Cooperative Vehicle Infrastructure (V2X) Specific

On-board Equipment WB-L20B
User Guide

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I. Product Profile

WB-L20B on-board unit is the equipment dedicated in cooperative intelligent transportation (V2V, V2I, V2X) based on 5.855 ~ 5.925GHz DSRC technology, providing DSRC (IEEE802.11 p), Bluetooth, Wi-Fi, Bluetooth, Ethernet and CAN interfaces in connected vehicle. It is mainly used in collaborative transportation, trafficsafety and automatic driving applications. WB-L20B is a class C device according to Table 9 of ASTM E2213-03 and is for private application.

1.1 Product Features

DSRC standard supported

- ✧ Comply with IEEE 802.11p, IEEE1609.X, SAE-J2735 protocol/standard
- ✧ Provide user development package WB - SDK1.0
- ✧ Working frequency: 5.855 GHz ~ 5.925 GHz
- ✧ Transmission rate: 3 ~ 27 Mbps

1.2 Communication Interface

- ✧ DSRC1/DSRC2 antenna interface, Wi-Fi interface
- ✧ GPS antenna interface, USB2.0 interface
- ✧ RS232/CAN interface, Ethernet RJ45 interface

II. Equipment Installation

This section focuses on the installation of WB-L20B. First, we introduce how to install power cord, antennas onto the corresponding interfaces. (To prevent damage to the equipment, please make sure to connect the antennas before power on); Then, we introduce how to use PC connecting to WB-L20B through Ethernet cable, and then configure WB-L20B and view log files.

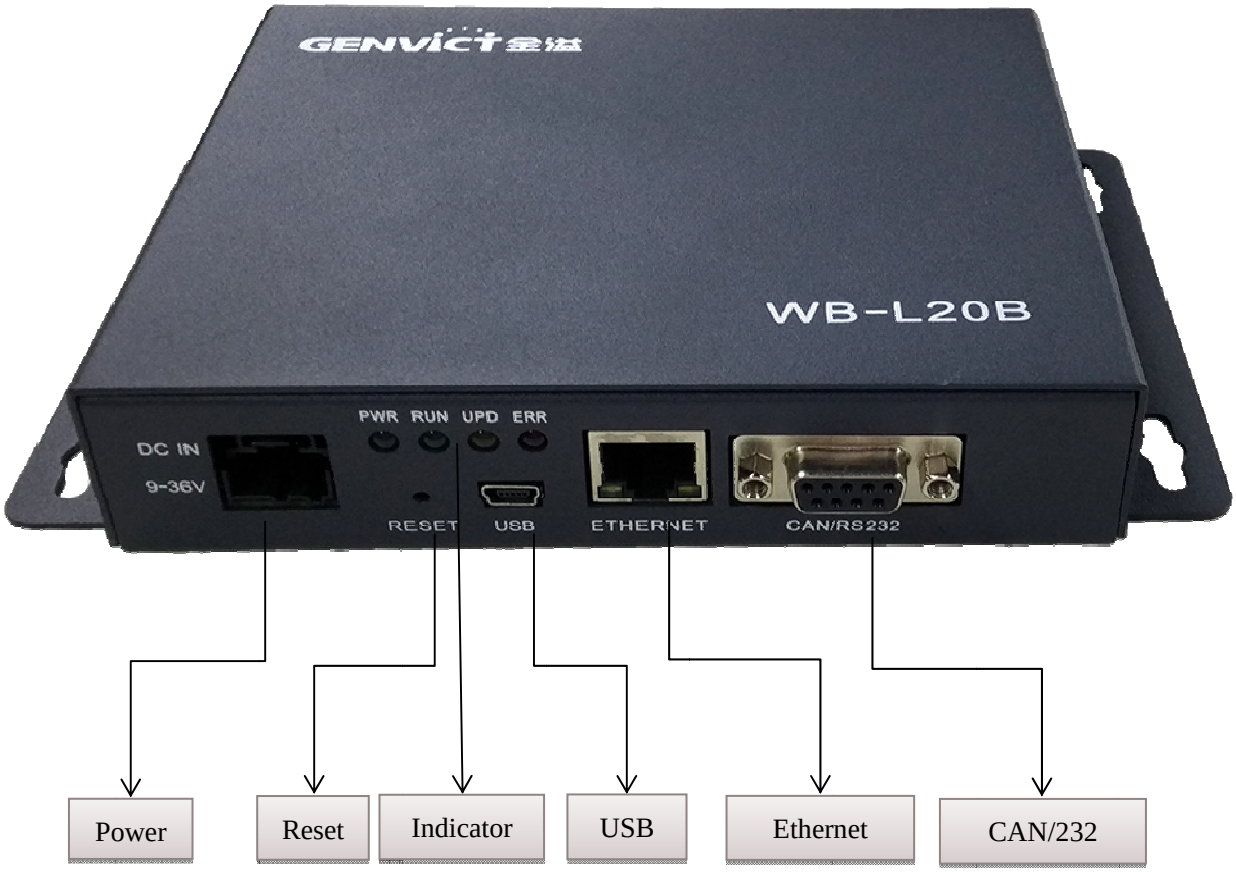

Figure 1-1 WB-L20Front Panel

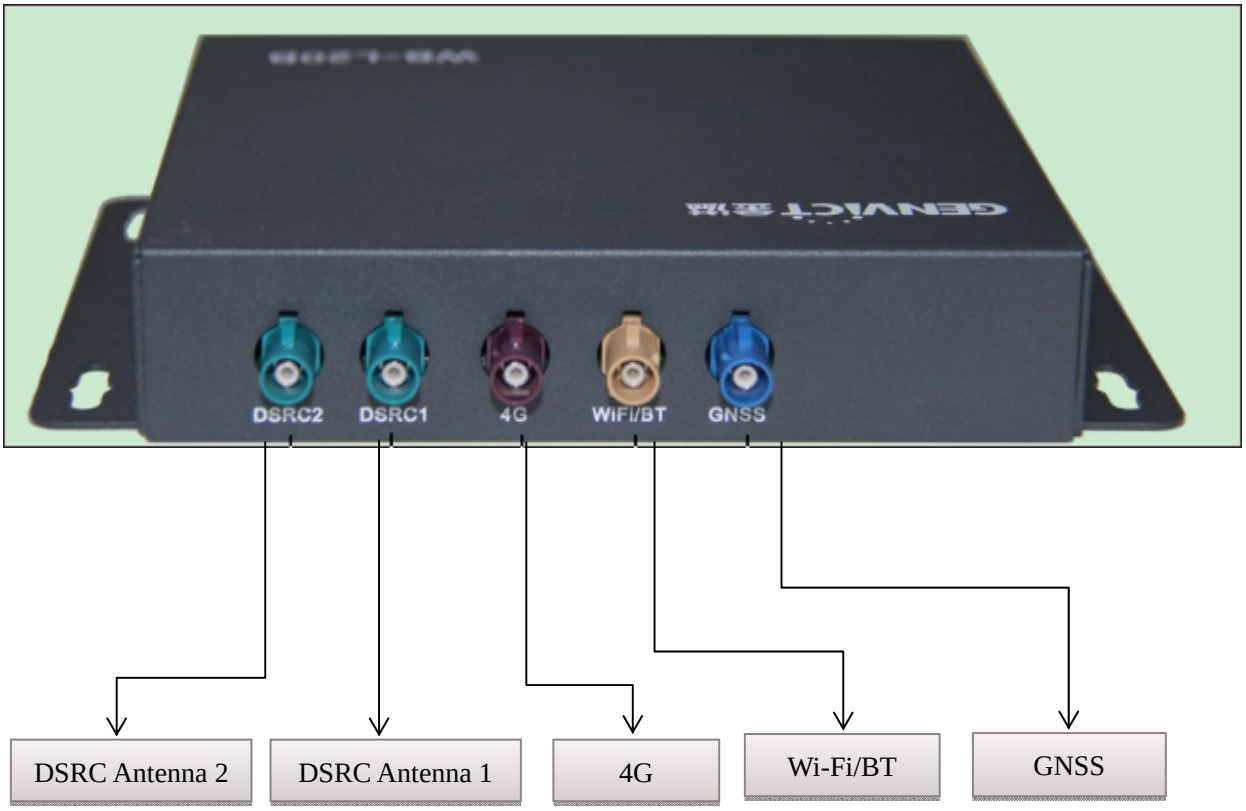

Figure 2-2 WB-L20B Rear Panel

Figure 2-3 is the antenna picture of WB-L20B,orderly are DSRC antenna (two units), 4G antenna（optional，this product is without 4G function）, Wi-Fi/BT antenna, GNSS antenna. Before turning on power, please install the antenna to the corresponding interface. DSRC antenna and GNSS antenna should be installed outside the vehicle for better performance.

DSRC Antenna Wi-Fi Antenna GNSS Antenna

Figure 2-3 WB-L20B Antennas

Figure 2-4 is the picture of accessories for WB-L20B, orderly are DB9 special extension wire, cigar lighter power cord. For DB9 special extension wire, one end is DB9 male, on the other side are two DB9 female (DB9 female I is standard RS232, DB9 female II is a serial port for debugging) and two CAN interfaces (brown line connects to low level, green line connects to high level). Power cord can access to 9v ~ 36v DC input (it is recommended to use 12v DC input).

DB9 Special Extension Wire Cigar Lighter Power Cord

Figure 2-4 WB-L20B Accessories

2.1 Access toWB-L20B

WB-L20B provides mini- B USB male interface, it can be used for installing programs and transferring data with external devices. Figure 2-5 is DB9 serial port wire. To access WB-L20B by PC,one can use this wire connect to serial I of DB9 special extension wire (cable is optional).

Figure 2-5 DB9 Serial Port Wire

2.2 Log-in WB-L20B

2.2.1 By serial port

Take serial port accessing tool Xshell5 for example, the steps of serial port accessing are as follows:

1) Open Xshell5, select "new" connection;

2) Choose "SERIAL" as protocol incatalog;

3) Configure parameters in SERIAL panel.

4) Click "Connect", choose accept and save key. Then type in user name: **root** and password: **victgen** to complete connection.

2.2.2 By Wi-Fi

For setting up Wi-Fi connection, please check chapter four, section two.

Use Xshell5 to access device, the configuration steps are as follows:

1) Open the Xshell5, select "new" connection;

2) Select SSH as protocol, set host address to 192.168.110.1, port number uses the default port

number 22.

3) Click "OK", choose accept and save key. Then type in user name: **root** and password: **victgen** to complete connection.

III. WB-L20B Automatic Start-up Items

Check script /etc/init.d/S90init-stuff for WB-L20B startup items, here will explain how to configure and edit each programwhich will run at the start of device.

1.To reviewscript S90init-stuff: vi/etc/init.d/S90init-stuff, as shown in figure 3-1:

```
#!/bin/sh
#
#

case "$1" in
  start)
    echo 3 > /proc/sys/kernel/printk

        echo "Starting gpsd..."
        /opt/scripts/gpsd.sh

        echo "Reseting 4G module..."
    /opt/scripts/run_reset4g.sh

        echo "Starting wireless AP..."
    /opt/scripts/run_wireless.sh
    /opt/scripts/run_ap.sh

        echo "Starting bluetooth..."
    /opt/scripts/run_bt.sh

        echo "Starting 4G..."
    /opt/scripts/huawei_909_dial.sh &

        echo "Starting WAVE..."
    /opt/scripts/start_wave.sh

        echo "Starting rtl3d...you may restart this process with different args as you need"
    rtl3d 192.168.110.1 224.0.0.1 &

    ifconfig eth0 up

        ;;

  stop)
        ;;
  restart|reload)
        "$0" stop
        "$0" start
        ;;
  *)
        echo "Usage: $0 {start|stop|restart}"
        exit 1
esac

exit 0
```

Figure 3-1 Automatic Start Scripts

2. Script content is as follows:

- gpsd.sh -- GPSD configuration script, through which user can configure GPSD serial port and baud rate, the gpsdbaud rate is 115200.
- run_wireless.sh -- Load Wi-Fi driver module, after running this script, device will act as an AP, waiting wireless terminal to access by Wi-Fi.
- run_ap.sh -- Hostapd configuration script, through whichuser can set IP address pool for client devices.
- run_bt.sh -- Bluetooth module loading script, after running this script,Bluetooth function is

switch on.

- start_wave.sh -- WAVE service module loading script, after running this script,DSRCfunction is switch on.
- rtl3d 192.168.110.1 224.0.0.1 -- Read local GNSS message, and send as multicast message tomulticast group address 224.0.0.1 on Wi-Fi interface address 192.168.110.1.

IV. WB-L20B Software Use Guidance

4.1 Device Network Interface Introduction

After login system, input command “ifconfig” to view device network interface information, as shown in figure 4-1:

```
[root@genvict ~]# ifconfig
eth0      Link encap:Ethernet  HWaddr 22:D7:FA:8D:76:82
          inet addr:192.169.5.200  Bcast:192.169.5.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:1289 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1289 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:182075 (177.8 KiB)  TX bytes:182075 (177.8 KiB)

usb1      Link encap:Ethernet  HWaddr 02:1E:10:1F:00:00
          inet addr:10.144.119.118  Bcast:10.144.119.119  Mask:255.255.255.252
          inet6 addr: fe80::1e:10ff:fe1f:0/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:636 (636.0 B)  TX bytes:1152 (1.1 KiB)
```

```
wave0     Link encap:Ethernet  HWaddr 32:FD:14:7B:B6:E6
          inet6 addr: fe80::30fd:14ff:fe7b:b6e6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr F4:B8:5E:27:B1:B7
          inet addr:192.168.110.1  Bcast:192.168.110.255  Mask:255.255.255.0
          inet6 addr: fe80::f6b8:5eff:fe27:b1b7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:649 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:201192 (196.4 KiB)

[root@genvict ~]#
```

Figure 4-1 Network Interface Info

Through “ifconfig”command, there are five network interfaces on the device, namely eth0, lo, usb1, wave0 and wlan0. Eth0 is Ethernet interface, lo is local loopback interface, wave0 is DSRC communication interface and wlan0 is Wi-Fi interface. Please note that SIM card is not plugged in, usb1 interface won't appear.

4.2Wi-Fi Use Guidance

Type in command “ifconfig” to view device network interface information, as shown in figure 4-2:

```
wlan0     Link encap:Ethernet  HWaddr F4:B8:5E:27:B1:96
          inet addr:192.168.110.1  Bcast:192.168.110.255  Mask:255.255.255.0
          inet6 addr: fe80::f6b8:5eff:fe27:b196/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7343 errors:0 dropped:0 overruns:0 frame:0
          TX packets:9298 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:875070 (854.5 KiB)  TX bytes:2692797 (2.5 MiB)
```

Figure 4-2 Wi-Fi Interface

The default interface for Wi-Fi is wlan0and default IP address is 192.168.110.1, this is the AP address forother devices to connect to. User can change this IP address by editing corresponding configuration file. See the next section for detail.

4.2.1 Modify Wi-Fi IP Address and Assign IP Address Pool

Use vi to open /etc/udhcpd.conf, find “start” and “end” items.

```
# Sample udhcpd configuration file (/etc/udhcpd.conf)
# Values shown are defaults

# The start and end of the IP lease block
start           192.168.110.110
end             192.168.110.120

# The interface that udhcpd will use
#interface      eth0
interface       wlan0
```

Figure 4-2-1Wi-Fi Assign IP Address Pool

Change the start and end configuration in green spot to modify the address pool of AP.The default IP addresses for client is in 192.168.110.0 segment, totally 10 addresses (From 192.168.110.110 to 192.168.110.120). Note that if you want to modify default address, please make sure that “opt router” item in udhcpd.conf has the same address segment as AP address segment, shown in figure 4-2-2 highlighted in green.

```
# Examples:
opt     dns     8.8.8.8 8.8.4.4 #public google dns servers
option  subnet  255.255.255.0
opt     router  192.168.110.1
#opt    wins    192.168.10.10
#option dns     129.219.13.81   # appended to above DNS servers for a total of 3
#option domain  local
option  lease   864000          # default: 10 days
# Arbitrary option in hex form:
option  0x08    01020304        # option 8: "cookie server IP addr: 1.2.3.4"
```

Figure 4-2-2 Wi-Fi IP Address Detailed Info

4.3Ethernet Use Guidance

4.3.1 ManuallyConfigure Ethernet Interface IP Address

Connect WB-L20B to PC via Ethernet cable, log in and input“ifconfig eth0 up” and“ifconfig eth0 192.169.5.200 netmask 255.255.255.0”. Then eth0 IP address can be seen, as shown in figure 4-3. Note thatWB-L20B and PC must configure in the same network segment.

```
[root@genvict etc]# ifconfig
eth0      Link encap:Ethernet  HWaddr 22:D7:FA:8D:76:82
          inet addr:192.169.5.200  Bcast:192.169.5.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

Figure 4-3 ManuallyConfigure Ethernet Interface

4.3.2 AutomaticallyAcquire Ethernet Interface IP Address

Connect WB-L20B to router via Ethernet cable, input “udhcpc -i eth0”, then WB-L20B’s Ethernet interface can obtain IP address automatically, as shown in figure 4-3-1.

```
[root@genvict /]# udhcpc -i eth0
udhcpc (v1.22.1) started
Sending discover...
Sending select for 192.169.5.72...
Lease of 192.169.5.72 obtained, lease time 86400
deleting routers
adding dns 192.169.5.1
[root@genvict /]#
```

Figure 4-3-1 AutomaticallyAcquire IP Address

4.4 4G Network Interface Use Guidance

Usb1 is the 4G network interface.WB-L20B obtained IP address 10.144.119.118from server. The existence of this address stands that the device is capable of accessing to Internet, as shown in figure 4-4.

```
usb1      Link encap:Ethernet  HWaddr 02:1E:10:1F:00:00
          inet addr:10.144.119.118  Bcast:10.144.119.119  Mask:255.255.255.252
          inet6 addr: fe80::1e:10ff:fe1f:0/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:636 (636.0 B)  TX bytes:1152 (1.1 KiB)
```

Figure 4-4 4G Network Interface

4.5 System Upgrading Introduction

4.5.1 Upgrading File Preparation

First of all, prepare the upgrade file such as kernel;copy upgrading file to any path of the device. To do this, user can use Linux SCP command under Linux or SSH, WinSCPunder Windows. Now takingWinSCP as an example, the access configuration steps are as follows:

1) Open the WinSCP, configuration interface will appear as shown in figure 4-5;

2) SelectSCP as protocol, use 192.168.2.100 as host name, default 22 as port number, “root” as

user name and “victgen” as password.Click "login" to complete access. (If host key related security warning appears, select "update".)

After accessing using WinSCP shown in Figure4-5-1, with PC’s file directory on the left and WB-L20B file directory on the right.Then user can do file operations. As user has root privilege, please be cautious when applying operations.

4.5.2 Parameter Introduction

Viewsys_update.sh under /opt/scripts directory, this script supports four kinds of upgrading, including DTB, Uboot, Kernel and FS. User can use command line to upgrade. (For example,./sys_update.sh -x /xxx/xxxxxx.xxx)

1) -x to distinguish four types of upgrading files:

- -d stands for DTB upgrading

```
[root@genvict scripts]# ./sys_update.sh -f /home/test/rootfs.tar
```

- -u stands for Uboot upgrading

```
[root@genvict scripts]# ./sys_update.sh -u /home/test/uboot
```

- -k stands for Linux Kernel upgrading

```
[root@genvict scripts]# ./sys_update.sh -k /home/test/uImage
```

- -f stands for Filesystem upgrading

```
[root@genvict scripts]# ./sys_update.sh -f /home/test/rootfs.tar
```

- -d、-u、-k、-f can be used in any combination, this means that not only one type upgrading file, but multiple combination files can be used for upgrading. For example,-u, -k, -d, and -f using at the same time means the device needs to upgrade using DTB, Uboot, Kernel and FS files at the same time. Note that parameters are all lowercase letters.

2) /xxx/xxxmeans that upgrade file can locate in any path.
3) xxx.xxxstands for upgrading file name, this name can be user defined and has no format requirements

Technical Specification

Mechanical Properties	
Size	175*145*30（mm）
Shell Material	Sheet Metal Parts
Weight	About 700g
Color	Black
Installation	Pre-install

Electric Properties	
Power Supply Mode	DC9V-36V
Communication Distance	800M
Radio Frequency Output Power	-0.4dBm(Do not include the antenna gain and regulation)
RF Performance	Working Frequency: 5.855GHz-5.925GHz Channel Bandwidth: 10M (172~184),20M Wireless Transmission Rate: 3M, 4.5M, 6M, 9M, 12M, 18M, 24M, 27Mbps Channel Switching Delay<4ms

Environment Properties	
Operating Temperature	-30℃~+50℃
Storage Temperature	-45℃~+85℃
Operating Humidity	10%-95% no condensation

Warning

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment . This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

Make traffic more intelligent Make life easier

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