Pipeline Investigation Gauge

Case study

Customer

A leading manufacturer of Oil & Gas Pipeline investigation gauge in US and Canada.

Project Scope/Business Need

Design and development of Magnetic Flux Leakage PIG electronics, PCB Design, FPGA RTL, Firmware and Host PC APIs for their next generation PIG.

Product Highlights

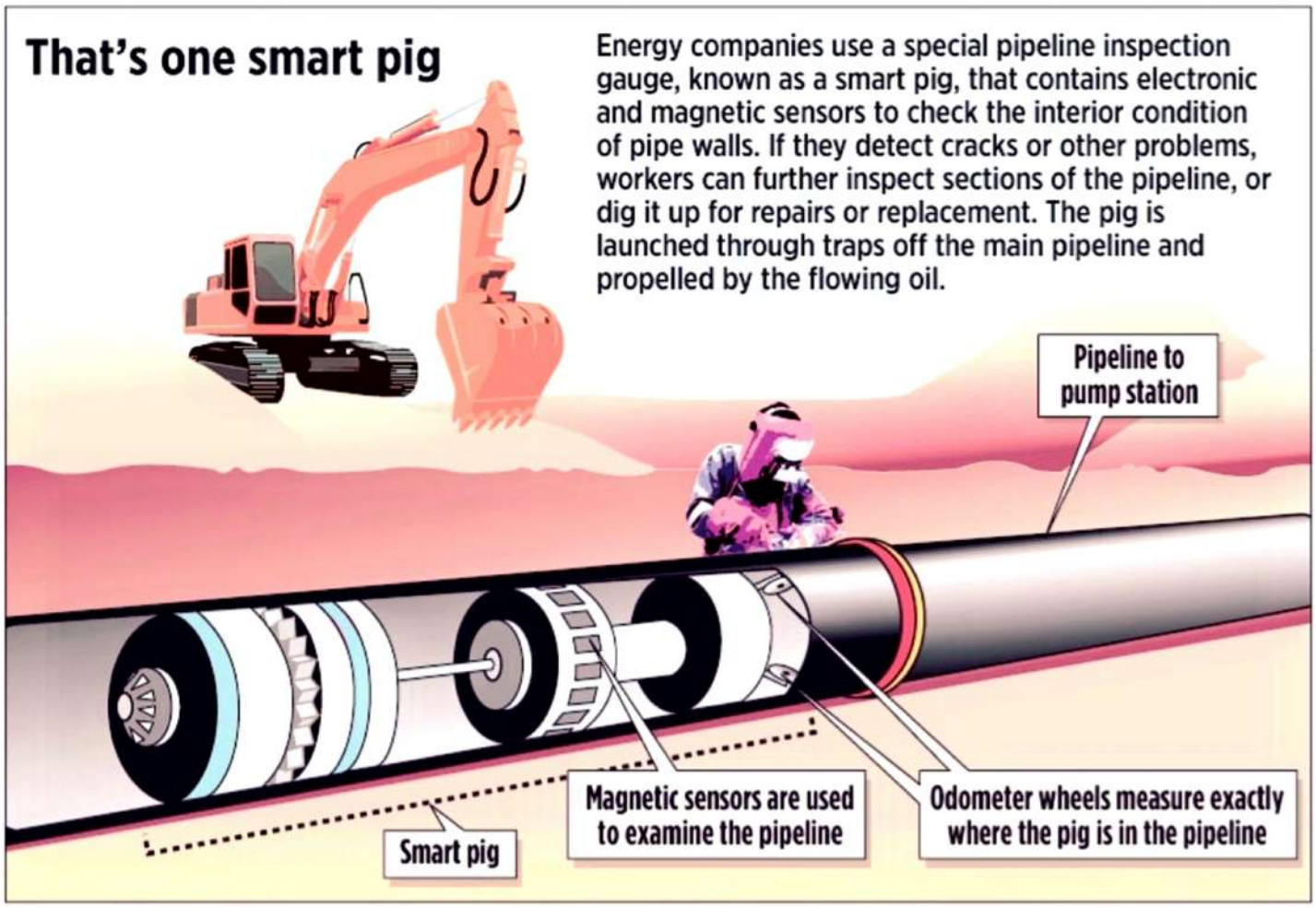
- Graceful Degradation.
- 100 hours of battery life (DD sized Li-SO_2 battery)

What is a PIG?

Pipeline Investigation gauges are devices that are inserted into pipelines and travel throughout the length of a pipeline driven by a product flow. PIGs are designed to record conditions, such as dents, wrinkles, ovality, bend radius, angle, cracks and occasionally indications of significant internal corrosion by making measurements of the inside surface of the pipe.

Why PIG a pipeline?

- To locate the damaged area.
- To prevents major outbreaks and damages.
- To save time, effort and revenue to repair a major damage.



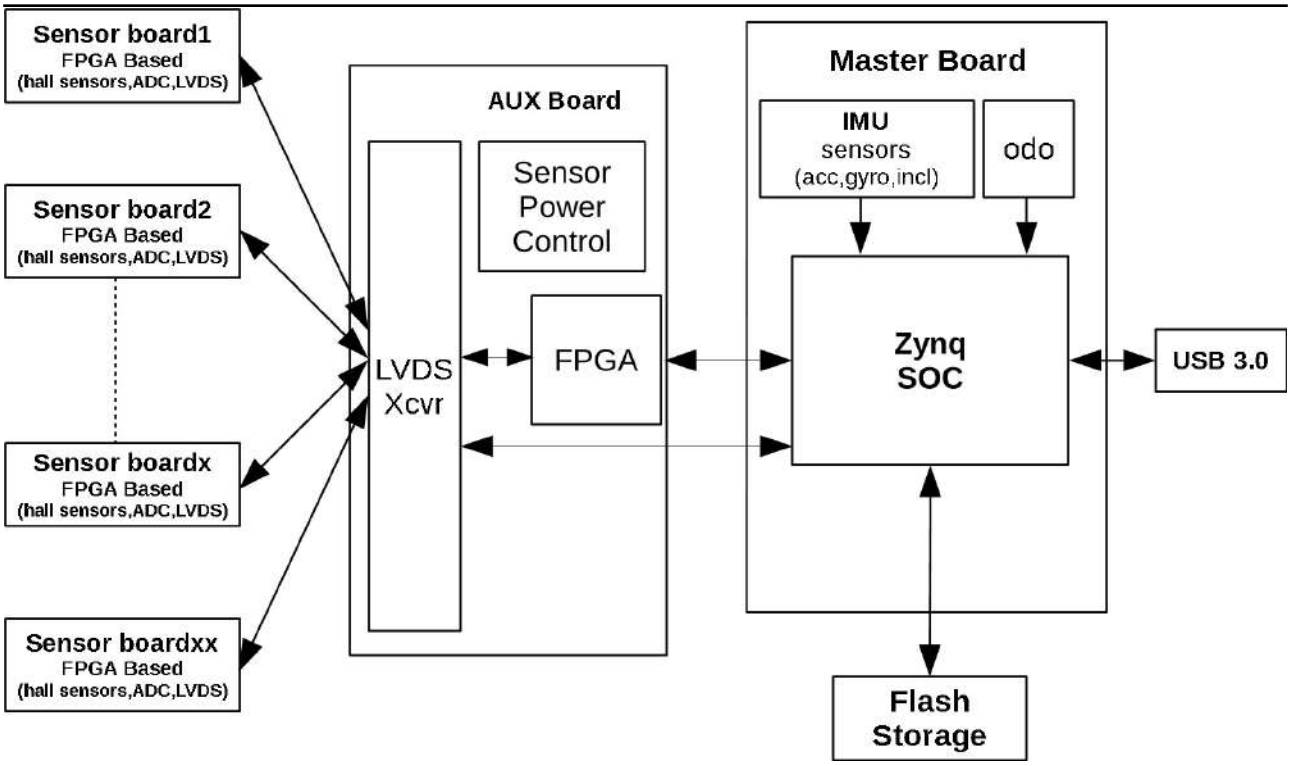
Avench System's Solution

Avench Systems Pvt. Ltd. developed a **MFL Pipeline Investigation Gauge** that could detect cracks and corrosion inside oil and gas pipelines using a technology called Magnetic Flux Leakage (MFL).

Magnetic Flux Leakage (MFL): This technology develops a strong magnetic field in the cross section of the pipe, through magnets located circumferentially around the PIG. An array of sensors record any flux leakage in the magnetic field, which indicates the metal loss.The sensors measure the magnetic flux leakage providing data of the thickness of steel around the pipe.

Drawing 1: MFL Pipeline Investigation Gauge

System Architecture



Drawing 2: High Level System Block Diagram

Master Board

The Master Board controls the entire functionality of the system and will perform the following tasks:

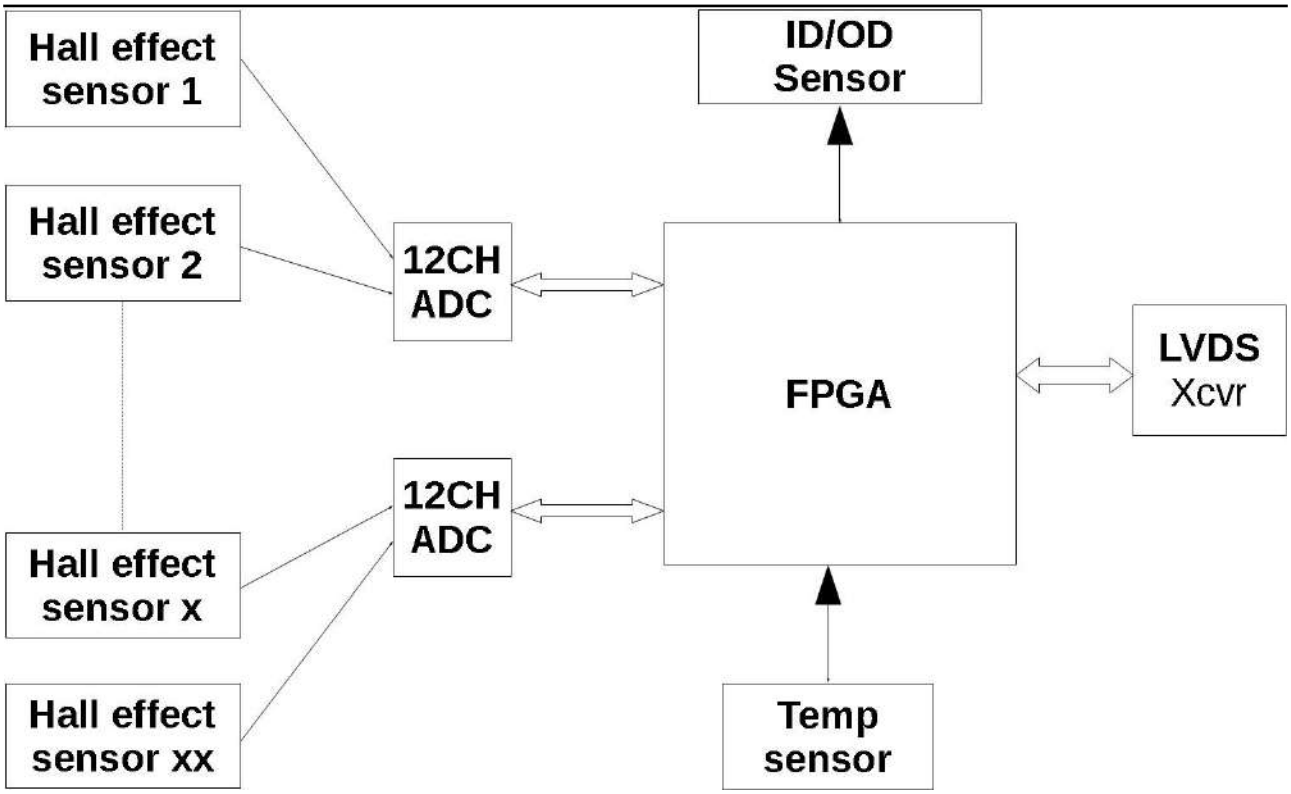
- Data download and tool configuration through USB3.0 link.
- Battery voltage monitoring.
- Temperature.
- IMU sensors (3 axis Accelerometer, 3 axis Gyro).
- Odometer Inputs.
- Real time clock.
- Data transfer to memory module.
- Data acquisition from different sensor boards and store the data into solid state storage device called Auxiliary Board.

Auxiliary Board

- FPGA based fault monitor and isolator for sensor boards.
- Can protect the system from physical failure of a Sensor board causing over-current or short circuit.
- Sensor Board Power management for optimal power usage.
- High speed M-LVDS signalling for sensors.
- Customisable based on number of sensor boards.

Sensor Boards

- FPGA based design.
- Data Acquisition of MFL sensors, Temperature and ID/OD defects.
- LVDS communication link.
- Max 24 ch Analog to digital converters in a single board.
- Sensor board is designed to support a number of hall sensors, and will vary according to tool size.
- High Density PCB design.



Drawing 3: Sensor Board

Storage Board

SD card based storage board can support up-to 2TB capacity.

- 2 x SD CARDs.
- 2 x Micro SD Cards.
- Raw storage for maximum performance.
- Can support, SD, SDXC cards.
- Uses Shock tolerant SD cards connectors for use in high mechanical shock environments.

Conclusion

ASPL could deliver the project as per the defined timeline and requirements. The client has successfully completed field trials of the product and it could perform with almost zero errors yielding extremely satisfying results. After the initial field trials, the customer has come up with additional requirements which we have completed and assured complete client satisfaction.