Mobile Computing Solutions

Think Big, Think IoV

Smart Public Transit Solutions

Smart Bus Ride to a Safe, Green, Fun & Comfortable Tomorrow

The VTC Series, an innovative series of in-vehicle computers, is designed for in-vehicle operation within trucks, buses, trains, and material handing vehicles. NEXCOM's compact in-vehicle computers and transportation computers are differentiated by a multitude of I/O interfaces that enable connectivity to various in-vehicle features and meet arbitrary application requirements.

ATC 3200

In-Vehicle AI Recognition

- nVIDIA JETSON TX2 SoM, up to 1.3 TFLOPS compute
- 4-CH MIPI SerDes Cameras up to 25m Distance
- Two GbE with PoE for LiDAR or IP CAM
- Diverse data secure storage, eMMC, SD, and 2.5" SSD

VTC 1020

Data Gateway In-Vehicle Computer

- Intel Atom® Dual Core x5-E3930
- 1 x WWAN LTE and 1 x WLAN support
- 5 x RS232 and 2 x RS485

VTC 6221

Communication Hub In-Vehicle Computer

- Intel Atom® Quad Core x7-E3950
- 6 x SIM Cards and 3 x WWAN LTE/5G Support
- 3 x mini-PCIe and 2 x M.2 socket expansion

VTC 7251-7C4

Communication Hub and Digital Surveillance

- Intel Core™ 8th Gen. CPU
- 4 x Independent 10/100/1000 Mbps PoE 802.3af/at
- 3 x WWAN module slot
- 4 x mini-PCIe slot and 1 x M.2 Key B slot

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NEXCOM

Smart Buses Steer into Smart Cities with Vehicle Telematics

The core thrust of smart city transformation is the concept of a "smart bus" promising to elevate road safety, operational efficiency, and passenger satisfaction.

What a smart bus needs is vehicle telematics data which can bring far-reaching changes in driver management, asset management and passenger services. Additionally, time, costs and efforts must be considered to ensure successful, largescale implementation on smart buses. This article discusses how smart bus services can be delivered for cost-sensitive bus carriers with compact vehicle terminals like NEXCOM's VTC 6221 powered by Intel Atom® processor x7-E3950. Moreover, we analyse the data extracted using the

telematics data from the in-vehicle VTC 6221 and deliver extended applications by integrating it with real-time communication, multi-display passenger information, bus announcement and other systems. They are solutions in delivering a high cost-performance value, ultimately, reshaping the landscape of the transportation industry.

Smart Cities Need Smart Bus Services

By 2050 the world population is anticipated to reach 9.7 billion (United Nations, 2019), and approximately 68% are expected to be living in urban areas (United Nations, 2018). Thus, meticulous planning of bus services is significant when it comes to maintaining and increasing ridership. Large populations positively correlate to city traffic; exacerbating problems like long travel time, unexpected delays and road collisions. This could result in frustrating passengers and in other road users blaming bus services, ultimately ruining their reputation. As for local governments, simultaneously keeping cities lively and thriving and achieving environmental sustainability is a difficult balance to accomplish.

The Elements of Smart Bus Services

A Treasure Trove of Vehicle Telematics Data

To address concerns about bus service operation, mobility in urban areas, and environmental sustainability, NEXCOM's VTC 6221 vehicle terminals are equipped with: Intel Atom® processors, data acquisition and sensing capabilities,

Figure 1. Smart buses are data treasure troves containing vehicle operation information, diagnostic messages, and transportation statistics

wireless communication technologies supporting electronic logging, vehicle-to-infrastructure (V2I) communication and passenger infotainment. The aim is to transform bus services with vehicle telematics. To advance bus service operation, the vehicle terminals have integrated multiple communication and sensing technologies to gather vehicle status and in-vehicle activities (Figure 1).

The VTC 6221 has met the SAE J1939 standards with optional module, communicating with vehicle microcontrollers over a control area network (CAN). It collects vehicle operation information and provides diagnostic messages about abnormalities. The location tracking function is 24/7 anti-theft protected, information is generated by a combination of a GNSS receiver with the dead-reckoning option when GNSS signals are interfered and blocked, and G-sensor for motion detection. Transportation statistics can be obtained by using the VTC 6221 in conjunction with passenger counters, door sensors, ticket machines and other peripheral devices. With VTC 6221's rich I/O design, bus carriers can compute the number of trips, boarding/alighting passengers, bus stop dwell time, etc. to evaluate transportation performance and the scope of fare evasion. Furthermore, wireless connections like LTE and 5G networks enable bus locations and transport statistics to be shared in real-time, providing live bus arrival information for bus bunching mitigation, and allowing for active adjustments to minimise passenger waiting time and direct voice communication in case of emergencies (Figure 2).

Wi-Fi connections present a cost-efficient alternative for uploading less time-sensitive data to backend servers after buses return to bus depots. Furthermore, the beacon technology, a variant of Bluetooth developed for the Internet of Things is ideal for accurate proximity sensing. It can be used to

manipulate traffic lights, granting priority to incoming buses. This prevents buses from being stuck in traffic, thus, increasing bus schedule reliability and passenger satisfaction while reducing fuel consumption and greenhouse gas emissions.

Passenger Infotainment

Thanks to the quad-core architecture of the Intel Atom® processor x7-E3950, the VTC 6221 can also provide passenger infotainment, and present signage contents and vehicle telematics data.

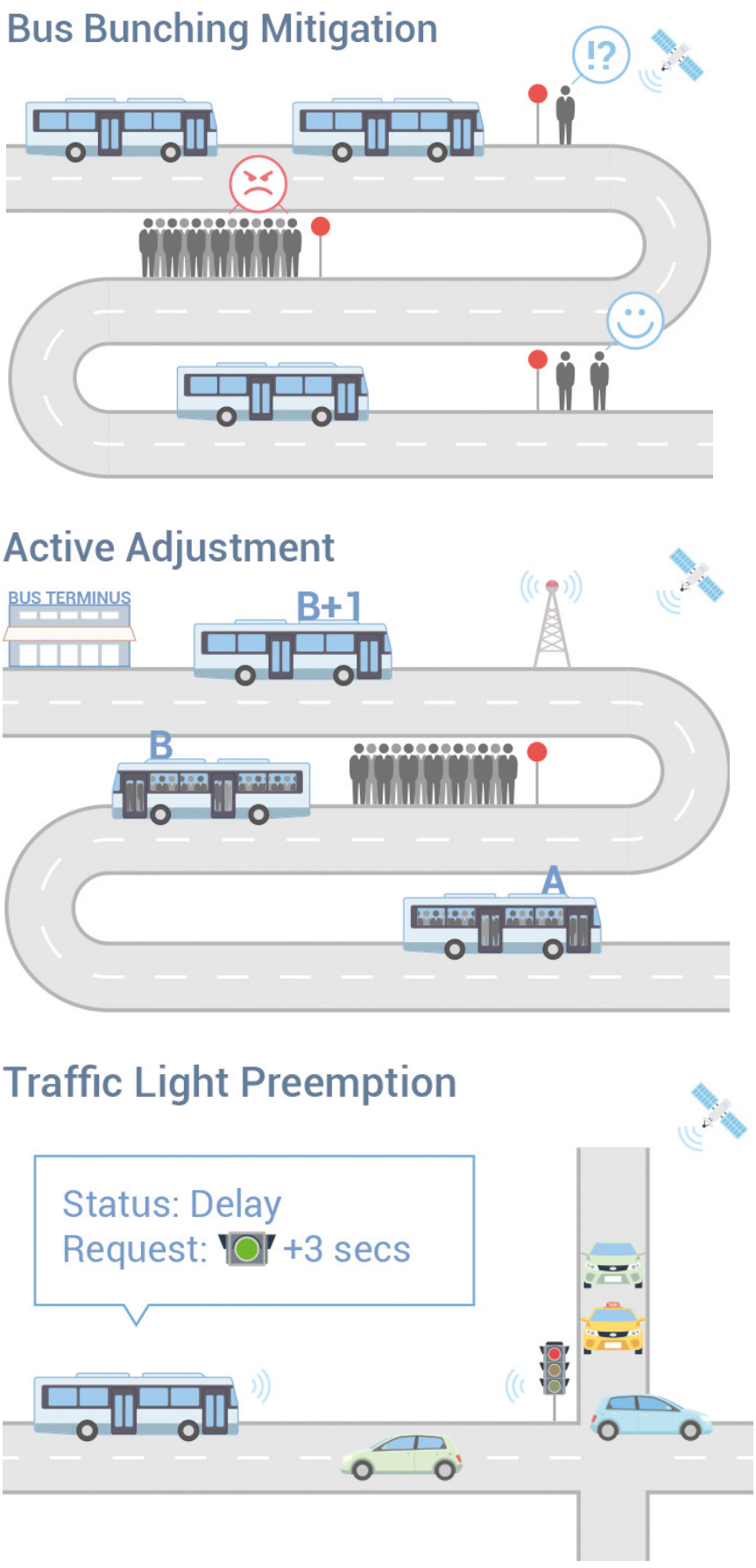
Combining with the graphics engine integrated in the processor, vehicle terminals can drive up to three displays simultaneously, showing route information, Ultra 4K commercials, and location-based promotions inside and/or outside a bus.

Moreover, extra system headroom is available for GNSS-based bus stop announcement and passenger side speakers to facilitate driver-passenger interaction.

Navigate through the Harshness

Taking advantage of the extended temperature support and the high power efficiency of the Intel Atom® processor, the VTC 6221 offers enhanced system durability even when confined in a small space with poor ventilation or under an ambient temperature ranging from -40°C to 70°C. The unstable vehicle power supply—transient voltage fluctuations and spikes induced by turning on ignition igniters or windshield wipers is dealt with by

Figure 2. Wireless communication allows bus carriers to use vehicle telematics to their advantage for service improvements



ignition on/off delay, 9V-to-36V DC support and low-battery voltage protection to avoid premature system failure. System reliability is further ensured by the fanless design which prevents dust and grease accumulation on the VTC 6221.

Put on Full Alert

The VTC 6221 brings additional benefits to bus services (Figure 3). In terms of driver management, vehicle terminals incorporating iButton readers grant bus access only to authorised drivers during their duty hours and combines vehicle status data, compiling their hours of service (HoS) logs.

While on the road, driving behaviour data of harsh braking, acceleration and speeding can be recorded and/or streamed live to assure safety guidelines are met. For asset management, vehicle operation information and diagnostic messages assist dispatchers to track the health status of an entire bus fleet and predict maintenance schedules, maximising bus utilisation while reducing accidents from vehicle malfunctions.

As for location tracking and motion detection, functions can be used to track buses; in the event of unusual incidents, GNSS coordinates, tilt angels, and pre-edited contents can be sent to registered phone numbers (Figure 4) under the driver's control. By using the utility software tool provided by NEXCOM, bus carriers can programme their software to set receivers to dispatchers, authorities, and even insurance companies based on the severity of the incident.

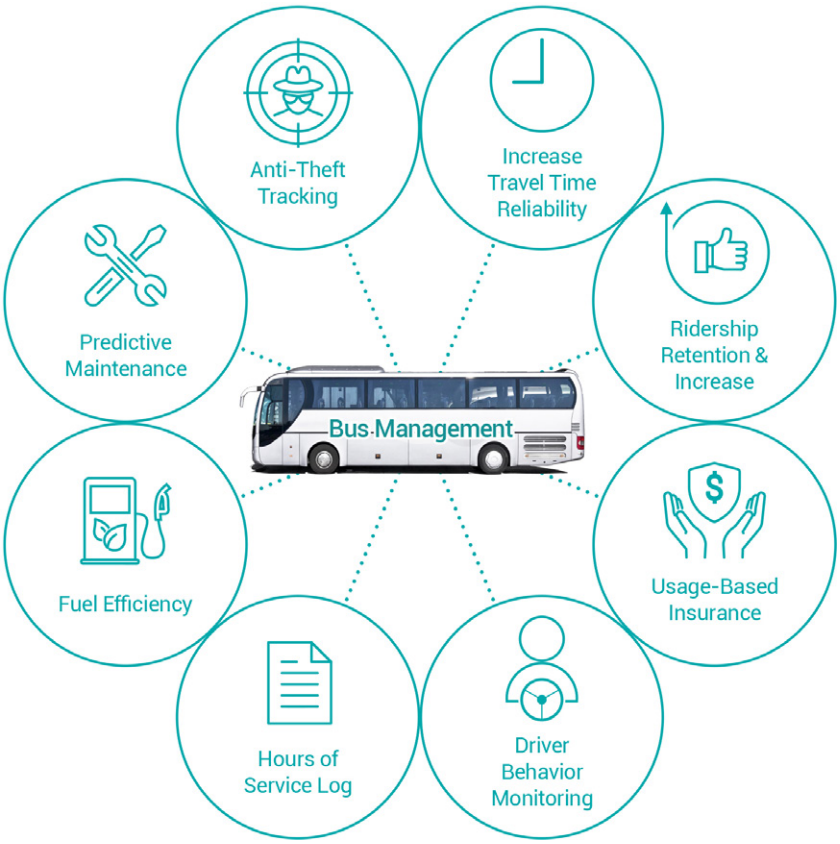


Figure 3. Vehicle telematics data also has various potential applications in terms of driver management and asset management

Conclusion

Information technology is reshaping the landscape of the transportation industry. Given the trends towards urbanisation and the rise of megacities, bus carriers must soon remodel service operations.

To usher in bus service reinvigoration, NEXCOM is propelling the proliferation of vehicle telematics with rugged mobile computing solutions to help bus carriers exploit data goldmines to confront challenges in daily bus operation and continuously drive operational improvement.

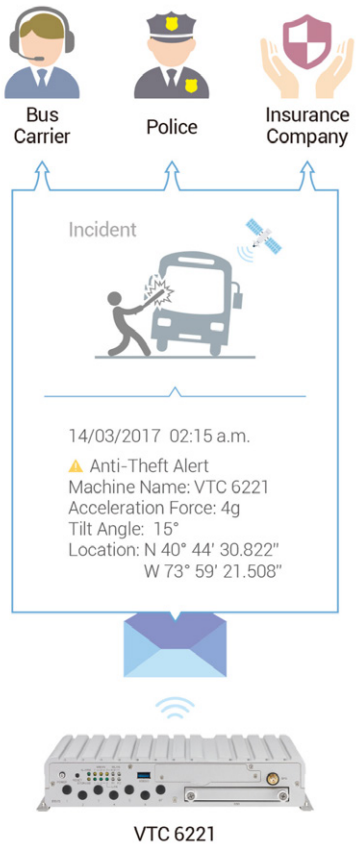


Figure 4. NEXCOM vehicle terminals feature 24/7 anti-theft tracking to strengthen the physical security of buses