



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.



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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19AUB204 – AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING

II YEAR / IV SEMESTER

Unit 5 – Electronics Systems

Topic : Electronic Engine Management and its Types



ELECTRONIC ENGINE MANAGEMENT SYSTEMS



- ❖ Electronic Engine Management Systems (EEMS) are sophisticated control systems designed to manage various aspects of an engine's operation, ensuring optimal performance, efficiency, and emissions control.
- ❖ By integrating these various components and systems, an EEMS ensures that an engine operates efficiently, reliably, and with minimal environmental impact.
- ❖ Advances in electronic control technologies continue to drive improvements in vehicle performance, safety, and emissions compliance.



COMPONENTS



❖ Electronic Control Unit (ECU)

- **Engine Control Module (ECM):** The main computer that controls engine functions such as fuel injection, ignition timing, and emissions systems.
- **Powertrain Control Module (PCM):** Integrates control of both the engine and the transmission.





COMPONENTS



- ❖ **Oxygen Sensors (O₂ Sensors):** Monitor the amount of oxygen in the exhaust gases to adjust the air-fuel mixture.
- ❖ **Mass Air Flow (MAF) Sensor:** Measures the amount of air entering the engine to determine the required fuel injection.
- ❖ **Throttle Position Sensor (TPS):** Monitors the position of the throttle valve to manage engine speed and load.
- ❖ **Coolant Temperature Sensor:** Measures the engine's coolant temperature to adjust fuel mixture and ignition timing.
- ❖ **Crankshaft Position Sensor:** Monitors the position and rotational speed of the crankshaft to control ignition and fuel injection timing.
- ❖ **Camshaft Position Sensor:** Works with the crankshaft position sensor to monitor the position of the camshaft, aiding in precise valve timing.



COMPONENTS



❖ Actuators

- **Fuel Injectors:** Deliver the precise amount of fuel into the engine's combustion chambers.
- **Ignition Coils:** Generate the high voltage needed to create a spark at the spark plugs.
- **Idle Air Control (IAC) Valve:** Controls the engine's idle speed by regulating air flow around the throttle plate.
- **Variable Valve Timing Actuators:** Adjust the timing of the intake and exhaust valves to optimize performance and efficiency.



WORKING



- ❖ Sensors continuously monitor various engine parameters and environmental conditions.
- ❖ The collected data is sent to the ECU in real-time.
- ❖ The ECU processes the incoming data using pre-programmed algorithms.
- ❖ It determines the optimal settings for fuel injection, ignition timing, and other parameters based on this data.
- ❖ The ECU sends control signals to the actuators based on its calculations.
- ❖ For example, it adjusts the duration and timing of fuel injector pulses and controls the ignition coils to manage spark timing.



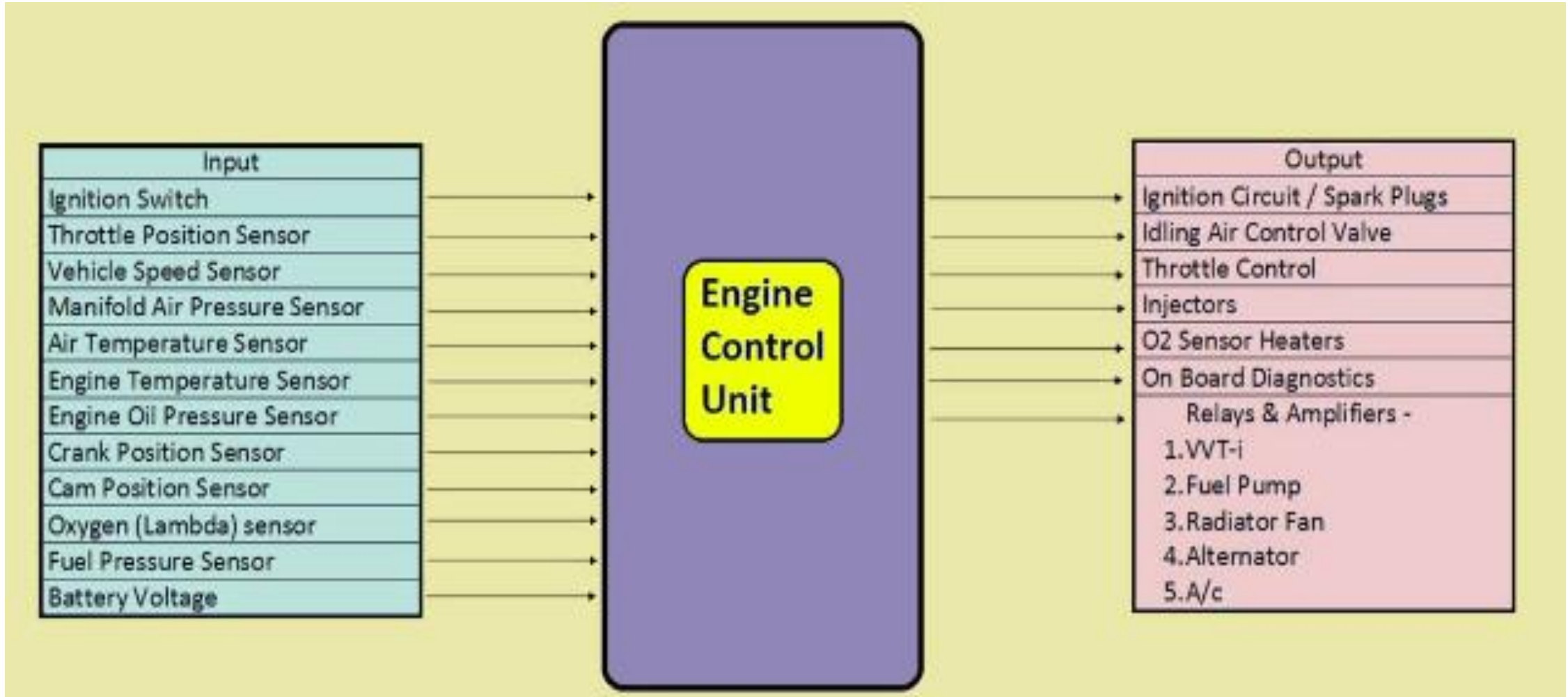
WORKING



- ❖ The system operates in a closed-loop, constantly adjusting parameters to maintain optimal engine performance.
- ❖ Feedback from sensors like the oxygen sensor helps the ECU fine-tune the air-fuel mixture to achieve efficient combustion and minimal emissions.



WORKING





TYPES OF ELECTRONIC ENGINE MANAGEMENT SYSTEM



FUEL INJECTION SYSTEM



- ❖ **Single-Point Injection (SPI):** Uses a single fuel injector located at the throttle body to supply fuel to all cylinders.
- ❖ **Multi-Point Fuel Injection (MPFI):** Uses individual injectors for each cylinder, placed at the intake manifold.
- ❖ **Direct Fuel Injection (DFI):** Injects fuel directly into the combustion chamber, allowing precise control over the air-fuel mixture.



IGNITION SYSTEM



- ❖ **Distributor-Based Ignition:** Uses a mechanical distributor to route high voltage from the ignition coil to the spark plugs.
- ❖ **Distributor-Less Ignition System (DIS):** Uses multiple ignition coils controlled by the ECU, eliminating the need for a distributor.
- ❖ **Coil-On-Plug (COP) Ignition:** Each spark plug has its own ignition coil, allowing precise control over spark timing.



VARIABLE VALVE TIMING SYSTEM



- ❖ **Variable Valve Timing (VVT):** Adjusts the timing of the intake and exhaust valves to enhance performance and efficiency.
- ❖ **Variable Valve Timing and Lift (VVTL):** Adjusts both the timing and the lift of the valves for improved engine control.
- ❖ **Variable Valve Timing with intelligence (VVT-i):** Toyota's version of VVT that optimizes valve timing based on engine speed and load conditions.



EMISSION CONTROL SYSTEM



- ❖ **Exhaust Gas Recirculation (EGR):** Recirculates a portion of exhaust gases back into the intake manifold to reduce nitrogen oxide (NO_x) emissions.
- ❖ **Catalytic Converter Management:** Ensures optimal operation of the catalytic converter to reduce harmful emissions.
- ❖ **Oxygen Sensor Management:** Uses feedback from oxygen sensors to adjust the air-fuel mixture for optimal combustion and emissions control.



THANK YOU !!!