TWINTECH®

Since 1989

TWINTECH CONTROL SYSTEMS PVT. LTD.

Your Single Destination For Electronic Product Innovation/ Product Division

ELECTRONICS SYSTEM ENGINEERING SERVICES

- ELECTRONICS HARDWARE DESIGN
- EMBEDDED SOFTWARE
- SIGNAL PROCESSING AND CONTROL SYSTEMS
- MODEL BASED DESIGN
- SIMULATION AND TESTING
- MECHANICAL DESIGN
- INTEGRATION, COMPLIANCE AND SAFETY
- LIFECYCLE MANAGEMENT

Partner with us for excellence in electronic innovative solutions which meet global standards.

Electronic System Engineering (ESE) services

WHY TWINTECH FOR ELECTRONIC INNOVATION?

1. Since 1989, pioneering indigenization of process control instruments and sensors.
2. Specialized Knowledge and use of latest tools and technologies.
3. End-to-end capabilities, from design and prototyping to deployment and maintenance.
4. Offer fully customized designs with client-centric approach.
5. A history of successful partnerships with repeat customers.
6. Compliance with international and industry-specific regulations.
7. Maintaining quality certifications for the last 20 years.
8. Completed over 52 projects since 2015 for more than 15 companies.
9. Focus on locally designed and manufactured products, tailored to meet global standards.

OUR ESE SERVICE OFFERING

- **Electronic Hardware Design:** Crafting custom hardware solutions tailored to specific client needs.
- **Embedded Software Development:** Developing software for embedded systems to ensure seamless hardware-software integration.
- **User Interface (UI) Design:** Creating intuitive interfaces that enhance user experience.
- **industrial Internet of Things (IoT):** Implementing IoT solutions to optimize industrial processes and connectivity.
- **Android Development:** Building Android applications to support various industrial applications

WE HAVE DELIVERED

1. 8 types of import substitute speed sensors
2. Various process control instruments, simulators and testing jigs
3. Smart Devices with connected ecosystems
4. Digital Speedometers and steering control systems for Agriculture applications
5. New CAN Bus display systems

ELECTRONICS HARDWARE DESIGN

A) **Electronics Hardware Design** involves the creation of physical electronic circuits and systems that perform specific functions. This process includes designing individual systems, selecting appropriate components, creating schematics, laying out printed circuit boards (PCBs), and testing prototypes.

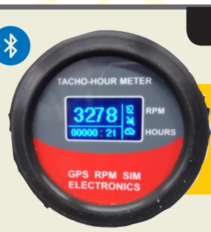
1. **Architecture Design:** Understand the requirements of the electronic system being designed, including functionality, performance, power consumption, size constraints, cost targets, and regulatory requirements.
2. **Component Selection:** Select electronic components such as resistors, capacitors, inductors, integrated circuits (ICs), connectors, and sensors based on the system requirements, performance specifications, and availability.
3. **Schematic Design and PCB Layout:** Create a schematic diagram using electronic design automation (EDA) software to represent the interconnections between components and their electrical properties. The schematic serves as a blueprint for the physical layout of the circuit. Design the layout of the printed circuit board (PCB) using PCB design software. Place components on the PCB, route traces to connect the components according to the schematic, and optimize the layout for signal integrity, electromagnetic compatibility (EMC), and thermal management.
4. **Thermal Management:** Design the PCB layout and select components to manage heat dissipation effectively and prevent overheating. Consider factors such as component placement, thermal vias, heatsinks, and airflow within the enclosure.
5. **Power Supply Design:** Design the power supply circuitry to provide stable and clean power to the electronic components. Select appropriate voltage convertors, filters, and protection circuits to meet the power requirements and ensure reliability.
6. **EMC/EMI Compliance:** Designing the PCB layout and enclosure to minimize electromagnetic interference (EMI) and ensure compliance with electromagnetic compatibility (EMC) standards.

EMBEDDED SOFTWARE

B) **Embedded Software Design** involves the creation of software that runs on embedded systems, which are specialized computing devices designed for specific functions within larger systems. Embedded software is typically tailored to the hardware platform and optimized for performance, efficiency, and real-time constraints.

1. **Architecture Design:** Understand the requirements of the embedded system, including functional requirements, performance specifications, input/output interfaces, memory constraints, and real-time behaviour. software components, communication protocols, data flow, and interfaces between software modules.
2. **Software Design:** Design the software modules and algorithms required to implement the system functionality. Break down the software into smaller, manageable units, define interfaces between modules, and establish data structures and algorithms for efficient operation.
3. **Device Drivers and Hardware Abstraction:** Develop device drivers and hardware abstraction layers (HALs) to interface with hardware peripherals, sensors, actuators, and communication interfaces.
4. **Memory and Power Management:** Manage memory resources efficiently, including RAM, ROM, and non-volatile memory, to minimize memory footprint, optimize performance, and prevent memory leaks or fragmentation. Implement power management strategies to optimize energy consumption and extend battery life in battery-powered embedded systems.
5. **Embedded GUI Design:** It to the process of creating graphical user interfaces (GUIs) for embedded systems. Designing GUIs for such systems involves unique challenges and considerations, as the hardware and software capabilities are often limited compared to general-purpose computers
6. **Error Handling and Fault Tolerance:** Implement error handling mechanisms and fault tolerance strategies to detect and recover from software errors, hardware faults, and exceptional conditions, ensuring system reliability and robustness.

CASE STUDIES - 1



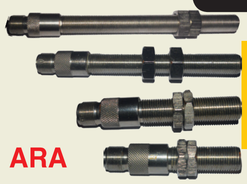
TACHOMETER BLUETOOTH ENABLED

YEAR 2017

Twintech ESE Service

- ELECTRONICS HARDWARE DESIGN
- LIFE CYCLE MANAGEMENT
- EMBEDDED SOFTWARE
- INTEGRATION COMPLIANCE AND SAFETY
- MECHANICAL DESIGN
- SIMULATION AND TESTING

CASE STUDIES - 2



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IMPORT SUBSTITUTE MAGNETIC PICKUP

YEAR 2019

Twintech ESE Service

- SPECIAL MAGNET USED
- LIFE CYCLE MANAGEMENT
- STRUCTURE DESIGN
- INTEGRATION COMPLIANCE AND SAFETY
- MECHANICAL DESIGN
- NEW DIE DESIGN
- SIMULATION AND TESTING

SIGNAL PROCESSING AND CONTROL SYSTEMS

C) Signal Processing involves the manipulation of signals to extract useful information, enhance features, or remove unwanted components. It encompasses both analog and digital techniques for processing various types of signals, including audio, video, image, sensor data, and communication signals. Here are key aspects of signal processing:

1. **Signal Representation:** Signals can be represented in time-domain or frequency-domain representations, allowing analysis of their characteristics and properties.
2. **Filtering and Transforms:** Filtering techniques are used to remove noise, distortions, or unwanted components from signals. This includes low-pass, high-pass, band-pass, and notch filters. Signal transforms, such as Fourier transform, Laplace transform, and Z-transform, are used to analyse signals in different domains (frequency, time, or complex).
3. **Digital Signal Processing (DSP):** DSP involves the implementation of signal processing algorithms using digital hardware or software platforms. DSP chips and software libraries provide efficient means for processing signals in real-time.

C1) Control systems are used to regulate the behaviour of dynamic systems, ensuring that they operate according to desired specifications or performance criteria. Control systems utilize feedback mechanisms to continuously adjust system parameters based on measured signals or sensor data.

1. **Control Strategies:** Different control strategies, including feedback control, feedforward control, cascade control, and adaptive control, are employed based on system requirements and characteristics. Feedback control systems continuously monitor system output (or state) and adjust control inputs to maintain desired performance or stability. Controllers, such as proportional-integral-derivative (PID) controllers, are used to compute control signals based on error signals between desired and actual system states.
2. **System Stability:** Stability analysis ensures that control systems remain stable under various operating conditions and disturbances. Stability criteria, such as Bode plots and Nyquist criteria, are used to assess system stability.
3. **Real-Time Implementation:** Control algorithms are implemented in hardware (e.g., microcontrollers, PLCs) or software (e.g., control software running on embedded systems) for real-time control of physical processes.

MODEL BASED DESIGN

D) Model-Based Design (MBD) is an approach to the development of complex systems that focuses on creating and using models to design and simulate the system before implementation. This methodology is widely used in various engineering disciplines, including control systems, signal processing, embedded systems, and mechatronics. Here's an overview of Model-Based Design:

1. **Model Development:** In MBD, engineers create mathematical and computational models of the system being developed. These models capture the behavior, dynamics, and interactions of the system's components and are represented using mathematical equations, block diagrams, state machines, or other formalisms.
2. **Simulation and Analysis:** Once the models are developed, they are simulated using specialized software tools, such as MATLAB/Simulink, Modelica, or VHDL-AMS. Simulation allows engineers to evaluate the system's behavior under different conditions, inputs, and scenarios, helping identify potential issues, validate design decisions, and optimize performance.
3. **Verification and Validation:** MBD enables rigorous verification and validation of system designs through simulation-based testing. Engineers can verify that the system meets functional requirements, performance specifications, and safety standards by simulating various operating conditions and edge cases.
4. **Rapid Prototyping:** MBD facilitates rapid prototyping and iterative design by enabling engineers to quickly modify and iterate on the system models. Changes to the model can be easily implemented and tested in simulation before committing to hardware implementation, reducing development time and cost.

5. **Automatic Code Generation:** One of the key benefits of MBD is the ability to automatically generate production-ready code from the system models. This code can be directly deployed to target hardware platforms, such as microcontrollers, ASICs, saving time and effort in manual coding and debugging.
6. **Design Optimization:** MBD enables optimization of system designs by leveraging simulation-based optimization techniques. Engineers can explore design alternatives, parameter values, and control strategies to achieve desired performance metrics, such as speed, accuracy, efficiency, or cost.

E) Simulation and Testing are essential processes in the development and validation of systems across various engineering domains. These processes help engineers evaluate the performance, reliability, and safety of systems before they are deployed in real-world environments.

SIMULATION AND TESTING

E1) Simulation:

Simulation involves creating a computational model of the system and running it under different conditions to analyse its behaviour. Simulations can be conducted at various stages of the development lifecycle, from early design phases to final validation. Here are key aspects of simulation:

1. **Model Development:** Engineers create mathematical, computational, or physical models of the system using simulation tools or software platforms. Models capture the system's behaviour, dynamics, and interactions with its environment.
2. **Analysis:** Simulation results are analysed to evaluate the system's performance, response to inputs, stability, and other characteristics of interest.
3. **Real-Time Simulation:** Real-time simulation platforms enables us to simulate complex systems in real-time, allowing for hardware-in-the-loop (HIL) testing and validation of embedded systems, control algorithms, and mechatronic systems.

CASE STUDIES - 3

BATTERY MANAGEMENT SYSTEMS FOR ELECTRICAL VEHICLE APPLICATION

YEAR 2021

Twintech ESE Service

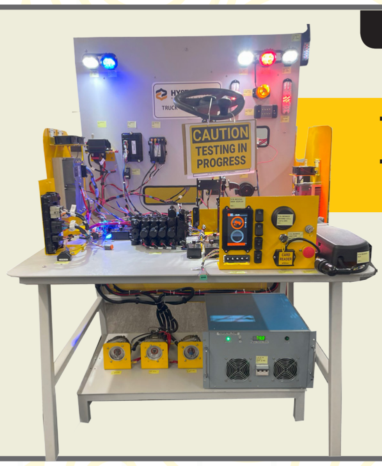
- ELECTRONICS HARDWARE DESIGN
- EMBEDDED SOFTWARE
- INTEGRATION COMPLIANCE AND SAFETY
- MECHANICAL DESIGN
- SIGNAL PROCESSING AND CONTORLS
- MODEL BASED DESIGN
- SIMULATION AND TESTING

E2) Testing:

Testing involves executing the system under controlled conditions to verify its functionality, validate its performance, and identify potential defects or issues. Testing can encompass various techniques and methodologies, depending on the nature of the system and the objectives of testing.

1. **Test Environment Setup:** Testing environments are prepared to replicate real-world conditions and scenarios. This may involve setting up physical test rigs, test benches, simulators, or virtual environments, depending on the nature of the system.
2. **Defect Identification and Debugging:** During testing, defects or issues may be identified, such as software bugs, hardware faults, or performance bottlenecks. we troubleshoot and debug these issues to address them effectively.
3. **Verification and Validation:** Testing verifies that the system meets specified requirements and validates its performance against expected behaviour. Verification ensures that the system is built correctly, while validation confirms that it meets user needs and expectations.

CASE STUDIES - 4



TRUCK SIMULATOR-TRUCK ON A BENCH

YEAR 2024

Twintech ESE Service

- ELECTRONICS HARDWARE DESIGN
- EMBEDDED SOFTWARE
- INTEGRATION COMPLIANCE AND SAFETY
- MECHANICAL DESIGN
- SIGNAL PROCESSING AND CONTORLS
- SIMULATION AND TESTING

MECHANICAL DESIGN

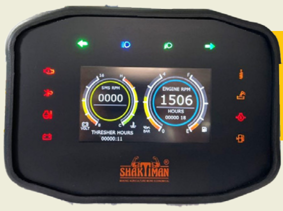
F) Mechanical Design involves the creation of physical components, mechanisms, and systems that perform specific functions in various engineering applications. Mechanical engineers use principles of mechanics, materials science, and manufacturing techniques to design products ranging from small components to large-scale machinery. Here's an overview of the mechanical design process:

1. **Conceptual Design:** Generate conceptual ideas and design concepts that meet the specified requirements. Explore different design alternatives, configurations, and mechanisms through sketches, brainstorming sessions, and feasibility studies.
2. **Computer Aided Design:** Develop detailed drawings, models, and specifications for the selected design concept. Specify dimensions, tolerances, materials, manufacturing processes, and assembly methods. CAD (Computer-Aided Design) software is commonly used for detailed design and 3D modelling
3. **Material Selection:** Select appropriate materials based on mechanical properties, thermal properties, corrosion resistance, cost, and manufacturing considerations. Consider factors such as strength, stiffness, toughness, and weight to ensure that the chosen materials meet design requirements.
4. **Prototyping:** Build prototypes or mock-ups of the design to validate its functionality, performance, and manufacturability. Prototyping allows engineers to identify design flaws, assess ergonomics, and gather feedback for refinement before full-scale production.
5. **Manufacturing Considerations:** Consider manufacturing constraints and capabilities during the design process. Design components for manufacturability, minimize machining operations, optimize material usage, and select suitable fabrication methods such as casting, machining, forging, or additive manufacturing.

INTEGRATION, COMPLIANCE AND SAFETY

G) Integration of Simulation and Testing:
Simulation and testing are often integrated throughout the development lifecycle to facilitate iterative design, validation, and verification. Simulation results inform testing activities by providing insights into system behaviour and performance, while testing helps validate and refine simulation models. This iterative process promotes continuous improvement and ensures that the final system meets quality and performance requirements. Overall, simulation and testing are critical processes in engineering design and development, enabling engineers to build robust, reliable, and high-performance systems that meet user needs and specifications. By leveraging simulation and testing methodologies effectively, we mitigate risks, reduce development time and cost, and deliver innovative solutions across various engineering domains.

CASE STUDIES - 5



DIGITAL INSTRUMENT CLUSTER

YEAR 2022

Twintech ESE Service

ELECTRONICS HARDWARE DESIGN

EMBEDDED SOFTWARE

MECHANICAL DESIGN

SIGNAL PROCESSING AND CONTORLS

SIMULATION AND TESTING

G1) Compliance involves ensuring that the electronic system complies with relevant industry standards, regulations, and specifications. Compliance requirements may vary depending on the application, industry, and geographical region.

1. **Regulatory Standards:** Identify applicable regulatory standards, such as safety standards (e.g., IEC 61508, ISO 26262), electromagnetic compatibility (EMC) standards (e.g., FCC, CE), and product safety standards (e.g., UL, CSA). Ensure that the system design and components meet these standards.
2. **Certification and Testing:** Obtain necessary certifications and approvals from regulatory agencies or certification bodies. Conduct testing and assessment to demonstrate compliance with relevant standards and regulations.
3. **Documentation:** Maintain documentation of compliance efforts, including design documents, test reports, certificates, and compliance statements. Ensure that documentation is up-to-date and accessible for audit and review purposes.

G2)Safety is paramount in electronic system engineering, especially in applications where failure could lead to harm or injury to users or the environment. Safety considerations are integrated into all phases of the design process.

1. **Safety Architecture:** Design a safety architecture that incorporates safety-critical features, redundancy, fault tolerance, and fail-safe mechanisms to minimize the likelihood and impact of failures.
2. **Safety Standards:** Adhere to safety standards and guidelines applicable to the specific application and industry. Follow safety-critical development processes, such as those outlined in IEC 61508 for functional safety of electrical/electronic/programmable electronic safety-related systems.
3. **Safety Verification and Validation:** Conduct safety verification and validation activities to ensure that the system meets safety requirements and operates safely under normal and abnormal conditions. Perform safety testing, fault injection testing, and failure mode and effects analysis (FMEA).

LIFECYCLE MANAGEMENT

H) Lifecycle Management in electronics systems engineering involves overseeing the entire lifecycle of an electronic system, from its initial concept through design, development, production, operation, maintenance, and eventual disposal or retirement. Effective lifecycle management ensures that electronic systems meet the intended requirements, comply with regulatory standards, and are delivered on time and within budget while minimizing risks and costs.

1. **Supply Chain Management:** Manage the supply chain to ensure the timely availability of components, materials, and resources. Monitor and mitigate risks related to component obsolescence, supply chain disruptions, and quality issues.

2. **Manufacturing and Production:**

1. **Manufacturing Planning:** Develop a manufacturing plan that includes sourcing components, selecting manufacturing processes, and defining production schedules. Establish relationships with suppliers, manufacturers, and assembly partners.
2. **Production Engineering:** Optimize the design for manufacturability (DFM) to reduce production costs and improve yield. Implement quality control processes to ensure that the manufactured products meet design specifications and standards.
3. **Operational Support:** Establish a support system for troubleshooting, maintenance, and repairs. Develop and deploy software updates to enhance functionality, fix bugs, and address security vulnerabilities. Plan for hardware upgrades or retrofits if needed to extend the system's lifecycle.

4. **Quality Assurance:**

1. **Quality Documentation:** Maintain thorough documentation of all quality processes, procedures, test results, and corrective actions. Ensure that all documentation is controlled, versioned, and easily accessible for reference and audits.
2. **Traceability:** Implement traceability systems to track components, materials, and processes throughout the product lifecycle. Ensure that every product can be traced back to its manufacturing and testing records for accountability and quality control.
3. **Quality Audits:** Conduct regular internal and external audits to ensure compliance with quality standards and identify areas for improvement. Review and update quality processes and procedures based on audit findings and industry best practices.
4. **Process Control:** Establish manufacturing process controls to ensure consistent quality during production. Use Statistical Process Control (SPC) techniques to monitor and control key process parameters.
5. **In-Process Quality Inspection:** Perform in-process inspections at critical stages of manufacturing to detect and address defects early.
6. **Final Product Testing:** Conduct final product testing, including functional testing, burn-in testing, and safety testing, to ensure the product meets all specifications and requirements. Implement End-of-Line (EOL) testing to validate the functionality and performance of each unit before it is shipped to customers.
7. **Root Cause Analysis:** Investigate defects, failures, or quality issues to identify their root causes. Use tools like Fishbone diagrams, 8D, and Failure Mode and Effects Analysis (FMEA) to systematically analyse and resolve issues.

5. **Maintenance**

1. **Preventive Maintenance:** Implement preventive maintenance schedules to reduce the likelihood of system failures and extend the product's lifecycle. Perform regular inspections, testing, and recalibration as needed.
2. **Corrective Maintenance:** Respond to and resolve system failures, malfunctions, or performance degradation. Provide spare parts and replacement components to support repairs and maintenance activities.

6. **Continuous Improvement:**

1. **Feedback Loops:** Establish feedback loops from all stages of the lifecycle to inform ongoing improvements in design, manufacturing, and support processes. Incorporate user feedback, field data, and technological advances to enhance future products.
2. **Process Optimization:** Continuously optimize processes for design, manufacturing, and support to reduce costs, improve quality, and accelerate time-to-market. Use simulation and modelling tools to predict and mitigate potential issues before they arise.

From 2014, Twintech has proudly collaborated with our innovation partners, providing ESE services to help them design, develop, produce / assemble the following new products

COMPLETED ESE PROJECTS

YEAR	NEW PRODUCTS	OUR INNOVATION PARTNER
2014	CAT Tachohour Meter	Caterpillar india Pvt. Ltd
	Digital Solid State Potentiometer (DPS)	Cummins India Ltd.
	RPM Indicator - 710	Railway
2015	Overspeed Card	Snark power Pvt. Ltd.
	Temprature Controller	Lawatherm Furnace Pvt Ltd.
	Precision millivolt source	Ashay measurment
	Wind Solar Charge Controller	Leanway Energy Pvt Ltd.
2016	Cell Access Door Interlock System	Cummins India Ltd.
	Temperature Switch	Greaves power
	Temperature Controller - Fish Industry	Raj Biotech
	Settable RPM Indicator	Kallapanna Awade Jawahar Shetkari Sahakari Sakhar Karkhana
	RPM Calibrator	Yenkay Instruments
2017	Tachometer with Bluetooth	Greaves power
	Frequency and Current Calibrator	Mishra Automation
	Speedometer	Tirth Agro Technology
	DPG Panel	Cummins India Ltd.
2018	Diesel Engine Parameter Display	Cummins India Ltd.
	High Voltage PWM Convertor	Cummins India Ltd.
	Tacho Hour Meter	Dynatec Industries Pvt Ltd.
	2W 4W Switch	Tirth Agro Technology
	Speed and Direction Sensor	Walchandnagar Industries
2019	Angle Sensor	Automotive reasearch association of India (ARAI)
	Smart Pressure Controller	Kaustubha Udyog
	Contnuity Machine Display	Magnkraft Automation
	Import Substitute Magnetic Speed Sensor (ARA)	Precision Electrodynamics
	M12 Hall Effect Sensor (Indigenisation)	Schaeffler India
2020	Diesel Flow Metering	Indus Tower
	TruMonitor- Blood Bank	Softwise Mechatronics
2021	EV battery manegment system (BMS)	C-DAC
	Import Substitute Magnetic Speed Sensor (GRUS)	Machine tool prototype factory (MTPF)
2022	Engine Frequency Generator	Cummins india Ltd.
	DIgital Cluster for Harvester	Tirth Agro Technology
	Indigenisation of Digital Hour Meter	Kirloskar Oil Enigine Ltd. (KOEL)
	Digital Gauges	Tirth Agro Technology
2023	Electronic Architecture for EV Tractor	Central Mechanical Engineering Research Institute (CMERI)
	Digital Cluster for EV Boom Sprayer	Tirth Agro Technology
2024	Handheld probe for oral and oropharyngeal cancer screening	Karkinos Healthcare Pvt. Ltd
	Truck Simulator - Truck on a Bench	Hyster-Yale Lift Trucks India Pvt. Ltd.
	CANJ1939 Digital Input Module	Enovation Controls India Pvt. Ltd

Partner with us to experience excellence in electronic innovative solutions which meet global standards.

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