example, webcams;



– pause;






– R – reset all accumulated information about frame difference.

### 3.4. Information column

Indication of information column (fig. 3.9) depends on using mode:



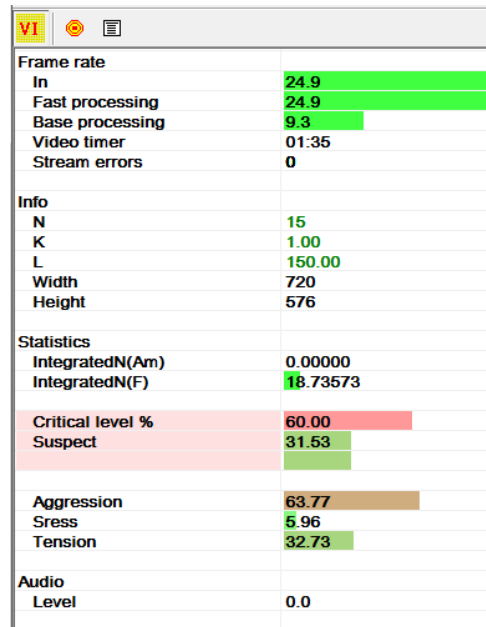
*Fig. 3.9. Modes of the information column*

- In the mode  information about adjustments of system and results of data vibraimage processing is displayed;
- In the mode  settings of basic parameters for work with **VibraMid** are configured;
- In the mode  input and selection of the demographic information and a folder for archive storage is configured.

**Note,** values of parameters in fields which are allocated by a green font, can be changed by the user (fig. 3.10, parameters N, K, L – it is possible to change in Information table). For this purpose it is necessary to bring the mouse pointer to the chosen field and twice to click the left button of a mouse.

### 3.4.1. Information column. VI mode

In the mode «**VI**» information panel (fig. 3.10) displays following information:



VI	
<b>Frame rate</b>	
In	24.9
Fast processing	24.9
Base processing	9.3
Video timer	01:35
Stream errors	0
<b>Info</b>	
N	15
K	1.00
L	150.00
Width	720
Height	576
<b>Statistics</b>	
IntegratedN(Am)	0.00000
IntegratedN(F)	18.73573
Critical level %	60.00
Suspect	31.53
<b>Aggression</b>	
Sress	63.77
Tension	5.96
<b>Audio</b>	
Level	0.0

Fig. 3.10. Information column in the VI mode

#### Frame rate:

- «**In**» – Number of the frames per second, received from the video source;
- «**Fast processing**» – Maximum number of the processed frames per second used for calculation. Selected by user;
- «**Base processing**» – Number of the processed frames per second used in base algorithm. Selected by user;
- «**Video Timer**» – For camera mode- displays time of supervision. For recorded video - time of current video-file record. For viewing a video-file - time from the file beginning);
- «**Stream errors**» – The counter of mistakes which increases if time between the next accepted frame unstably. This mistake can arise, if productivity of a computer suffices or poor-quality video is loaded;

#### Info:

- **N** – Number of the frames for accumulation. Selected by user;
- **K** – Gain Factor. Selected by user;
- **L** – Palette Threshold. Defines a threshold in the displayed image, value of brightness less threshold is considered «black». Selected by user;

**Width** and **Height** – Displays the current video camera or avi file resolution;



**Statistics:**

- **IntegratedN(Am)** – Average frame amplitude vibraimage intensity processed for the N frames;
- **IntegratedN(F)** – Average frame frequency vibraimage intensity processed for the N frames;
- **«Critical level %»** – threshold of a psychoemotional status of the person exposed in % in case of which exceeding on the remote terminal the warning message will be issued;
- **«Suspect»** – Calculated level of suspect for object in frame;
- **«Anger»** – Calculated level of anger for object in frame;
- **«Stress»** – Calculated level of stress for object in frame;
- **«Tension»** – Calculated level of tension for object in frame;

**Audio:**

- **«Level»** – current level of audio signal.

**3.4.2. Information column. Mode of parameters settings**

Information column in the mode of parameters settings (fig. 3.11) allows adjusting vibraimage parameters and displays the following information:

**Frame rate**

Fast processing	Frequency (fps) for processing «fast» parameters of vibraimage, noted by a word «fast»
Base processing	Frequency (fps) for processing «base» parameters of vibraimage, noted by a word «base»
FPS proc. period	Frequency of the frames (fps) during calculation period
Downrate	Reduce input frame rate. At value 3, will be processed every third frame.

**Main settings**

N(2)	Minimum number of accumulated frames. By default, 2
N(10)	Average number of accumulated frames. By default, 10
N	Maximum number of accumulated frames. By default, 100
K	Gain factor.

L	Threshold of a palette. Defines a threshold of displayed image, value of less brightness considers as «black».
Parallelization	Parallel number of processing in multi core systems. Default 0 – for Core 2 Duo.
Apply global filter	If this parameter is included, all the remaining calculated parameters change on processed by filters.

### Filters

Single points	Removes single points, surrounded by black
Extended	It is intended for reduction of noise of a video camera. Delete video noise in bit. By default, 8. This filter is important, when the object is motionless, and values changed because of camera noise.
Extended (fast)	Delete video noise for fast processing.
Stretch	Scale normalization filter to a range 0 – 255 after its «trimming» by filter « <b>Extended</b> »
Max speed contour	At the included mode, calculation fast parameters are made only inside of aura contour, at switched off - on the whole frame.
Am scale	Multiplication factor used for vibraimage visualization in a «amplitude» mode
Space	Reduce vibraimage on borders of motionless contrast objects. Frame difference <b>D</b> (x, y) is multiplied by the factor K

$$K = (1 (SV*MB)/100);$$

where SV – parameter of the filter, MB – the maximal difference between levels of brightness of a point (x, y) and the next points in the initial image

### Not:

Switching off filters accelerate the computer functionality.

Advanced user could switch filters from default settings.

**Attention**, switching-off below parameters calculation could automatically stop calculation and sets of other characteristics which used values of the switched off parameter.

Color image	No – Black and white real image in image area. Yes – color image in image area.
Crop X, Crop Y	If real image size more than 640x480 pixels, than will be use only 640x480 pixels from center part of image.
Crop X pos, Crop Y pos	When cropping images define the coordinates (position of the upper-left corner) of the clipping region

F6 HF	Sets in % frequency of a cut for the filter of high frequencies at processing F1_fast parameter.
F6 LF	Sets in % frequency of a cut for the filter of low frequencies at processing F1_fast parameter.
F6 N	Number of averaging frame at calculation of F6 parameter
FPS filter	It is used for exact synchronization with a binding to the concrete frame at work with AVI files. Frequency of the input frame from the camera divided on set Base processing frequency and for processing will undertake each N frame.
Auto downrate	Automatic calculation of « <b>Downrate</b> » parameter is made in view of frequency of the input frames, Base processing frequency and computing capacity of a computer.
Fixed contour	In this mode vibra-aura around the human contour will be built around a fixed path, and not to repeat the contours of the body.
Suspicious thresholds Ag, St, Tn	Suspicious level in the Aggression parameters (Ag), «Stress» (St), «Tension» (Tn) is set. When exceeding level of danger the system gives out a sound signal and fixes a frame.
<b>AVG filter</b>	
Anger	Number of frames for aggression level averaging
Stress	Number of frames for stress level averaging
Tension	Number of frames for tension level averaging
Suspicious	Number of frames for suspect level averaging
Macro defaults	Default settings

VI	
Frame rate	
Fast processing	0.0
Base processing	15.0
FPS proc. period	2.00
Downrate	0
Main	
N(2)	5
N(10)	10
N	15
K	1.00
L	150.00
Parallelization	0
GPU processing	No
Apply global filter	No
Filters	
Single points	Yes
Extended	8
Extended (fast)	8
Stretch	No
Max speed contour	No
Am scale	16.00
Space	4.00
color image	No
crop X	0
crop Y	0
crop X pos	0
crop Y pos	0
F6 HF	0
F6 LF	10
F6 N	100
FPS filter	No
Auto downrate	No
Fixed contour	No
Stab. X	0
Stab. Y	0
State levels	
Ag	80.00
St	80.00
Tn	80.00
Motion detector	No
level	0.10
auto reset	No
skip frames	20
AVG filter	
Aggression	10
Stress	10
Tension	10
Suspicious	0
Macro mode	Yes
level L	150
level S	5
aura mode	No
macro mode+	Yes
Face detection	Yes
Detection quality [1..4]	3
Scale 1:X	1.00
Min size	30
Max size	300
config	C:\ELSYS\Wib
draw	All
Alerts	
Critical level %	60.00
Area threshold %	0.00
Area level %	0.00
Auto capture image (s)	2
Show N image	3
Sound (Susp.)	No
Sound (A)	0 %
Sound (S)	0 %
Sound (T)	0 %
marker's beep	No
reset beep	No
Macro default	Set

Fig. 3.11. Information column. Mode of parameters settings.

### 3.4.3. Information column. DB (data base) mode

In the «DB» mode information column (fig. 3.12) adjusts parameters of recorded video information and shows the following information:

<b>VI</b>	
Capture	
max length(s)	0
purge old files (Mb)	0
timer	No
stop in	HH:MM:SS
start at	HH:MM:SS
stop at	HH:MM:SS
save src.	No
save extra info	No
save XML	No
save TXT	No
save DTF	0
save LD	No
save Faces	No
HTTP status	
capture mode	AVI
DB folder...	
Selected record	C:\ELSYS\Ivibrainage8mid\
New record...	

Fig.3.12. Information column in the DB mode

- **«Capture»:**
  - **«Max length(s)»** – Defines the maximal length (in seconds) for recorded video file. After file limit finished and closed, a new file creates.
  - **«Purge old files»** – Defines system action when the empty space on a hard disk will finish. «YES» – the oldest video files will be removed.
  - **«Timer»** - The system can begin record at the appointed time.
    - **«Stop in»** – sets time (HH (hours): MM (minutes): SS (second)) through which it is necessary to stop record of a video.
    - **«Start at»** – sets time when it is necessary to begin record of a video.
    - **«Stop at»** – sets time when it is necessary to stop record of a video.
- **«Save SRC»** - images of «dangerous» people will be written to separate BMP files.
- **«Save extra information», «save TXT», «save XML» «save DTF»** define in what format the information on system settings and on system parameters change for the period of supervision will be saved.
- **«Save Faces»** is used in the mode of setup of system for testing of different algorithms of facial recognition.
- **«HTTP status»** – the address of a remote server where results of system operation will be transferred
- **«Capture mode»** defines record of video (AVI) or images (IMG).

- «**DB folder**» – way to the database folder for written video files and files of statistics.
- «**Selected record**» – data on current object of research.
- «**New record**»: «**Name**», «**Birth date**», «**Comments**» – the demographic information on object of research

*Fig.3.13. Create «New record»*

*Fig.3.14. Viewing new record in the information column*

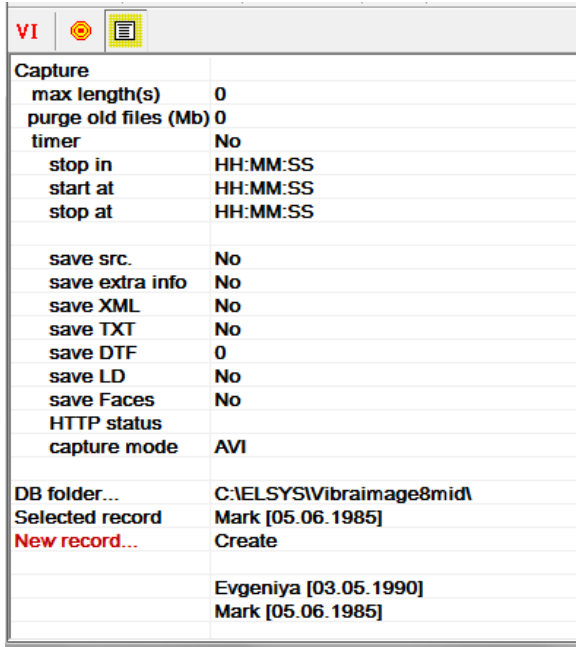
### 3.5. Save of measurements results

**Note**, the folder for saving archive the record AVI, BMP won't be specified yet and other files of settings and results in archive will be disabled. All results will remain in the uniform «\_Default» folder created in the directory where the **VibraMid** program was installed.

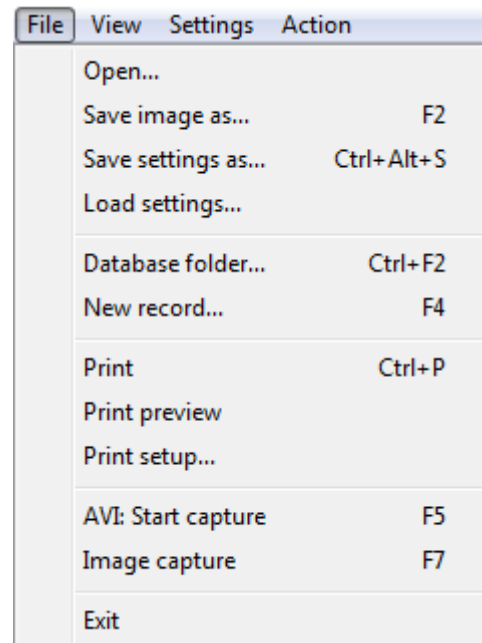
For choice of the catalogue where the video-file will be kept is intended a command «**Database folder...**» menu «**File**» or a line «**DB folder**» an information column in DB mode (fig. 3.15).

Input and save of the demographic data in a file db.info is carried out in information column in DB mode at filling corresponding fields of «**New record**»: «**Name**», «**Birth date**» and «**Comments**». After filling the demographic data in a field «**New record**» will appear an inscription «**Create**», to save the data in archive, it is necessary to bring the mouse pointer and twice click the left button of a mouse.

Filling of field «**Selected record**» is made at choice of corresponding line in the list of a database.




a)




b)

Fig.3.15. a) New record, b) menu «File»

### 3.5.1. Save of current images

Save of the current image in format BMP file is carried out with the help of a command «**Save image ...**» menu «**File**» or  toolbar.

The structured store of observable images in format BMP files according to the entered demographic data is carried out with the help of a command «**Image capture ...**» menu «**File**» or the corresponding button  of the toolbar.

### 3.5.2. Save of video file

Save of the current image which appears in the basic window, in format AVI file is carried out with the help of a command «**AVI: Start Capture**» menu «**File**». The stop of record process of AVI-file

is carried out on a command «**AVI: Stop Capture**» menu «**File**». The same actions can be executed with the help of the corresponding button  of the toolbar.

For increase of video files recording reliability designed the field «**Capture – max length (s)**» (records in seconds). If record lasts over the specified interval current AVI the file will be closed and save on a disk and record will be continued in a new file. At filling the whole disk if the switch «**Capture – purge old files**» record of new video-files will be made atop of old. The first «oldest» will leave by date of creation video-files.

### 3.5.3. Save of results and settings files

**VibraMid** program allows to save in an external file, results of measurement and processing of integrated intensity of image pulsation for some time interval. Saving of values sequence for integrated vibraimage characteristics, received for the certain time, in a file of the report is carried out automatically at record of video file. The user can define type and a format of a file in which reports will be made:

- extension \*.xml – viewing of file contents report is carried out by program Microsoft Excel;
- extension \*.txt – an ordinary text file, which contains the same information, as in file XML, only in the other format of representation.

**NOTE**, that save of parameters carries events character i.e. as soon as value of parameter is calculated by system, it save the name in a file, therefore, sequence of parameters records in a file is not fixed as some parameters demand more often calculation, than others.

In addition the user can save in file with extension \*.set system settings at the moment of the beginning of information gathering.

In addition the user can save in an external file with extension \*.xml system settings at the moment of the beginning of the information analysis.

Item «**Save settings as ...**» the menu «**File**» is intended for saving the current system settings to external XML file.

Item «**Load settings ...**» is intended for loading before saving settings from external XML file.



## 4. Macro mode. Suspicious behavior detection in flow.

**VibraMid** operates in vibraimage Macro Mode and detects suspicious person with abnormal movement value parameters differs from other persons in crowd. The typical movement value for normal persons in frame shows statistics range for changes in status window for some time period.

Vibraimage accumulation period for macromovements registration is smaller than for microvibration registration. It mostly determines by the speed of human body movement and do not suppose movement accumulation and movement repetition.

Typical accumulation period for macromovements covers 1 second and maximum setting N (accumulated frames) depends on camera frequency, for example for 15f/s user stands  $N=15$ , or for 30f/s user stands  $N=30$ .

There is no sense to stand difference between base processing and fast processing frequency for macromovements registration. For micromovement analysis was recommended to stand base processing frequency lower than fast processing because head micromovement is practically invisible for time period less than 0,1 second. But for macro hand movement or body movement it is not so and when person is active or aggressive it moves very fast, so it is recommended to stand base processing frame rate between  $(15 - 30)$  f/s. Also for macromovements analysis is recommended to set frame number  $N(2) = 5$ , because standard 2 frames accumulation gives more red color for any movement (tired operators eyes) and use this window in amplitude or frequency mode. For  $N(10)$  and  $N(15/30)$  used frequency mode.

Changes in Information Table settings between default mode (microvibrations registration) and macromovements shown on fig. 4.1, 4.2.

VI	ST	M	LD	GR	C
Frame rate					
Fast processing		0.0			
Base processing		5.0			
FPS proc. period		2.00			
Downrate		0			
Main					
N(2)		2			
N(10)		10			
N		100			
K		1.00			
L		2.00			
Parallelization		0			
GPU processing		No			
Apply global filter		No			
Filters					
Single points		Yes			
Extended		8			
Extended (fast)		8			
Stretch		No			
Max speed contour		No			
Am scale		16.00			
Space		4.00			
color image		No			
crop X		0			
crop Y		0			
crop X pos		0			
crop Y pos		0			
F6 HF		0			
F6 LF		10			
F6 N		100			
FPS filter		No			
E-Monster		No			
Auto downrate		No			
Fixed contour		No			
Stab. X		0			
Stab. Y		0			
State levels					
Ag		80.00			
St		80.00			
Tn		80.00			
GV path					
disable Am		No			
disable F		No			
disable 2x(fast)		No			
disable VI(10)		No			
disable VI(2)		No			
disable FFT		No			
disable Entropy		No			
disable Audio		Yes			


Fig. 4.1. Default settings micromovements control

VI	ST	M	LD	GR	C
Frame rate					
Fast processing		0.0			
Base processing		15.0			
FPS proc. period		2.00			
Downrate		0			
Main					
N(2)		5			
N(10)		10			
N		15			
K		1.00			
L		150.00			
Parallelization		0			
GPU processing		No			
Apply global filter		No			
Filters					
Single points		Yes			
Extended		8			
Extended (fast)		8			
Stretch		No			
Max speed contour		No			
Am scale		16.00			
Space		4.00			
color image		No			
crop X		0			
crop Y		0			
crop X pos		0			
crop Y pos		0			
F6 HF		0			
F6 LF		10			
F6 N		100			
FPS filter		No			
E-Monster		No			
Auto downrate		No			
Fixed contour		No			
Stab. X		0			
Stab. Y		0			
State levels					
Ag		80.00			
St		80.00			
Tn		80.00			
GV path					
disable Am		Yes			
disable F		No			
disable 2x(fast)		Yes			
disable VI(10)		Yes			
disable VI(2)		Yes			
disable FFT		Yes			
disable Entropy		Yes			
disable Audio		Yes			

Fig. 4.2. Default settings micromovements control

After changing settings user need to control CPU usage and make sure that it is less than 100%, preferable less than 60%.

At the next step user need to control camera real output frequency and make sure that in VI table frame rates In, Fast Processing and Base Processing show approximately equal meanings near set Base Processing frequency (15 f/s) (fig. 4.3).

Specially for adjustment of display modes at work in Macro mode in a field of an information column  are added a number of parameters:

- **Macro mode** – If «Macro mode = Yes» than danger level calculation is made on the basis of values of parameters P13, P14, P15 (the description of parameters is see lower). In «Micro» mode danger level calculation is made on the basis of the analysis of values of aggression (P7), stress (P6) and tension parameters.
- **Level L** – sets a palette threshold at danger level calculation. Vibraimage points which brightness less than the specified threshold, are considered «black» and are not used at

calculation of a danger level. The vibraimage point is considered active, if its brightness more than the set threshold «Level L». Parameter **P15** defines the relation between the area of «active» vibraimage points to the area of all frame.

- **Level S** – defining the area of «active» vibraimage points. If the area of points (in %), which value of brightness is more than value «Level L», is less than value «Level S», than danger level value displayed in status window equally 0. So, if in the frame it is not a lot of «active» points, the level of danger is not calculated. Parameter **P14** defines in % excess of the area of active vibraimage points above the set threshold of «active point» «Level S». So, if the number of «active» points grows, value of this parameter too grows also a level of danger increase.
- Parameter **P13** characterizes shift of the histogram to the right in area of high frequencies. So that parameter defines primary color of «active» points of vibraimage.




VI	ST	M	LD	GR	C			
Frame rate								
In	25.0							
Fast processing	15.4							
Base processing	14.2							
Video timer	01:12:10							
Stream errors	16							
Info								
N	15							
K	1.00							
L	150.00							
Width	640							
Height	480							
Statistics								
IntegratedN(Am)	0.00000							
IntegratedN(F)	0.00344							
Critical level %	60.00							
Suspect	0.00							
Aggression								
Sress	4.82							
Tension	41.28							
Audio								
Level	0.2							

Fig. 4.3. Right VI table indication for macromovements control





VI	ST	M	LD	GR	C			
Frame rate								
In						25.0	<div></div>	
Fast processing						25.0	<div></div>	
Base processing						14.1	<div></div>	
Video timer						01:08:56		
Stream errors						11		
Info								
N						15		
K						1.00		
L						150.00		
Width						640		
Height						480		
Statistics								
IntegratedN(Am)						0.00000		
IntegratedN(F)						9.78894		
Critical level %						60.00	<div></div>	
Suspect						46.53	<div></div>	
Aggression						64.68	<div></div>	
Sress						8.95		
Tension						56.66	<div></div>	
Audio								
Level						0.2		

Fig. 4.4. System Setting at 100% CPU

## 4.1. Face detection mode

Switch on « **Face detection**» mode is made in the same section of the information panel  (fig.4.29). If « **Face detection**» =Yes – face detection mode is used. No – without face detection.

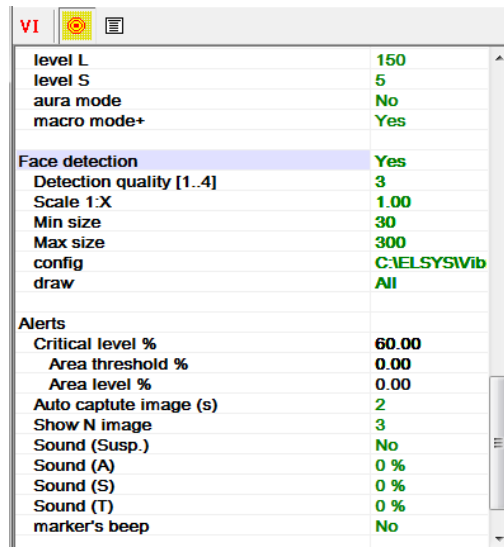


Fig.4.5. Face detection mode settings.

If parameter «**Draw=No**» – not draw rectangle around face. If «**Draw=Yes**» – draw rectangle around «more danger» single person, «**Draw=All**» – draw rectangle for all person in frame. For non-danger person rectangle draw green color, but if person suspect level more than «**Critical level**», than rectangle draw red color (fig. 4.6).

The parameter « **Detection quality**» defines quality of persons face capture. 1 – capture only one large person in the frame (loading of the processor is minimal), 4 – search of all face (even small) persons in the frame (loading of the processor is maximal).

Parameters « **Mines size**» and «**Max size**» set the sizes of rectangular (in pixels) for persons face searching. The given parameter is necessary for set depending on concrete medium-sized people on the computer screen.

Parameter «**Scale 1:X**» sets picture compression ratio before process of search of persons. By default, value 2.0, i.e. video of a format 640x480 will be transformed by the program to a format 320x240. Compression of a format is necessary for reduction of loading of the central processor in case of simultaneous increase in speed of the main processing (base processing). In case of value 0 compression isn't made.


The parameter «**Config**» is intended for loading new algorithms of persons search. At installation of Vibraimage program on your computer in the catalogue \Vibraimage8Mid\ will be created the subdirectory ... \Ocv \ in which files of various algorithms of persons search settle down. For loading new algorithm it is necessary to execute the following actions:

1. To stop process of persons search: «**Face detection**»=**No**
2. In «**File**» menu select first item «**Open**». Then open folder \ Vibraimage8Mid \Ocv\ and choose new algorithm for calculation.
3. In line «**Config**» appear path to selected file.
4. Restart person search process: «**Face detection**»=**Yes**.



Fig 4.6. Attention, «Critical level» is exceeded.

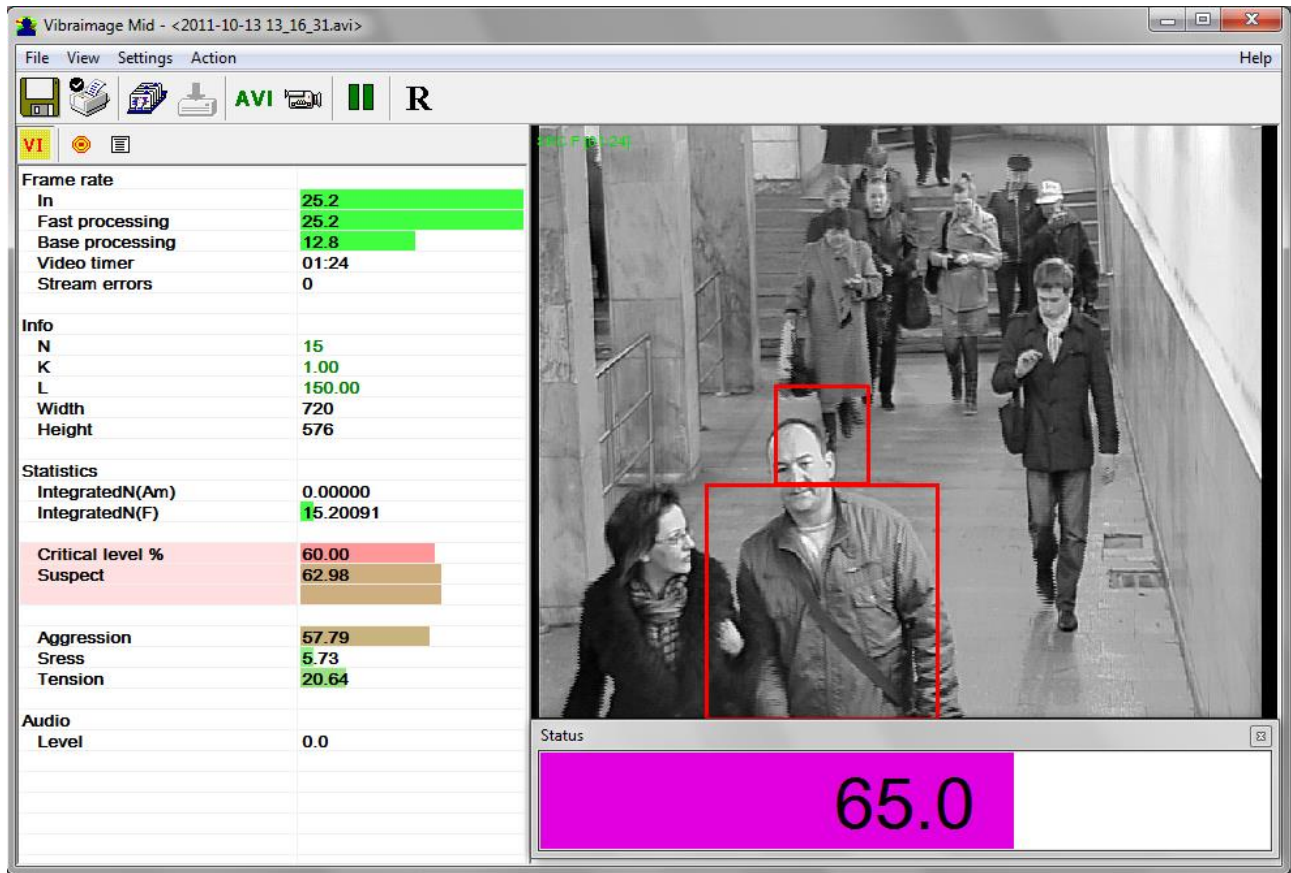
**Note**, each algorithm by operation requires different quantity of the computer resources and realizes different quality of capturing of persons. It isn't recommended to exceed loading of the central processor more than 70%. By default, in case of installation of **VibraMid** the most a little resource-intensive algorithm of `ocv_face.xml` boots. For productive computers it is recommended to load algorithm of `frontalface_default.xml`. But, pay attention, the choice of algorithm and quality of taking of persons is recommended to be made in case of setup of system after its installation in a specific place.

For convenience of the operator in section «Alerts» of the  information panel (fig. 4.6) the following additional parameters are entered:

1. **«Critical level»** – sets a threshold of «danger level» at which excess the person is considered «dangerous»
2. **«Auto capture image (s)»** – If set «non zero» value, than the image of «dangerous» object at his detection will be automatically save in an external file. The chosen value of the given parameter determines in seconds the period of saving the pictures in a file. Simultaneously the image «dangerous» will be displayed in **«Video windows»**.
3. **«Show N image»** – If set value N distinct from 0 in **«Video windows»** will be displayed at once N images of the «dangerous» people which have been found out for the specified interval **«Auto capture image (s)»**. If set value N=1 – that for the specified interval in **«Video windows»** will be displayed only one image, and we can pass other «dangerous»

person! **Note attention**, at work in the given mode «**Video windows**» should be preliminary open!

**Note**, when operating in this mode, the window «**Video windows**» should be previously opened!



*a) working window with «Source» video mode*





*b) saving information about interesting person in BMP file*

*Fig. 4.31. Recommendation for working mode*

## 4.2. First start and settings determination

1. Control status level window during the statistics period
2. Based on the aims of Vibraimage Macro Mode change or leave default settings for «levels L» and «levels S» in macro mode settings.

Standard aim of vibraimage macro mode control is to indicate situation with movement value in frame more than threshold. For example, we control entrance of 100 persons through controlled place. 50 persons has status level (during macro mode control) less than 50%, 80 persons have status level less than 55%, 90 person has status level less than 60%, and only 10 persons have status level more than 60%. That means if we want to indicate 10% of crowd differs from middle, in this case default settings with alarm threshold 60% are ok.

But if we have that 100 entering persons have status level less than 30%, that means we need to change alarm threshold, or better, levels L and S in macro mode settings from default. Standing less L and S levels we increase the sensitivity of Suspected status indication, so we could change default settings for  $L = 1$  and  $S = 1$ .

3. Control status level window with changed settings during the statistic period.

With new settings we will see the other % of Status for the same recorded or live video. Supposed that for  $L = 1$  and  $S = 1$  settings we will see that 100 persons have status level less than 55%. That means we need to change again settings for achievement alarm threshold 60%.

4. Based on the aims of Vibraimage Macro Mode change or leave next settings for levels L and S in macro mode settings.

So we change settings to  $L = 1$  and  $S = 0,1$ .

5. Do the same steps till status level statistics will satisfy aims of Vibraimage Macro Mode.

For this settings  $L = 1$  and  $S = 0,1$  we have 90 persons status less than 60%, and for 10 persons more than 60%. We could fixed this settings if we have aim to indicate 10% of people with movement amount more than stand threshold.

6. Stand requested «non zero» level for Auto capture image (s) in Alerts settings based on Vibraimage Macro Mode aims for storage images of suspected persons on the hard disc. Stand other Alerts settings according to control aims.
7. Now control status level window on the screen. For work **it is recommended** to use a «**Source video**» viewing mode then if suspect level of person excess «**Critical level**» and value of «**Auto capture image**» parameter not equal 0 in an external file in the specified catalogue the image will be saved, allowing to identify the person.

Control more colored person by the other means if status level is more than stand threshold and program gives alarm signal.



## 5. Warranty

Maintenance service and service regulations of **VibraMid** system is carried out according to this Manual and instructions of used hardware maintenance (a computer, the camera, etc.).

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