

Smart solutions for industry

Sensors from **Sensor Technology** have been used in many interesting applications. In one recent case the TorqSense devices have been used in a capping machine for the pharmaceutical industry; while the company's load sensors are helping to ensure operational efficiency for helicopter operators

Based in Banbury, Sensor Technology has been providing measurement solutions for many years, resulting in its sensors and transducers being selected for a wide range of diverse and interesting applications. One area in which the company specialises is its series of torque sensors which include the latest non-contact TorqSense (SAW) technology. Such technology has been used widely, however one of its most recent applications was in a capping application for the pharmaceutical industry.

Staff in hospitals wanted tops on bottles of diagnostic fluids that, while being easy to open, would be secure enough to ensure sterility of the fluid. So, Capcoder of Oxford has developed a range of capping machines that tighten the caps to a precisely defined tolerance and are also capable of logging every detail of each bottle. In operation, filled bottles are presented to a torque head which screws the cap on quickly.

However, during the development process the machine had to be highly engineered as a batch size is typically 10,000 bottles, and approximately one cap had to be placed per second. In addition, sterility had to be ensured. As the need for traceability emerged, the company realised it would have to design a standard solution which, while not being identical for each machine, would be based on the same technology deployed in the same way.

As a result, the company selected the TorqSense range from Sensor Technology due to its simplicity, robustness, speed and because it is wireless. According to Sensor Technology, TorqSense is wireless in that it does not need to physically contact the bottle caps or shaft of the torque head it is monitoring. Instead, sensing is achieved through a radio frequency link. Two tiny piezoelectric combs are attached to the shaft of the torque head, perpendicular to one another and at 45° to the axis of the shaft. These form half of a Wheatstone bridge circuit, which is in radio contact with the other half in the main body of the TorqSense.

When the shaft rotates a phenomenon known as Surface Affect Waves causes

one comb to expand and the other to contract, changing their electrical resistance in proportion to the speed of rotation. This unbalances the bridge and generates a signal indicating the torque value.

Software was also required for this project that would: run the torque up to 10kgcm within tolerances of 10%, and record the actual value achieved. This ensures the cap is secured to the bottle at a level of tightness that would ensure both security and sterility, yet could be opened relatively easily by an adult. The logged values are saved to a hard drive as a permanent record.

Roger Brown of Capcoder commented: "Diagnostic fluids are distributed widely, typically to every hospital in the country, where they may be stored for months before use. Tracing each bottle's origin would be practically impossible without full records being automatically produced and saved to a central location."

Managing information

Looking at a completely different industry, and a smart load sensor from Sensor Technology is providing commercial helicopter operators with the information needed to optimise efficiency and increase profitability.

With commercial helicopter operations it is important to manage costs to maximise profitability of flying hours, but how do they charge for their services? If it is based on weight of load they will need to know exactly how much it weighs and the precise distance it will be hauled. For crop spraying services, the rate of delivery of the pesticide needs to be controlled and, when the load is exhausted, this has to re-filled then returned to the exact place spraying stopped previously. Spraying also needs to be controlled to avoid buildings, roads, rivers etc. Similar issues are faced in helicopter fire fighting operations.

In addition to these requirements, however, the CAA (Civil Aviation Authority) puts the onus on the operator to ensure safety with slung loads and the final



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responsibility for the acceptance of any load rests with the helicopter captain.

As a solution, Sensor Technology developed the HeliNav-LoadMaster. This intelligent hook marries GPS capability with effective load sensing and other functions to automatically optimise complex operations such as spraying and multiple random load billing.

Its operation is autonomous, using its own on-board sensors, computers and batteries, making it exempt from the need for CAA or other approvals. Of additional benefit, it can be swapped from one craft to another in seconds.

The system is built around an intelligent load sensor which is based on strain gauge technology and can be calibrated as standard in 1.5 ton and three ton ranges; a cockpit display; and a ground receiver. A built-in battery powers its embedded computer and a transmitter (operating on an unrestricted 2.4GHz waveband), enabling accurate load data to be sent both to the pilot's touchscreen cockpit display and to the ground receiver. The display gives the pilot a real time measure of the load, while the GPS facility relates this data to position and time. The information presented is accurate to the kilogram-metre, and the system also logs all of this data for any subsequent analysis.

For applications such as crop spraying, the system can also be configured to provide flow indication and control, and the display can indicate whether the flow is too fast or slow for the ground speed of the helicopter. An active option provides accurate flow control, with feedback to the hopper or bucket to maintain an even application rate according to the ground speed of the helicopter. It also takes into account the reducing force at the opening as the product is used up, actively adjusting the flow rate accordingly. The load and position data is sent to the ground-based remote receiver over the 2.4GHz band, enabling data to be checked and the buckets returned completely empty.

The system also provides many data analysis functions, and enables detailed reports to be generated.

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