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## Food & Beverage Packaging

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A smartphone controlled system to monitor and record the presence of oxygen in Modified Atmosphere Packaging (MAP) food products

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**Introduction:** The presence of excessive amounts of oxygen inside a food package at any point in the supply chain represents a real problem for the food industry, since it usually results in a detrimental effect on the food products contained within that packaging. In an effort to counteract this problem, the food industry adopts many techniques to remove oxygen from the interior of packaged goods in order to extend the shelf-lives of food products.

**Purpose:** In response to this identified need for a food-packaging based oxygen sensor, this paper describes the design of a smartphone enabled; RFID- based electronic system to monitor and record the presence of oxygen in Modified Atmosphere Packaging (MAP) food products throughout the supply chain.

**Methods:** The paper outline the basic concept of the system developed and provides details the system's two distinct components. In the first instance there is the smart label, incorporating both an oxygen indicator and an RFID tag component, which would ultimately be integrated within the product packaging. Secondly, there is the Smart Reader, the main hardware component of the system which combines an RFID reader module, an optical sensor component and a Bluetooth module. The Smart Reader is used to interrogate the smart label in order to identify breaches of the packaging, through the detection of the specified levels of oxygen.

**Results:** Initial lab testing of the Smart Reader, incorporating the wireless optical sensor and the prototype RFID tags, has delivered very promising results with proof of concept established. Testing of the developed system confirmed that the Smart Reader was able to successfully distinguish between both non-compromised and compromised packaging. When there was less than 2% concentration of oxygen in the food package the oxygen indicator remained colourless, which was detected by the Smart Reader. On the other hand, when the level of oxygen in the food package exceeded 2%, the oxygen indicator turned sufficiently blue in colour to be detected and recognised by the Smart Reader.

**Significance:** The ability to build a simple and inexpensive system that can detect and communicate the colour change in a novel oxygen indicator in the presence of excessive oxygen levels within the packaging offers a solution to a documented problem of accurately and reliably detecting breaches in food packaging.

## Biography

Gearóid O'L.aighin is an Established Professor of Electronic Engineering and Head of Electrical & Electronic Engineering at NUI Galway. His research interests are in the design of electronic health and wellness medical devices and particular interest is in Human Movement Sensing, the application of Neuromuscular Electrical Stimulation, Connected Health, Smartphone Usage in Health and Wellness and Usability considerations in the design of health and wellness medical devices for home healthcare. He is a member of the Editorial Board for Medical Engineering & Physics and a Fulbright Scholar. He has co-authored over 150 scientific articles in international peer-reviewed publications and has a Google Scholar h-index 33 and over 5,000 Google Scholar citations.

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