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# BROADBAND CONNECTIVITY USING OPTICAL ACCESS FOR THE EASTERN PROVINCE OF SRI LANKA

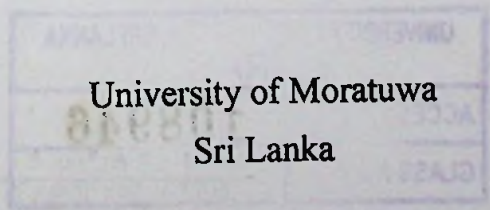
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Thesis Submitted in Partial Fulfillment of the Requirement for the Degree Master of  
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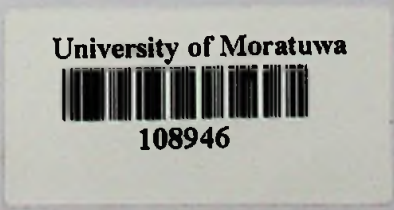
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## **Abstract**

In Sri Lanka the widely used wired technology for broadband access is Asymmetric Digital Subscriber Line (ADSL). Fiber access is available in the Western Province with limited usage such as for business purposes. The Eastern Province is the focus for this research because it is one of the affected areas during the last two decades of war and therefore has limited facilities for the people living in that part of the country. The development work in the Eastern Province is in progress at present and it also includes facilities for broadband access.

ADSL broadband usage within Eastern Province is available but limited to city areas only. This work focuses on a system to implement Fiber to the Home (FTTH) for the Eastern Province and thus provide efficient broadband access for its people. The available Fiber Access technologies are analyzed and the most suitable one is selected for implementation. The thesis proposes a network based on Passive Optical Network (PON) technology to be employed with Gigabit PON (GPON) in order to provide FTTH to a wider area of the Eastern Province. The GPON technology includes Coarse Wavelength Division Multiplexing (CWDM) with Time Division Multiple Access (TDMA); known as Hybrid PON.

For the selected four cities Optical Line Terminal (OLT) locations are identified and Ring topology access is used with Remote Nodes which can be expandable when customer number increased.

A cost estimate using the current equipment prices and the payback of the capital are calculated and presented in the thesis. The performance of the proposed network is analyzed which includes the Link Power Budget and the Bit Error Rate (BER). The performance analysis shows that the proposed Optical Access Network using GPON is feasible for implementation in the Eastern Province.



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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
ADSL	Asymmetric DSL
AGC	Automatic Gain Control
AON	Active Optical Network
ATM	Asynchronous Transfer Mode
AWG	Arrayed Waveguide Gratings
BER	Bit Error Rate
CDR	Clock-and-Data Recovery
CMTS	Cable Modem Termination System
CO	Central Office
CWDM	Coarse Wavelength Division Multiplexing
DBA	Dynamic Bandwidth Allocation
DF	Distributed Fiber
DFB	Distributed Feedback
DSL	Digital Subscriber Line



DWDM	Dense Wavelength Division Multiplexing
EDFA	Erbium doped Fiber Amplifier
EPON	Ethernet Passive Optical Network
FDD	Frequency Division Duplex
FTTC	Fiber to the curb
FTTH	Fiber to the home
FWM	Four-Wave Mixing
GEM	General Encapsulation Method
GVD	Group –Velocity Dispersion
HDSL	Bit Rate DSL
HDTV	High High-Definition Television
HSBB	High Speed Broadband
IDI	ICT Development Index
IEEE	Institute of Electrical and Electronics Engineers
ITU-T	International Telecommunication Union- Telecommunication standardization sector

LMDS	Local Multipoint Distribution Service
MAC	Media Access Control
MMDS	Multichannel Multipoint Distribution Service
MPCP	Multiple-Point Control Protocol
O/E/O	Optical/Electrical/Optical
ODN	Optical Distribution Network
OFDM	Orthogonal Frequency Division Multiplexing
OLT	Optical Line Terminal
ONT	Optical Network Terminator
ONU	Optical Network Unit
P2P	Point-to-Point
PDF	Probability Distribution Function
PMD	Polarization Mode Dispersion
PON	Passive Optical Network
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service

<b>QPSK</b>	<b>Quadrature Phase Shift Keying</b>
<b>RMS</b>	<b>Root Mean Square</b>
<b>RN</b>	<b>Remote Node</b>
<b>SOA</b>	<b>Semiconductor Optical Amplifier</b>
<b>SONET</b>	<b>Synchronous Optical Network</b>
<b>TDD</b>	<b>Time Division Duplex</b>
<b>TDM</b>	<b>Time-Division Multiplexing</b>
<b>VDSL</b>	<b>Very high Bit Rate DSL</b>
<b>Wi-Fi</b>	<b>Wireless Fidelity</b>