# Low Cost Microcontroller Based Metal Detector

A. T. J. C. Attanayake[1], L. Udawatta[2], J. M. L. C. Piyathilaka[1], R. M. T. C. B. Ekanayake[1] and A. R. Nihmiya[1]

[1]Uva Wellassa University, Sri Lanka
[2]University of Moratuwa, Sri Lanka

In many manufacturing processes, especially in the food industry, mixing of metal particles with the major product is a problem. Therefore, metal detectors are widely used for this kind of detection purposes in the industry. Some of the drawbacks with the commercially available metal detectors include, their higher cost, low discriminating power, and when they are in operation they give a lot of false alarms. Generally, the ratio between the detection of a metal and getting a false alarm varies in the region of 1:100 to 1:1000 depending on the location.

The aim of this study is to introduce an Electromagnetic Induction Device that can detect small metal particles with low false alarm rate Detailed studies on Pulse Induction (P1) type Metal Detectors have shown that, the presence of a ferromagnetic object changes the phase of the signal induced in the receiving coil. This phase change heavily depends on the type of the alloy. This property was used to classify ferromagnetic alloys in the proposed methodology.

The field survey shows that the processing speed of the system should be fast and accurate. The aliased signal from the detector receiver coils was used in this study to reduce the processing time. At the first level a high frequency signal was generated and switched using a transistor. After that, it was fed to the search coil. The induced analog signal was then amplified and converted to a digital signal using the microcontroller and displayed the digital value on the LCD display together with an output LED array and a speaker.

The result shows that different metals could be classified with 5% significance, same material but different size could be classified with 10% significance and alloys could be classified into different classes. These results depend on the templates used in the environment. Further by changing the classification algorithm, the detected objects could be classified into different groups.

Key words: Metal detector, Microcontroller, Discrete wave analysis, Electromagnetic induction.