Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 8, July, 2021: 609 -617

Research Article

Benchmarking And Reverse Engineering Of Pcba's For Iecp's & Hvac's

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ABSTRACT

The objective of this work is to find out various functions and working of the products under Body control systems and steps for manufacturing, assembling of PCB's and the materials used for the making of PCB. After finding the functions as given we should know in depth the details of the different company products under IECP's and HVAC's. from those we should choose a product under each stream and do bench marking for the products. For that we should reverse engineering. The work deals with the benchmarking of the PCB's of IECP (HVAC) system and finding out the cost comparison, functional difference and we should find out the value addition the PCB by comparing it with the other manufacturers or original equipment manufacturer (OEM's).Then we should perform reverse engineering for our PCB by manually designs procedure.

Keywords:PCB, IECP, HVAC

Introduction

Bench marking enables the comparison of design, cost and functional variation between products of competitors of the same class

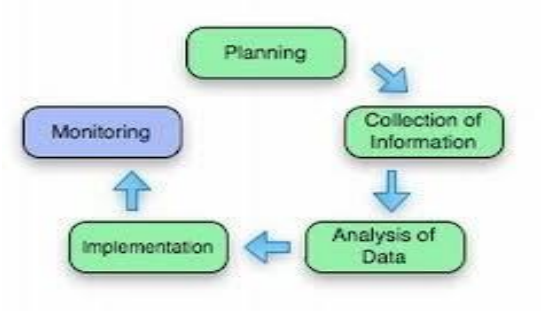

Fig1: Benchmarking

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Reverse Engineering

Reverse engineering is the process of discovering the technological principles of a device, object, or system through analysis of its structure, function, and operation.

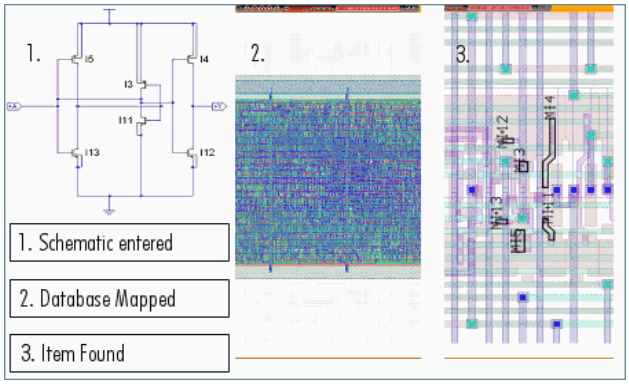


Fig2: Reverse Engineering

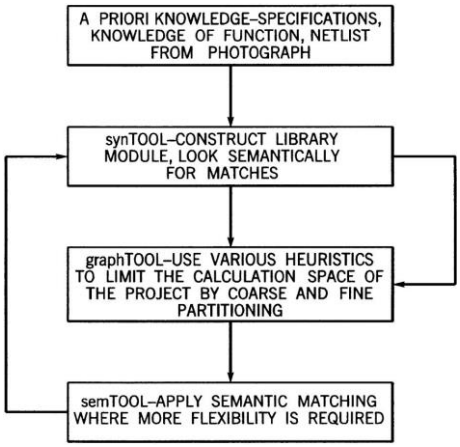
Benchmarking and Reverse Engineering of Integrated Circuits

The software comprises several tools, each of which performs particular functions in the Reverse Engineering process. The analyst, through a standard interface, directs each tool to the portion of the task to which it is most well suited, rendering previously intractable problemssolvable.The tools are generally used iteratively to produce a successively more abstract picture of a circuit, about which incomplete a priori knowledge exists.A six-sigma driven improvement philosophy from product design to post launch helps the company deliver high quality, cost competitive IECP, SCCM, MMI, HVAC, Sensors, Access System.

Fig3: Six-sigma

ConceptualFramework

FLOW CHART FOR 'RE' OF PCB:



AUTOMOTIVE ELECTRONICS

Automotive electronics are the electronics used in automobiles. Automotive electronics first began with the need for better controls for the engine. In fact, the first electronic part in an automobile was called an ECU which actually means" Engine control unit", but as they used similar electronic control for other automotive application they called it the same ECU but with a more general meaning "Electronic control unit". A modern car may have up to 100 electronic control units and a commercial vehicle up to 40.Automotive electronics or automotive embedded systems are distributed systems and according to different domains in the automotive field they can be classified into:

1. EngineElectronics.
2. Transmission Electronics.
3. ChassisElectronics.
4. ActiveSafety.
5. Driverassistance.
6. PassengerComfort.
7. Infotainment systems.

The project deals with Infotainment systems which include:

1. Navigationsystem
2. Musicsystem
3. Informationaccess

The developments methods of these systems vary according to the manufacturer. Different tools are used for both hardware and software development.

BODY CONTROL SYSTEMS

BCS is a leading producer of electronic heating and air conditioning controls and displays, integrated electronic centre panels with capacitive switching, modular steering controls with integrated steering angle sensors and rain sensors, man/machine interface controls and switches, including a wide array ergonomic application. In addition, BCS is the industry leader for in-vehicle HVAC software and systems, as well as rain light sensor technology and multi-sensor technology.
BCS products are categorized by six product lines:

- Integrated Control Panels (IECP)/CentreModules/Infotainment.
- Steering Column Control Module (SCCM).
- Switches/Man Machine Interface (MMI) Modules.
- HVAC (Heating, Ventilation, AirConditioning).
- Sensors.
- AccessSystems.

Technologies in the BCS product line portfolio include:

Integrated Control Panels (IECP)/Centre Modules/Infotainment:

Advancements in vehicle electrical architecture and styling direction has driven the development of Body Control Systems (BCS) IECP, Centre Modules and Infotainment.Combining the functions of climate controls, radio and navigation display-typically found separately in the instrumentation panel centre stack –into a single part reduces cost and complexity at the vehicle assembly plant.

Fig: IECP

Technologies in BCS Integrated Electronic Control Panels product line portfolio include:

1. LED Backlighting.
2. Capacitive TouchSensing.
3. Touch ScreenDisplays.
4. Dead Front CurvedSurfaces.
5. Knobs and Buttons with custom travel and Effortcharacteristics.

HVAC (Heating, Ventilation & AirConditioning)

BCS is an industry leader for in-vehicle heating, ventilating & air conditioning (HVAC) software and systems, and a leading producer of electronic heating and air conditioning controls and displays.With a goal of efficient climate control, products are designed to use minimum energy required to maintain cabin comfort, resulting in increased fuel economy for conventional vehicles and extended range for hybrid and fully electric vehicles.Functions are

electronic heating, air conditioning and displays. They have automotive cabin comfort and HVAC sensors.

Fig: HVAC

The HVAC product line portfolio includes a wide variety of HVAC products:

6. HVACControls.
7. Remote Climate Control Modules(RCCM).
8. Efficient Comfort ControlAlgorithm.

FUNCTION OF COMPONENTS IN IECP (HVAC)

First car with actual AC system was the Packard in 1939. It consists of a large evaporator, called the “cooling coil”, which took up the trunk space of the vehicle (control blower switch). From 1970 the demand increased, 75% of all new cars are equipped with air conditioners in 2006 and this might increase to 85% in 2012. Modern automatic temperature control set ups allow individual adjustments, even for those on the backseat.R134a refrigerant, which contains no chlorine redesigned AC system. R744 – Additional cooling and heating performance.Integrated Electronic Control Panel/IVI as a set of solutions and applications for automobiles which satisfy different customer needs including commerce, entertainment, safety, maintenance, communication and info mobility (i.e. navigation).The functional difference between the different OEM’s and the supplier name followed by the assembly and mounting method.

AUDI A6 Supplier - COTINENTAL.

SKODA SUPERB Supplier -BEHR HELLA THERMO CONTROLGmbH.
FORDMONDEOSupplier-BLAUPUNKT GmbH (ROBERTBOSCH).
FORDFOCUSSupplier-TRW.

Car audio/video (car AV) or Vehicle audio for non-car vehicles, auto radio, mobile audio, 12-volt and other terms are used to describe the sound or video system fitted in a vehicle.
First car with actual A C system was the 1939 Packard. It consists of a large evaporator, called the “cooling coil”, which took up the entire trunk space (control blower switch). Modern automatic temperature control set-ups allow individual adjustments, even for those

of back seats.From the earliest days of radio, enthusiasts had adapted domestic equipment to use in their cars. The commercial introduction of the fitted car radio came in the 1930s from the Galvin Manufacturing Corporation.Heating, ventilating, and air conditioning is based on inventions and discoveries made by Nicolay Lvov, Michael Faraday, Willis Carrier, Reuben Trane, James Joule, William Rankine, Sadi Carnot, and many others.

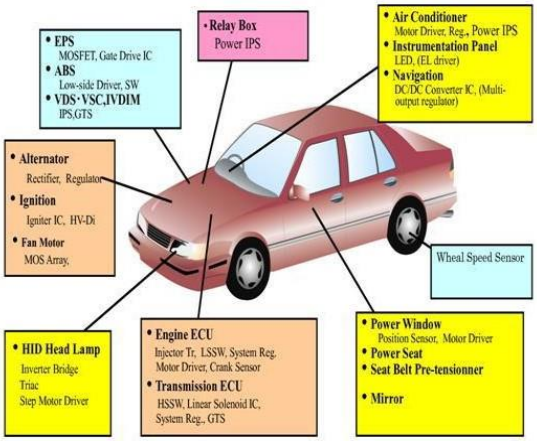


Fig: Electronic Functions

MECHANICAL FUNCTIONS OF IECP (HVAC)

- ACButton.
- RearDefog.
- Mode ControlButton.
- Air CirculationButton.
- Driver Side TemperatureControl.
- Passenger Side TemperatureControl.
- Blower Control Button.
- Front Defog.
- Passenger Side AutoButton.
- Driver Side AutoButton.
- LCDDisplay.
- Dummy Buttons/BlankButtons..
- OFFButton.
- SensorButton.
- SynchronizeButton.
- Rotary PushButton.

- TopLeft
- Selectionkey
- Electric BrakeSystem.
- Gear Lever PositionIndicator.
- Touch PadControl.
- Provision for GearLever.
- MMI ControlConsole.
- Provision for EngineStart/Stop.
- Volume Control SystemOn/Off.
- Next/PreviousButton.
- NAVkey.
- TELKey.
- Menu Key.
- Bottom Left SelectionKey.
- BackKey.
- Bottom Right SelectionKey.
- CarKey.
- MediaKey.
- RadioKey.
- Top Right SelectionKey.

COMPONENTS IN PCB OF IECP (HVAC)

- VOLTAGE MODE ACTIVE CLAMPCONTROLLER.
- 5V LOW DROP VOLTAGEREGULATOR.
- MICROCONTROLLER.
- RESISTORS.
- CAPACITORS.
- TRANSISTORS.
- DIODES.
- OPAMP.
- SMART HIGH-SIDE POWERSWITCH.
- SINGLE 8-CHANNEL ANALOGMULTIPLEXER/DEMULTIPLEXER.

BENEFITS

1. Optimized climate control feature, function andperformance
    1. Provide passengercomfort
    2. Full range of features andfunctionality
2. Vehicle integration and applicationexpertise
3. Architecture that supports cockpit assembly andintegration
4. Designs result in significantly fewer parts than other availabledesigns
5. Blower fan technology for optimized energyconsumption
6. Multiple air distribution options for design and systemflexibility
7. Air particulate and odor filtration systems for improved comfort and convenience

APPLICATIONS

HVAC units for a wide range of vehicles, from the commuter/mini segments of Asia to the premium sports cars of Italy. Applications also include light, medium and heavy duty trucks and off-road agricultural/construction related vehicles. The IECP offers flexible customized design including color matching to the interior, back lighting and jeweled surfaces, as well as providing superior fit and finish. It could include external device interfaces – offering both direct and wireless (Bluetooth]) interface and control of nomadic devices including cell phones, MP3 players, Radio, Broadband internet access, and navigationdevices. The IECP technology roadmap calls for a number of sophisticated developments including hybrid touch sensing technologies touch screen displays, proximity sensing and the possibility of gesture recognition and advanced vision technology to assist in controlling vehicle functions.

Limitations

The Limitations regarding our project are:

1. Availability of the text books limited too few due to less exposure on the practicalknowledge.
2. Lack of knowledge on the metals, plastics used in the automotivesystems.
3. Lack of specific knowledge on the where to use a particular component for designing the printed circuitboard.

Conclusion

The knowledge gained at present is with the help of the company guide and the going to the innovation Centre for more practical knowledge. Working under the live project CLOCK SPRING PCBA COST ESTIMATION AND DETAILED ANALYSIS.A better understanding on the automotive electronics by UNDERSTANDING AUTOMOTIVE ELECTRONICS and other electronic text books.

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