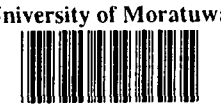
USE OF GROUND PENETRATING RADAR FOR LANDMINE CLASSIFICATION BASED ON ARTIFICIAL NEURAL NETWORK

By

P.S.L. Fernando

This thesis is submitted to the Department of Electronic and Telecommunication Engineering at the University of Moratuwa in partial fulfilment of the requirements for the Degree of Master of Engineering



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Examining Committee

Dr. V.P.C Dassanayaka (Chairperson)

Dr. D.A.I. Munindradasa

Dr. K.G.P. Dharmawardena

This Research Project was carried out at the Department of Electronic and Telecommunucation Engineering of the University of Moratuwa during the period from February 2002 to October 2004

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DECLARATION

The work presented in this dissertation has not been submitted for fulfilment of any other degree.

UOM Verified Signature

P.S.L. Fernando
Candidate

Dr. D.A.I. Munindradasa
Supervisor

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P.S.L. FERNANDO

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NOMENCLATURE

μ_0	Absolute magnetic susceptibility of free space
ρ	Conductivity of the soil (S/m)
G_t	Gain of the transmitting antenna (dB)
G_t	Gain of the receiving antena (dB)
η_0	Intrinsic impedance of the free space (Ω)
η_1	Intrinsic impedance of the soil (Ω)
η_2	Intrinsic impedance of the buried object (Ω)
$\tan\delta$	Loss tangent of the material
f	Operating frequency (Hz)
ϵ_0	Permitivity of the air (F/m)
μ_r	Relative permiability of the soil
ϵ_r	Relative permitivity of the soil
μ_r	Relative magnetic susceptibility of material
α	Signal attenuation constant of the soil (dB/m)

Abstract

This research is mainly aimed at developing a technique based on neural networks to classify metal and plastic objects buried within a range of soil conditions. In addition, the validity of this technique is also presented.

The explosives in land mines are generally cased in metal or plastic containers. Identification of buried metal and plastic objects using a neural network and a sensing technique based on an electromagnetic method are discussed in this thesis. Neural network simulation results for plastics and metal objects in the range of soil condition are also reported.

Finding the appropriate frequency window (FW) for the Ground Penetrating Radar (GPR) operation and the development of a theoretical mathematical model is also presented. Using this model, the appropriate FW for GPR operation is derived.

Furthermore the estimation of important system parameters of GPR, modulation and detection techniques, modelling of GPR, and clutter reduction techniques are also discussed in the context of this thesis.

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