

Vision Sensor Mode Commands for MU OS 1.0

Morpx Inc

Introduction

MU vision sensor module is a versatile sensor designed by Morpx based on advanced computer vision technology. By setting the MU module into the “Vision Sensor Mode”, a developer can communicate with MU using UART or serial USB, setting parameters and streaming detection results. This mode is intended for connecting with Arduino, Teensy, Raspberry Pi, bluetooth module, cell phone or PC. Additionally, one can make use of the two sets of servo connectors to create a 2-degree-of-freedom vision sensor platform. These standard servo connectors output PWM signals and can be integrated into other robotic platforms. All these interfaces make it easier to build complex robots using MU as the vision sensor, without the limitation of requiring a Infra-Red remote control channel.

Command Set

General Command Format

A MU command is a text string used to set a parameter for a menu item, in this format:

CMD+AA_BB=CC

CMD: Command Marker. Currently only “CMD” is supported.

AA: Menu item.

BB: Sub menu item. (optional)

CC: Parameter

Note 1: All character must be in UPPER CASE.

Note 2: Every command must be followed by “**CR LF**” at the end, e.g. 0x0D 0x0A

Note 3: a single question marker “?” in the place of the parameter **CC** can be used to query the current setting of this parameter.

SENSOR Menu

CMD+SENSOR_SETUP

Parameter: None

Description: Enter “Setup” mode

Note: When MU is not in the “Setup” mode, the only available commends are:

CMD+SENSOR_SETUP, CMD+SENSOR_HELP, CMD+SENSOR_STATUS,
CMD+SENSOR_EXIT

CMD+SENSOR_HELP

Parameter: None

Description: Display help information.

CMD+SENSOR_STATUS

Parameter: None

Description: Query the current parameters of all the menu items.

CMD+SENSOR_EXIT

Parameter: None

Description: Exit the Setup mode.

If there is any setting change, it will be automatically saved during sensor exit.

VISION Menu

CMD+VISION_STATUS=XXXX

Parameter: ENABLE, DISABLE, ?

Description: Enable, disable, or query the status of the vision detection functions. By default, vision detection is “ENABLE”

Default: ENABLE

CMD+VISION_TYPE=XXXX

Parameter: BALL, LINE, BODY, FACE, ?

Description: Select or query the vision detection algorithm. The available detection algorithms are: ball, line, upper body, face

Default: BODY

USB Menu

CMD+USB_STATUS=XXXX

Parameter: ENABLE, DISABLE, ?

Description: Enable, disable or query the status of serial USB output of the vision detection results, (For details please see Appendix 1).

Default: DISABLE

UART Menu

CMD+UART_STATUS=XXXX

Parameter: ENABLE, DISABLE, ?

Description: Enable, disable or query the status of UART output of the vision detection results, (For details please see Appendix 1).

Default: ENABLE

CMD+UART_BAUD=XXXX

Parameter: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 576000, ?

Description: Set or query the UART baud rate.

Default: 115200

SERVOX Menu

CMD+SERVOX_STATUS=XXXX

Parameter: ENABLE, DISABLE, ?

Description: Enable, disable or query the status of Servo X (horizontal moving servo)

Default: DISABLE

CMD+SERVOX_STEP=XXXX

Parameter: integer in [-100, 100], ?

Description: Set or query the step size of SERVO X, [-100, 100] map to multiplier of [-10, 10]. When the parameter is negative, the servo will turn into the reverse direction. For example, 15 maps to a speed multiplier of 1.5. -20 maps to a speed of 2 in the reverse direction.

Default: 10 (which means multiplier 1)

CMD+SERVOX_INITANGLE=XXXX

Parameter: integer in [0, 180], ?

Description: Set or query the initial angle of SERVO X

Default: 90

CMD+SERVOX_REVERSE=XXXX

Parameter: ENABLE, DISABLE, ?

Description: Enable, disable or query if SERVO X is set to the reverse rotation.

Default: DISABLE

SERVOY Menu

CMD+SERVOY_STATUS=XXXX

CMD+SERVOY_STEP=XXXX

CMD+SERVOY_INITANGLE=XXXX

CMD+SERVOY_REVERSE=XXXX

Description: These four menu items controls the Y direction (Vertical) servo. They have the same parameter meanings and default values as SERVOX menu.

Appendix 1: Output Format

Once the “Vision Sensor” is in the running mode, it will keep emitting detection results once per video frame based on the current setting. The Vision Detection Result Output format is a binary format with a length of 9 bytes:

Byte	0	1	2	3	4	5	6	7	8
Content	0xFF	0xFE	Detected	Score H8	Score L8	X	Y	Width	Height

0xFF: Header byte 1

0xFE: Header byte 2

Detected: Whether the detection target is found in the current frame, 1: detected, 0: not detected

Score H8: The high 8 bit of the detection score (if target is detected).

Score L8: The low 8 bit of the detection score. (if target is detected).

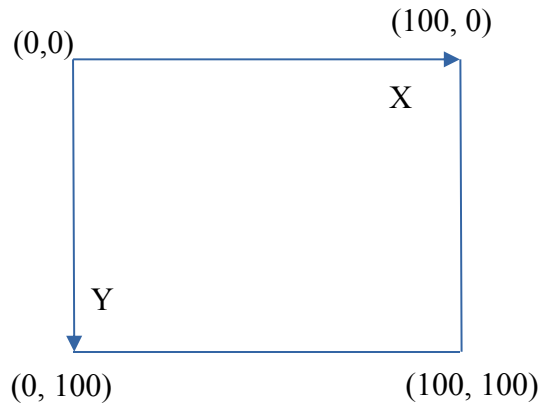
X: X (horizontal) coordinate of the center of the detection rectangle, in the range of [0, 100].

Y: Y (vertical) coordinate of the center of the detection rectangle, in the range of [0, 100].

Width: The width of the detection rectangle, in the range of [0, 100].

Height: The height of the detection rectangle, in the range of [0, 100].

Note that X, Y, Width, Height use relative coordinates with respect to the width and height of the image frame. As show in this figure:



Appendix 2: A Simple UART Example

This is an example of using UART to communicate between MU and Arduino for an face detection application.

1. Firstly, you have to install a Serial Debugger or Serial Port Terminal (Ubuntu), which can be download from the Internet.
2. Long press to switch MU to “Vision Sensor Mode”
3. Short press to switch MU to “Setup Mode”
4. Connect MU to the computer via an USB cable and open the Serial Debugger
5. Set the Application's parameters as: Baudrate = 115200, Data bits = 8bits, Stop bit = 1, Parity = None, and then, open the serial com port
6. Send the following commands:

CMD+SENSOR_SETUP

CMD+VISION_TYPE=FACE

CMD+UART_STATUS=ENABLE (Default is ENABLE)

CMD+UART_BAUD=115200 (Default is 115200)

CMD+SENSOR_EXIT

After sending command CMD+SENSOR_EXIT, MU will automatically change to “Vision Sensor Mode”. Now the vision program will start running and your Arduino program can start receive detection result from UART.

The setting in Vision Sensor will be saved even after power off.

Appendix 3: A Simple SERVO Example

This is an example of using cradle head to control MU for an ball detection application.

1. Repeat the above steps from 1 to 5
2. Send the following commands:

CMD+SENSOR_SETUP

CMD+VISION_TYPE=BALL

CMD+SERVOX_STATUS=ENABLE (UART is DISABLED automatically)

CMD+SERVOY_STATUS=ENABLE

CMD+SERVOY_STATUS=70 (Set SERVOY a little higher)

CMD+SENSOR_EXIT

Connect a cradle head to the IO ports and it will control the MU follow a ball.