Senso Glove DK3

Specifications

Senso Devices Inc

Senso DK3 VR Glove

Senso DK3 VR glove is a wireless controller designed for tracking of palm's and fingers' position, calculating angular data and transferring it to the central computer via wireless interface.

This data can be used for visualization in real time, used for mocap or other purposes.

Sources of angular data are IMU sensors located at fingertips, wrist and outer side of palm.
Central module has MCU, IMU sensor, RF transmitter, Li-Po battery, connector to the wrist module and infrared receivers / transmitters.

Wrist module also has MCU, IMU sensor, LRA vibration motor and connectors to the central module and USB / charger.

External plastic housing parts made from IR-transparent polycarbonate.
Built-in IR transmitters located in the central module and wrist module designed for use with an active IR tracking system for obtaining 3d position and direction of VR glove in 3d space.

There are also IR receivers designed for obtaining 3d position from SteamVR positioning system, compatible with version 1 and 2.

Finger module has an IMU sensor which is connected to the central module.
Also, each finger of the glove has an LRA vibration motor for providing haptic feedback.

Hardware parameters

Central module:

- TI CC1350 as main MCU
- Atmel SAMD21 as auxiliary MCU
- 2.4 / 868 / 915 built in antenna
- BOSCH BNO055 9dof IMU sensor
- 5 TI DRV2605 - haptic driver with vibration effects library
- 4 SteamVR sensor TS4231 with IR receiver
- 3 groups of IR LED transmitters
- Li-Po 3.7 400mAh battery

Wrist module:

- Atmel SAMD21 as main MCU
- BOSCH BMX055 9dof IMU sensor
- TI DRV2605 - haptic driver with vibration effects library
- SteamVR sensor TS4231 with IR receiver
- 1 group of IR LED transmitters

RF USB module:

- TI CC1350 as main MCU
- External SMA-M antenna
- FTDI FT230 USB to serial converter

Finger part:

- BOSCH BMI160 6dof IMU sensor
- LRA motor

Each finger has one IMU sensor + LRA motor, except the thumb which has additional IMU.

Senso Glove DK3 is provided in several sizes – S, M and L
Fabric of the glove is thin and very elastic biflex, 80% nylon 20% elastane with overall density 230 gr/sqm which covers all intermediate sizes.

Performance parameters

Central IMU is working in intelligent data fusion mode (NDOF mode) with direct quaternion output (internal fusion of data from gyroscope, accelerometer and compass)
Parameter of FPS are not controlled by external modules

Wrist IMU is working in normal mode with these parameters:
Accelerometer: +-16G, 500Hz
Gyroscope: 2000 degrees/second, 400 FPS
Compass: 30 FPS

Finger IMU is working in normal mode with these parameters:
Accelerometer: +-16G, 200Hz
Gyroscope: 2000 degrees/second, 200 FPS

Radio interface supports three different mode:

- 2-GFSK 600 kbit/sec mode for ISM frequencies 863-930 MHz
- HiSpeed mode 2MBit/sec for ISM frequencies 863-930 MHz
- Bluetooth LE 4.0 frames for ISM frequencies 2400 - 2500 MHz

Most used mode is 1st, 2-GFSK 600 kbit/sec which provides good performance (about 100 FPS) with max. range about 10 meters at 14dB TX level
HISpeed mode is slightly better for FPS but has less max. range
Bluetooth LE 4.0 frames mode is used for 2.4 ISM band only.

Network of RF adapters can be used for creating mesh networks with seamless switching between adapters.

Wired USB connection can be used for data transceiving instead of RF channel as well.

Software parameters

IMU data from the glove in real time is received by a central computer, processed by software and converted into quaternion-form JSON packets.

In order to make it easier for developers we offer plugins for Unity and Unreal engines, though raw JSON stream is available directly from TCP/UDP connection and could be used in any language including C++, Java, Python, PhP etc.

External 3D positional tracking is available with Senso Eye IR tracking system (active IR markers)

Senso DK3 is also compatible with Steam VR tracking technology on hardware level, though firmware is not ready yet and expected to be released in 2021.

For the haptic feedback there is a library of vibration effects provided by TI DRV2605

Appendix A

Vibration effects

001 Strong Click - 100%
002 Strong Click - 60%
003 Strong Click - 30%
004 Sharp Click - 100%
005 Sharp Click - 60%
006 Sharp Click - 30%
007 Soft Bump - 100%
008 Soft Bump - 60%
009 Soft Bump - 30%
010 Dbl Click - 100%
011 Dbl Click - 60%
012 Triple Click - 100%
013 Soft Fuzz - 60%
014 Strong Buzz - 100%
015 750 ms Alert 100%
016 1000 ms Alert 100%
017 Strong Click 1 - 100%
018 Strong Click 2 - 80%
019 Strong Click 3 - 60%
020 Strong Click 4 - 30%
021 Medium Click 1 - 100%
022 Medium Click 2 - 80%
023 Medium Click 3 - 60%
024 Sharp Tick 1 - 100%
025 Sharp Tick 2 - 80%
026 Sharp Tick 3 60%
027 Short Dbl Click Strong 1 100%
028 Short Dbl Click Strong 2 80%
029 Short Dbl Click Strong 3 60%
030 Short Dbl Click Strong 4 30%
031 Short Dbl Click Medium 1 100%
032 Short Dbl Click Medium 2 80%
033 Short Dbl Click Medium 3 60%
034 Short Dbl Sharp Tick 1 100%
035 Short Dbl Sharp Tick 2 80%
036 Short Dbl Sharp Tick 3 60%
037 Long Dbl Sharp Click Strong 1 100%
038 Long Dbl Sharp Click Strong 2 80%
039 Long Dbl Sharp Click Strong 3 60%
040 Long Dbl Sharp Click Strong 4 30%
041 Long Dbl Sharp Click Medium 1 100%

042 Long Dbl Sharp Click Medium 2 80%
043 Long Dbl Sharp Click Medium 3 60%
044 Long Dbl Sharp Tick 1 100%
045 Long Dbl Sharp Tick 2 80%
046 Long Dbl Sharp Tick 3 60%
047 Buzz 1 100%
048 Buzz 2 80%
049 Buzz 3 60%
050 Buzz 4 40%
051 Buzz 5 20%
052 Pulsing Strong 1 100%
053 Pulsing Strong 2 60%
054 Pulsing Medium 1 100%
055 Pulsing Medium 2 60%
056 Pulsing Sharp 1 100%
057 Pulsing Sharp 2 60%
058 Trans. Click 1 100%
059 Trans. Click 2 80%
060 Trans. Click 3 60%
061 Trans. Click 4 40%
062 Trans. Click 5 20%
063 Trans. Click 6 10%
064 Trans. Hum 1 100%
065 Trans. Hum 2 80%
066 Trans. Hum 3 60%
067 Trans. Hum 4 40%
068 Trans. Hum 5 20%
069 Trans. Hum 6 10%
070 Trans. Ramp Dn Long Smooth 1 100->0%
071 Trans. Ramp Dn Long Smooth 2 100->0%
072 Trans. Ramp Dn Medium Smooth 1 100->0%
073 Trans. Ramp Dn Medium Smooth 2 100->0%
074 Trans. Ramp Dn Short Smooth 1 100->0%
075 Trans. Ramp Dn Short Smooth 2 100->0%
076 Trans. Ramp Dn Long Sharp 1 100->0%
077 Trans. Ramp Dn Long Sharp 2 100->0%
078 Trans. Ramp Dn Medium Sharp 1 100->0%
079 Trans. Ramp Dn Medium Sharp 2 100->0%
080 Trans. Ramp Dn Short Sharp 1 100->0%
081 Trans. Ramp Dn Short Sharp 2 100->0%
082 Trans. Ramp Up Long Smooth 1 0->100%
083 Trans. Ramp Up Long Smooth 2 0->100%
084 Trans. Ramp Up Medium Smooth 1 0->100%
085 Trans. Ramp Up Medium Smooth 2 0->100%
086 Trans. Ramp Up Short Smooth 1 0->100%
087 Trans. Ramp Up Short Smooth 2 0->100%
088 Trans. Ramp Up Long Sharp 1 0->100%
089 Trans. Ramp Up Long Sharp 2 0->100%
090 Trans. Ramp Up Medium Sharp 1 0->100%

091 Trans. Ramp Up Medium Sharp 2 0->100%
092 Trans. Ramp Up Short Sharp 1 0->100%
093 Trans. Ramp Up Short Sharp 2 0->100%
094 Trans. Ramp Dn Long Smooth 1 50->0%
095 Trans. Ramp Dn Long Smooth 2 50->0%
096 Trans. Ramp Dn Medium Smooth 1 50->0%
097 Trans. Ramp Dn Medium Smooth 2 50->0%
098 Trans. Ramp Dn Short Smooth 1 50->0%
099 Trans. Ramp Dn Short Smooth 2 50->0%
100 Trans. Ramp Dn Long Sharp 1 50->0%
101 Trans. Ramp Dn Long Sharp 2 50->0%
102 Trans. Ramp Dn Medium Sharp 1 50->0%
103 Trans. Ramp Dn Medium Sharp 2 50->0%
104 Trans. Ramp Dn Short Sharp 1 50->0%
105 Trans. Ramp Dn Short Sharp 2 50->0%
106 Trans. Ramp Up Long Smooth 1 0->50%
107 Trans. Ramp Up Long Smooth 2 0->50%
108 Trans. Ramp Up Medium Smooth 1 0->50%
109 Trans. Ramp Up Medium Smooth 2 0->50%
110 Trans. Ramp Up Short Smooth 1 0->50%
111 Trans. Ramp Up Short Smooth 2 0->50%
112 Trans. Ramp Up Long Sharp 1 0->50%
113 Trans. Ramp Up Long Sharp 2 0->50%
114 Trans. Ramp Up Medium Sharp 1 0->50%
115 Trans. Ramp Up Medium Sharp 2 0->50%
116 Trans. Ramp Up Short Sharp 1 0->50%
117 Trans. Ramp Up Short Sharp 2 0->50%
118 Long buzz for prog stop 100%
119 Smooth Hum 1 50%
120 Smooth Hum 2 40%
121 Smooth Hum 3 30%
122 Smooth Hum 4 20%
123 Smooth Hum 5 10%

Appendix B

IP rating and temperature condition

Senso DK3 glove is designed to work indoors with temperature range from 0 to 40 C with relative humidity no more than 95%

Overall IP rating is IP-52 which means partial protection from dust and vertical droplets. Recommended disinfection method is drying with warm air and UV exposure.

Partial washing can be done by this step-by-step method:

- Detach wrist module completely
- Detach central module from fabric partially (with IMU sensors inside)
- Wash carefully fabric with sensors (finger sensors & vibration motors are IP-65 sealed) in soap water
- Dry fabric with sensors in dry warm place
- Clean plastic housing of modules with tissue soaked in isopropyl alcohol
- Attach modules to the glove

Wet cleaning is not recommended to do often.
It's recommended to minimize time of washing and make long drying.