# Vehicle Alert and Notification System

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## Vehicle Alert and Notification System

The modern automobile is composed of a complex family of interrelated systems. These systems are subject to breakage at the most inopportune times, subjecting operators to inconvenient and potentially dangerous situations. Many of these breakdowns are preventable if notification of a failing system can be effected prior to failure.

In addition, more time and money may be wasted when the correct part is not carried by the service vehicle or tow truck. This results in extra towing charges as well as lost time between breakdown and ultimate repair.

A system, Vehicle Alert and Notification System (VANS), provides a solution to the problems described. The VANS system relies on modern and, in part, existing technology to provide an automatic notification of failure, or potential failure, of an automotive system. For the purposes of this document, an automotive system is defined to be any vehicle whose motive power is provided by a combustion engine, to include automobiles, trucks, and specialty vehicles like RVs or mini-vans.

VANS consists of an on-board platform, the VANS Monitor, which provides notification of failing or failed systems to an external agency. VANS continues to provide the traditional operator notification mechanism although with a much improved notification system. While the entire system will be discussed, it is the VANS Monitor which is the heart of the proposed system.

The essential concept of VANS rests of marriage of the following existing technologies:

1. Cellular telephony has proven a practical medium that is growing in popularity. It is this technology that will provide the communication mechanism between the on-board platform and the external agency.
2. Increased utilization of microprocessor chips in the control and monitoring automotive systems.
3. Decreased costs of basic hardware such as modems, memory and processor boards make the VANS approach commercially attractive.

The VANS system uses an on-board computer to monitor automotive systems via existing, and in some cases, newly devised chips. These chips generally are designed to monitor abnormal occurrences utilizing analog measurement systems. An example of this is a heat sensor used to control air flow in the engine. The VANS Monitor will receive these notifications, translate them into a digital format which may then be transmitted to an external agency. Transmission will be accomplished by utilization of existing cellular technology.

The VANS Monitor is the heart of the VANS system, it is the on-board platform which controls the notification of failure potential as well as actual failure events. The monitor is composed of the following components which are shown in the Figure and are described immediately following the Figure.

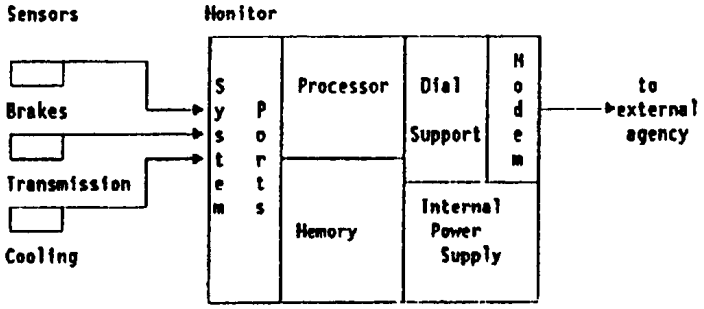


**Figure. VANS Monitor Internal Components**

Notes on the Figure

- System Ports - The system ports provide an interface between the analog sensors and the digital format required for processing and transmittal. Sensors are generally system or measurement type unique. Each may require a unique interface. For example, temperature readings from the cooling system require a different interface than fluid level readings from the transmission.

  The interface to the VANS monitor is a multiple port Analog to Digital (A/D) converter. The analog signals from the various monitoring devices on the vehicle are sampled at a sufficiently high rate to guarantee an accurate digital representation of the analog signal. The A/D converter accepts multiple inputs and has the capability to sample each input at a different rate. Since most signals in an automobile change slowly (from a computer's perspective), the conversion to digital signals can be accomplished with inexpensive A/D converters.

- Processor - Once the data is in digital format, it is interrogated by the processor and a determination is made whether the reading lies within a normal range. When data is within normal range for a specific system, it may be saved in order to create a history of previous readings. This history may be used in analyzing trends in the various systems to determine whether trends are present that indicate a potential failure occurrence. For abnormal readings the information is both transmitted to an external agency and displayed to the vehicle operator (not shown in the Figure).

  The monitor does not require a very powerful processor (at least by today's standards). The equivalent of the Intel 286 should be sufficient. The following types of memory are required.

  – Non-volatile random access memory (NVRAM):

    NVRAM is needed for storing the data derived from the ongoing sampling of the vehicle's operational parameters. There are existing NVRAM modules that include a

time of day and date function. This is needed to allow the accurate dating and time stamping of messages transmitted to the appropriate agency.

– Read-only memory (ROM) or FLASH:

ROM or FLASH memory is needed to store the code used by the processor. FLASH memory would allow code updates to be transmitted over the cellular link and updated automatically by the VANS monitor. ROMs would need to be replaced by a service technician.

- Dial Support and Modem - Dial support is invoked to transmit the diagnostic information to the external agency via standard communication mechanisms. (Note that the IBM S/390* family of processors have had a similar automatic dial feature for years). The dial support can be connected to the vehicle's existing cellular telephone or optionally to a cellular communication mechanism that is part of the VANS monitor.
- Power supply - Normally power is derived from the vehicle's electrical system. An additional battery backup is provided for use when the electrical system and battery have failed or been tampered with. Failure of either electrical supply results in a warning requesting service for the failed system.

The following aspects of the VANS Monitor are geared to provide a secure interface with an external agency.

- Hard coded phone number - To prevent the utilization of the dial capabilities of the monitor, only a single number will be supported. It is envisioned that this number would be an 800 number providing access only to the external agency.
- Vehicle Identification - Identification of transmitting vehicles will be maintained via the vehicles identification number which is required by law to be unique.

The VANS view of a suitable external agency would be an automotive manufacturer-funded service bureau. These corporations are already building databases which include service and ownership records of all new vehicles sold. The service bureau would provide the telephonic facilities for one or more manufacturers. Upon receiving a signal from a distressed vehicle, notification would be passed to a manufacturer and/or service vehicle.

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