REMOTE OTDR FOR A REAL-TIME OPTICAL FIBER TRACING

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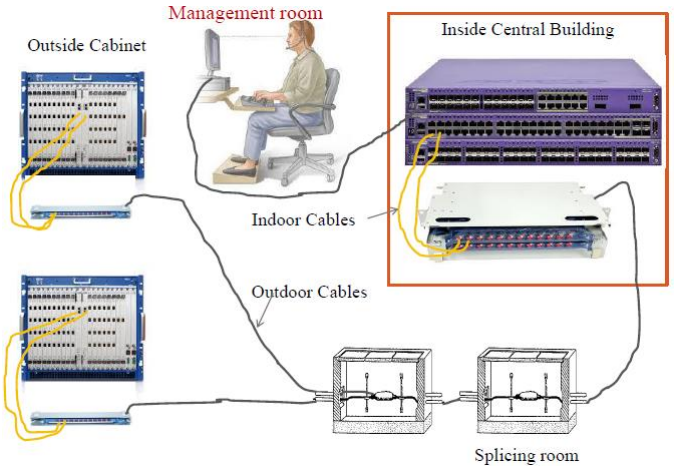
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***Abstract*—A real-time error detection through tracing optical fiber signal is an essential demand to perform continuous wired telecommunication service and the desired customer satisfaction in telecommunication industry. Data logging from remote OTDR and connected management system can monitor optical fiber cable trace to detect its status continuously. A number of parameters are associated with optical fiber cable. A simple real-time system is proposed and validated by simulation. The result shows that any change of trace status is a direct indication of fault action. Due to simple structure of the remote system, it is highly robust and easy to implement. The system can easily be implemented with an existing telephone fiber cable structure. A wire or wireless telemetry system can be used to send the real-time data from the proposed system to repairing teams mobile or a desktop computer at the monitoring lab in the exchange (central) [1].**

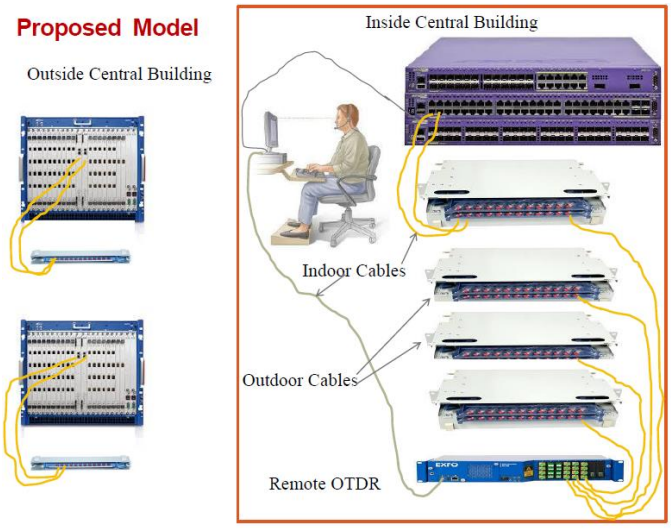
Keywords— Telephone optical fiber, remote OTDR, fault, exchange.

I. INTRODUCTION

There is not a monitor system for trace the optical fiber signal, but the existed is a management system which detect a fault without any help data as type of fault, location, and at any part of fiber network, the existed management system can be shown in figure (1- (a)). The proposed system consists of a remote OTDR connected with the existed management system inside the exchange (central) building as shown in figure (1- (b)).



(a): Existed management system.



(b): Proposed system.
Figure (1): Monitor Process.

Optical switch is used to in monitor process to make remote OTDR able to switch over the all fiber cable ports including the service ports and spare ports.

II. PRINCIPLE OF OPERATION

The idea of the proposed system is to put a remote OTDR connected with an optical switch and connected to the management room inside the exchange (central) to trace optical signal and send feedback to the repairing team outside exchange through mail or mobile message.

III. TRACING MODEL

The proposed system introduces tracing modeling for fiber network
In this case, the parameters of tracing modeling are:
- Remote OTDR,
- Optical switch,
- Management system, and
- Fiber network. In practical application, in case of fiber fault, OTDR sends an alarm to the nearing repairing team by mail or mobile message through the management system, the alarm

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contain all details of fault (time, location, Number of fiber port, part of network, time to reach fault).

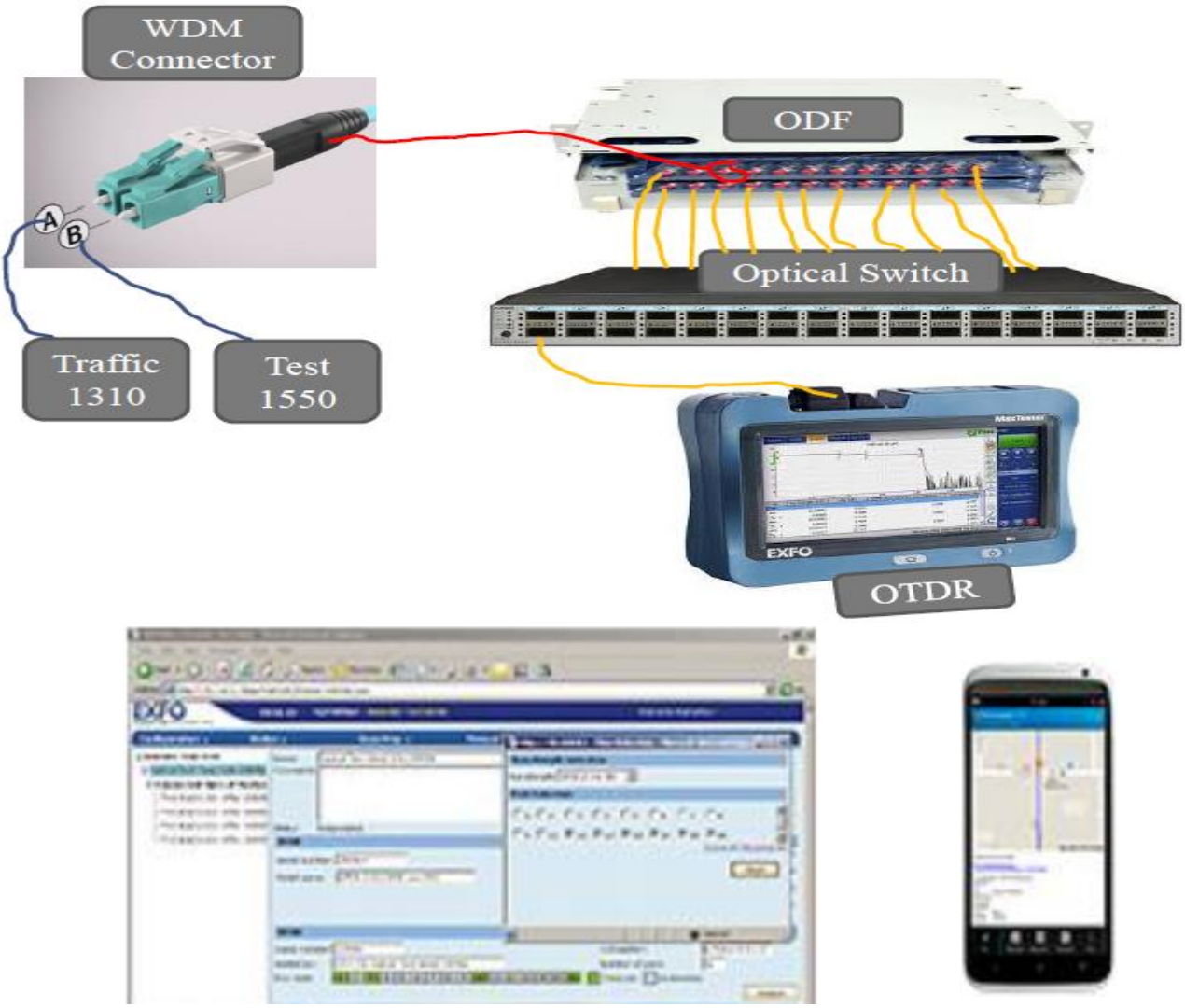


Figure (2): Tracing model of the Proposed System.

IV. MEASURING METHOD OF PROPOSED SYSTEM

The remote OTDR injects a series of optical pulses into the fiber under test and extracts, from the same end of the fiber, light reflected back from points along the fiber. The reflected light that is gathered back is used to characterize the optical fiber (trace). The strength of the return pulses is measured and integrated as a function of time, and plotted as a function of fiber length [1].

By using the 2 wavelength-OTDR (1310 nm, 1550 nm), WDM coupler, and optical switch, remote OTDR can measure all fiber ports in the fiber cable including the in-service ports.

$$Z = \frac{c}{2n}t \quad (1)$$

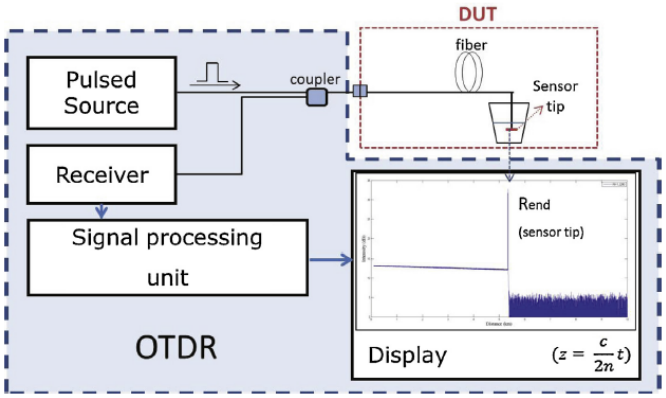
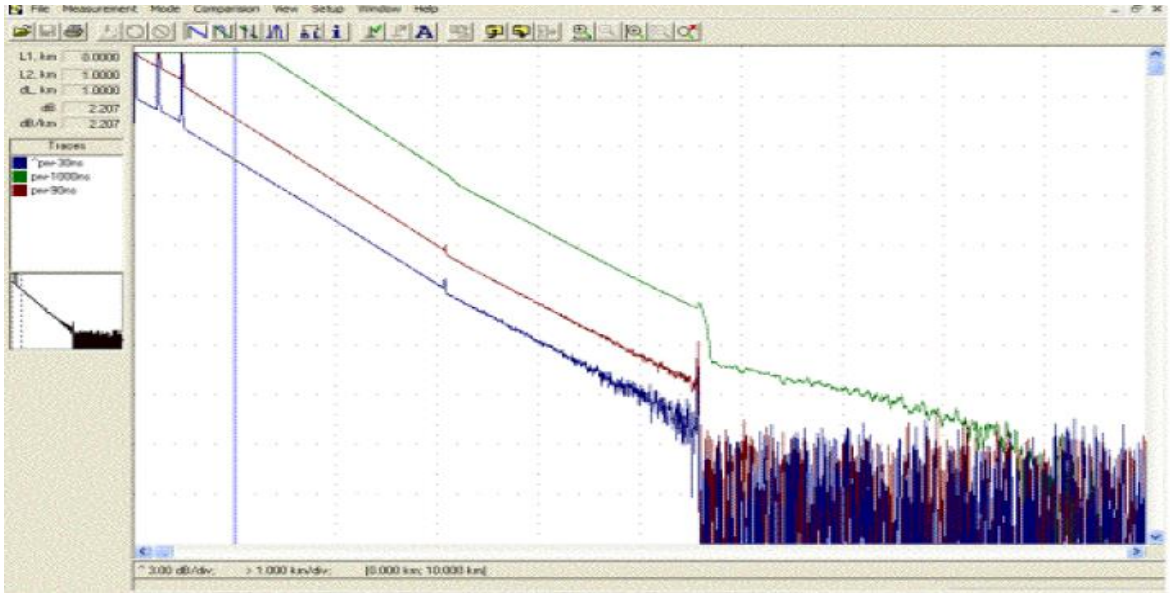


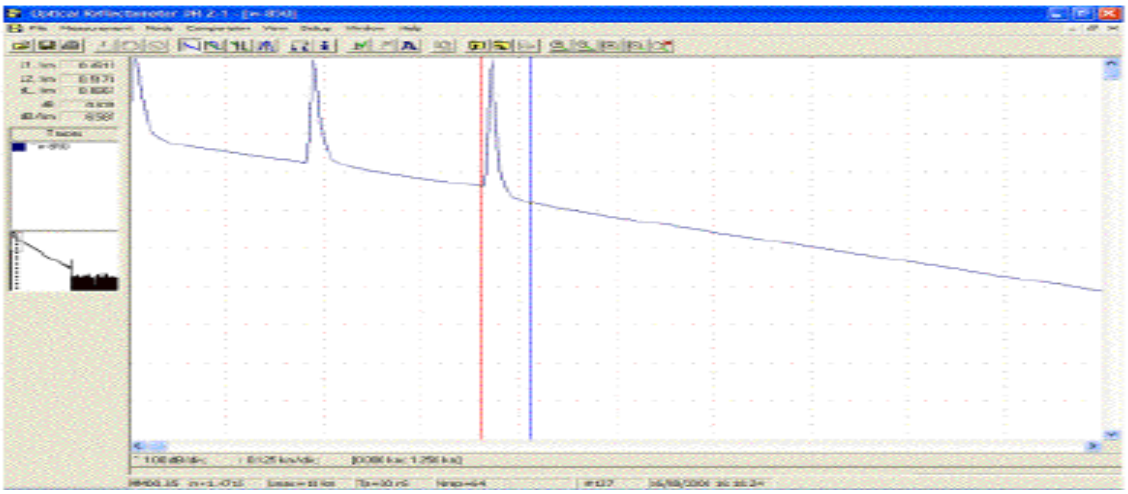
Figure (3): Measurement way of OTDR [2].

Where,
Z = the distance (length of fiber),
c = the speed of light in vacuum,
t = the pulse duration,
n = the index of refraction.
OTDR uses wavelength 1310 nm with out-service fiber and 1550 nm with in-service fiber through WDM coupler.
Through optical switch remote OTDR can switch from port to another continuously, every port of cable takes 20 seconds approximately for measuring and showing the status of fiber (its trace), according the capacity of optical switch, OTDR can measure more fiber ports.
The OTDR dynamic range (in dB) is very important element in this case, the bigger dynamic range, the longer fiber can be monitored [3].

Dynamic range = max power can be sent- min power can be sensed (dB)



(a): multiple wavelength traces



(b): Connector reflectance in fiber network.
Figure (4): Simulation results of the Proposed System.

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V. RESULTS AND DISCUSSION

The OTDR simulation program is studied for the proposed system and the result is shown in Figure. 4.
Figure 4 shows that the traces of fiber by using three different wavelengths in figure (4- (a)) and also the shape of trace in case of connector reflectance.

VI. CONCULSION

A remote OTDR with optical switch can be used as a monitoring system for fiber network. The OTDR linked with the management system which can send an alarm to the nearest repairing team. This principle may help to develop a simple and low cost real-time fiber network monitoring system.

VII. REFERENCES

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[3] Attila Zólomy, "OTDR - Optical Time Domain Reflectometer," BUDAPEST UNIVERSITY of TECHNOLOGY and ECONOMICS FACULTY of ELECTRICAL ENGINEERING and INFORMATICS,2010.