DFI

VC900-M8M Supports ARTC to Create Level 4 Self-Driving Electric Minibuses

Key Messages

- ARTC cooperates with DFI and other partners to create MIT electric buses with level 4 autonomous driving.
- Autonomous driving is trending worldwide, with an estimated market potential worth tens of billions of dollars in the next 5 to 10 years.
- Smart cars require remote software and firmware updates as well as AI algorithms. The role of the T-Box will become more important.

Industry: **Transportation**

Application: **Telematics Box (T-Box) system**

Solution: **VC900-M8M vehicle system**

As emerging technologies such as artificial intelligence (AI), cloud, and Internet of Things (IoT) become increasingly mature, Autonomous Vehicles have changed from being imagined to being real. Factors such as changes in the global labor structure have further encouraged experts from industry, government, academia, research, and other fields to join this battlefield that is potentially worth tens of billions of dollars and drive the growth of technological development.

DFI, global leader in embedded systems and industrial PCs, has leveraged their many years of experience in the automotive field and joined the Automotive Research & Testing Center (ARTC) and other manufacturers to provide the vehicle system VC900-M8M as well as technical support for implementation of functions such as system connections and security vulnerabilities. Together with various departments, they created WinBus, the country's first "MIT (Made in Taiwan)" self-driving electric minibus that meets level 4 autonomous driving as defined by America's Society of Automotive Engineers (SAE).

The VC900-M8M: A Safe and Rugged T-Box Solution

- **Enhancing In-Vehicle Cybersecurity**
  Integrate VicOne Autonomous Cybersecurity Solution
- **High-Speed Connectivity**
  Support such as C-V2X, 4G, Wi-Fi, LTE
- **High Stability**
  Certified to E-Mark and Military Level Standard (MIL-STD)
- **Real-time Video Data Collection**
  Equipped Micro SD card slot. Internal memory up to 64GB

Self-Driving Vehicles: One of the Solutions for Driver Shortages and Global Warming

In recent years, declining birth rates and aging populations have caused labor shortage to become an important global topic, similar to net-zero carbon emissions. Regarding the transportation industry, shortage of drivers for passenger and freight transportation is most critical. For example, the International Road Transport Union (IRU) published an article early 2023, pointing out that the shortage of bus and truck drivers in Europe is as high as 600,000. If the situation continues, the number will increase to 2 million in shortage by 2026. US Texas media "KBTX" also reported recently that 16 of the 116 local bus routes are unavailable, which has affected local children's access to school.

Self-driving cars are seen as one of the solutions, attracting investments from industries around the world. According to a report on the passenger car and commercial vehicle market by international research agency "Fortune Business Insights", the global self-driving market size could surpass US$19.9 billion in 2029, with a compound annual growth rate (CAGR) of 42.97% from 2022 to 2029. Another research agency "Future Market Insights" is also optimistic and believes the market size will exceed US$70 billion in 2033.

In terms of the key factors that are being discussed and that drive growth, it has become the industry consensus that self-driving cars equipped with advanced technologies such as LiDAR can replace traditional cars and improve road efficiency and safety. Additionally, "Future Market Insights" also believes that self-driving electric vehicles have the opportunity to help with global energy conservation and carbon reduction. To truly enjoy the aforementioned benefits of self-driving cars, Vehicle to Everything (V2X) has become an important technology that is indispensable. This is exactly the value of the T-Box.

The Key Feature for Autonomous Cars to Reduce Emissions: Connection

According to a report by the European Automobile Manufacturers' Association (ACEA), avoiding frequent braking and accelerating can reduce carbon emissions by 5 to 20%. To do this, it is necessary to connect the vehicle with the Intelligent Transportation System (ITS) through the Internet so that the vehicle can obtain real-time road conditions and carry out actions such as route prediction and early braking. As the data analysis platform for WinBus, VC900-M8M can be seen as the transmission nerve of the entire vehicle. Its main job is to connect the cloud platform and local devices to continuously conduct data storage and collection.

By connecting to a 4G router through the Ethernet, it can exchange real-time traffic data with ITS, including the light signal and seconds of nearby traffic lights. Simultaneously, it receives footage from the IP Camera to determine its relationship with surrounding vehicles.

Electronic control units (ECU) connected to controller such as the vehicle control unit (VCU), advanced driver assistance system (ADAS Controller), electric power steering system (EPS Controller), and anti-lock braking system (ABS) perform calculations based on data obtained by the T-Box and issue instructions to the corresponding units to perform actions such as braking and accelerating. All of the data in the vehicle is compressed as it is collected and transmitted to the cloud management platform built by ARTC so that personnel can remotely monitor the vehicle status and manage the data stored in the T-Box. The architecture is as follows:

The Data Collection Platform: Key for Winbus to achieved SAE Level 4 driving automation

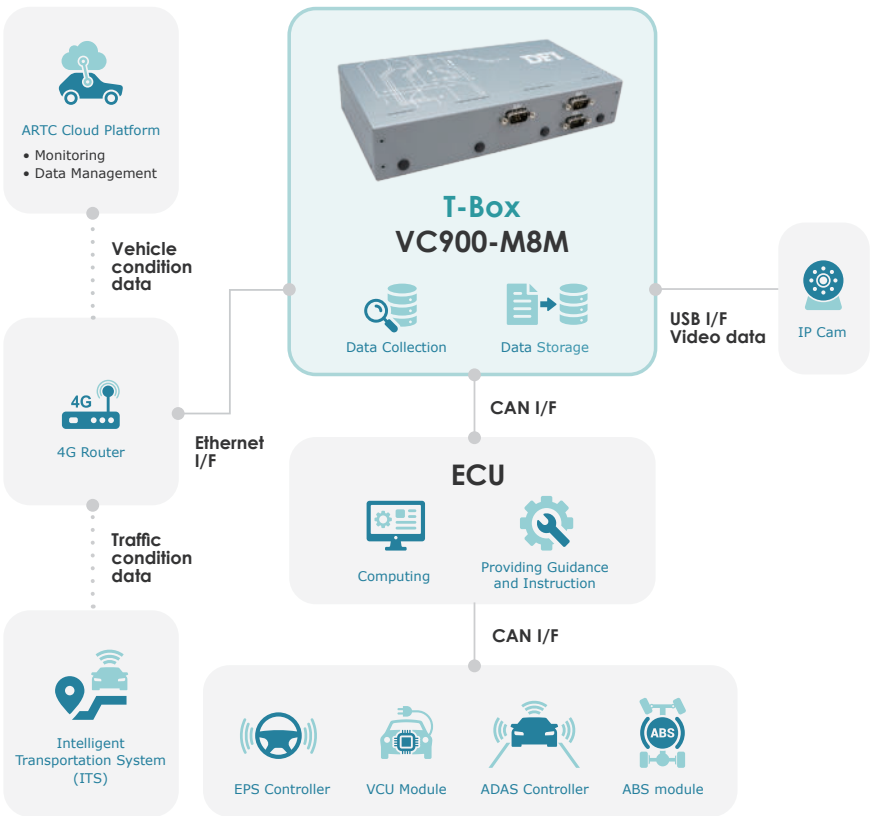
VC900-M8M serves as a T-Box, Collecting Essential Data for Fleet Operational Efficiency Enhancement

Key Objective

- Monitoring **Real-time** Traffic Condition
- Demonstrable Increase in Efficiency
- En-route Accident Avoidance

Perceived Problem for Autonomous Driving

- Cybersecurity issue
- Stable Connectivity
- Unpredictable Road Condition



The WinBus was created by ARTC with the support of the Technical Department of the Ministry of Economic Affairs and has gathered research and development capabilities from DFI and other industry manufacturers. In January 2020, its application was approved for the self-driving, sightseeing "sandbox" experimental project in the Zhangbin Lugang area and became Taiwan's first experimental self-driving vehicle operating on roads. In addition to sightseeing transfers at four attractions and the Tianhou Temple parking lot near the Zhangbin Industrial Park, WinBus was also implemented at Pingtung University of Science and Technology for campus shuttling verification. Function verifications were also conducted in closed areas such as Kenting Forest Recreation Area and Taoyuan City Hutoushan Innovation Hub.

In regards to Zhangbin's verification, the site was designed with signalized intersections, unsignalized intersections, crossroads, or T-intersections, etc. as well as conditions such as one-way lanes, two-way lanes, and lane reductions. There were also vehicles, pedestrians, and stray animals on the side with a total of 23 different combinations for the vehicle testing. After verifications in multiple areas, WinBus has completed scenario simulations of the basic self-driving system functions and has confirmed that its reliability meets actual needs.

What's Next: Enhancing Features to Provide Stronger Cybersecurity

The results achieved by WinBus are currently being transferred to other vehicle models such as medium-sized and large buses. ARTC also plans to standardize their program for subsequent expansion and promotion. In response to future needs for AI algorithm updates and smart car software and firmware updates, ARTC plans to enhance features such as system security and stability. This T-Box will have added functions such as improved encryption and decryption design and real-time online firmware updates (OTA). By doing so, hackers are prevented from invading the vehicle system, and system updates are more convenient. VC900-M8M's role will become increasingly important.

Safety, in particular, is a mandatory test for any device entering the online world. For vehicles that are closely related personal safety, it is essential to put "anti-hacking" at the top of the list. In view of this, DFI is leading the industry in integrating the xCarbon solution by VicOne, a vehicle information security solution manufacturer owned by global information security giant Trend Micro. This solution combines machine learning (ML) and other technologies to create tools such as smart sensor modules and virtual patches to implement functions such as domain/IP filtering and CANBus anomaly detection while using the least amount of resources. It is applicable to different automotive electronic and electrical architectures (EEA).

DFI Aims to Be Your Best Partner with High-Quality and Comprehensive Products

DFI has been deeply rooted in the IPC field for over 40 years. In addition to vehicle system solutions such as the VC900-M8M, it also has industry-leading, comprehensive product lines such industrial-grade motherboards and industrial-grade touch screen computers, as well as highly customized R&D capabilities and persistence in high quality of less than 1,000 PPM. Facing the future of a smart and functionally diverse automotive market, and with the automotive industry's persistence toward high safety and stability, DFI already has the capabilities to fulfill customer needs and will continue to develop solutions with more comprehensive functions and that are closer to what the market demands.

DFI

Founded in 1981, DFI is a global leading provider of high-performance computing technology across multiple embedded industries. With its innovative design and premium quality management system, DFI's industrial-grade solutions enable customers to optimize their equipment and ensure high reliability, long-term life cycle, and 24/7 durability in a breadth of markets including factory automation, medical, gaming, transportation, smart energy, defense, and intelligent retail.

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