

data and enabling the automation of the colour measurement process. Monitoring biochemical reaction rates in this way is proving invaluable in laboratory teaching environments, while non contact item identification is another application.

#### • Lighting

Solid state lighting has been one of the fastest growing applications for LEDs in recent years; its advantages over conventional lighting include higher efficiency, variable colour point and colour rendering index (CRI), and design flexibility.

In surgical theatres, the very high CRI of LED lighting enhances visibility during operations, while the colour temperature of the light can be controlled without colour fringing or shadowing and high intensity white light can be produced with less radiated heat and lower energy consumption. Meanwhile, LED lighting in dental theatres enables the suppression of blue light, which causes premature curing of dental resins.

Over time, the colour of light output from solid state lighting can become unstable due to device aging and changes in junction temperature. This has provided an opportunity to use colour sensors in closed loop LED lighting systems; colour feedback enables compensation for changes in order to maintain the desired colour.

#### • Sensing

Infrared sensing technologies play an increasingly important role in creating a healthier, cleaner and safer environment. The latest digital infrared sensing technologies are reliable, require less pcb space and offer improved EMI resistance, compared to analogue technologies.

Smart digital thermopiles and pyrodetectors now incorporate fully integrated event logic timing, adjustable sensitivity settings and ambient light sensing. The expected advent of surface mount versions in the near future will reduce space requirements even further.

In line with a general trend towards greener,

more energy conscious products and technologies, the ability to sense ambient light levels has enabled new energy saving functionality in many areas such as display power management, lighting optimisation and building management systems.

As the sensing market proliferates, Pacer has designed and developed custom combined sensor and LED modules for a number of applications, in order to provide a complete solution, rather than compromise with a 'best fit' solution.

#### • Laser applications

Laser Rangefinder Modules, which use time of flight principles to measure distances of up to 500m, have seen their application greatly extended through the use of modules designed to be robust enough for industrial use. Designs use the latest fpgas and low cost optical devices to

spectroscopic instruments to screen drugs in the field, reducing the time taken to identify contaminants; traditional sampling and testing methods are inefficient and slow. In an unusual application, wine producers can test grapes while still they are still on the vine to determine the optimum harvesting time.

#### • Multitouch displays

The launch of the Apple iPhone and similar 'smart' phones has made the multitouch capabilities of capacitive touchscreens an almost essential feature of any new product. The superior optical clarity of capacitive panels compared to resistive panels, especially when produced with sunlight readability, has made TFT displays usable under the most demanding conditions. True multitouch is now available under the

*“Use of efficient, non contact optical sensing and illumination techniques fits perfectly with the desire for a cleaner, safer and more energy efficient environment.”*

make them small enough for incorporation into handheld devices. Low cost and reduced size could, for example, enable courier companies to increase efficiencies by using a combined GPS, compass, laser rangefinder and camera module to locate and record delivery entrances precisely.

At the top end, high repetition rate lasers are being used in scanning applications to enhance the 3D mapping capabilities of applications similar to Google Earth.

#### • Portable spectroscopy

The advent of lightweight, portable spectrometers enables biological and geographical samples to be analysed in the field, rather than back in the lab. The pharmaceutical industry uses portable

#### • High performance imaging

Biomedical applications and the life sciences demand very high performance imaging systems. This often requires high numbers of low light level detectors which, in turn, makes them expensive.

Solid state silicon photomultipliers (SiPMs) offer very high photon detection efficiency, ultra short response times and extremely low power consumption; potentially at lower cost. SiPMs are expected to become widely established in a range of analytical applications. SiPMs could also enable small, rugged, portable and inexpensive instruments for point of care diagnostics.

In the infrared region, the 'high performance, low cost' gap is being filled by single element mid wavelength detectors using PbSe technology.