

Fiber Optic Water Depth Monitoring System

KOR Patent #10-1698835

Remote Water Depth Monitoring and Flood/Tsunami /Avalanche Alarm System using Fiber Optic Cable

- Real time remote water depth monitoring and alarming
- No electricity for Water Sensor, no failure, semi-permanent use
- No communication to Observation Post from the measuring point.
- Simple and easy to use
- To control & manage, measure, store and report by the Monitoring Unit at Observation Point
- Multiple measurement through 8 channel at the Monitoring Unit



Water Depth Sensor



Observation Post



Emergency Action



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Principle of Operation

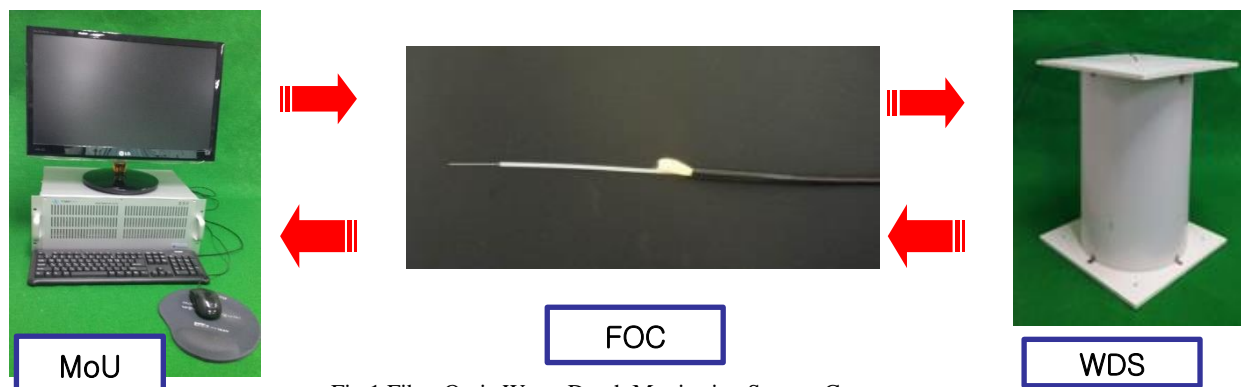


Fig.1 Fiber Optic Water Depth Monitoring System Components

The MoU (Monitoring Unit) periodically pumps Infrared Laser pulses into a FOC (Fiber Optic Cable) connecting to the WDS (Water Depth Sensor) placed under a stream, river, sea, lake, water reservoir, drain, well etc. and continuously monitors Optical Backscatter from WDS to measure water depth, display and store. At reception of water depth exceeding predetermined level, it triggers alarm and report emergency status to the operator or safety control center.

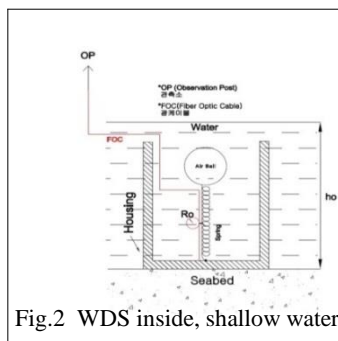


Fig.2 WDS inside, shallow water

The WDS consists with passive elements such as air ball and spring associated with Optical Fiber sensor ring which connect the air ball to the bottom. The air ball under water will move up pulling up the spring. The volume & buoyant force of the air ball will decrease proportional to the water depth to shrink the spring and to enlarge the ring accordingly. The Mathematical relationship between Optical backscatter strength and the ring radius R makes the MoU possible to calculate & obtain the water depth value.

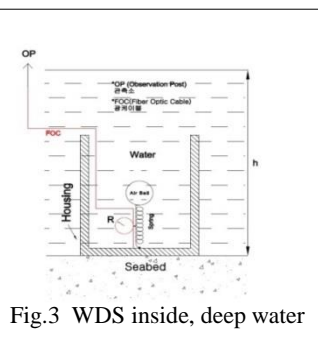


Fig.3 WDS inside, deep water

Recently Fibertron Co., Ltd. developed to present the Fiber Optic Water Depth Monitoring System utilizing the remote displacement measurement method by means of Optical fiber ring which was registered in early 2017 under KOR Patent #10-1698835 based on Fiber Optic Mesh Intrusion Detection System technology. Receiving continuous upgrading over 35 years since its invention by Dr. Youn Bae in 1982 while working as a researcher under Korea Agency for Defense Development.. The system has been installed at Korea Domestic facilities such as Korea Blue House, Nuclear Power Plants, Oil Reservoir etc. and at eminent facilities of eight foreign countries such as Saudi Ministry of Defense / ARAMCO, Kuwait Ministry of Foreign Affair, Singapore ISTANA / Ministry of Defense etc. to operate in perfect condition as zero nuisance alarm over years, 100% detection rate, locating within 15 meters accuracy etc.

Benefits by Water Guard

Weather forecasting technology rapidly grows but sometimes fails to provide early warning enough to keep people from flood due to overflow of stream, river, water reservoir, drainage etc. as well as tsunami. To be prepared for such water disaster, the authority used to hire patrol and recently try to install electronic water level measuring devices such as ultrasonic sensors or CCTV Cameras. However such electronic devices are actually ineffective in performance 1) because both the water level sensor and the data logger together must be placed at the measuring point requiring electrical power supply, 2) because both get degraded in performance or reach malfunctioning at bad weather - rainfall, lightening, cold weather, high temperature, storm etc. and day & night and 3) because the measured data need be read or stored manually by the operator/user. Any attempt to improve such manual measurement toward remote automatic measurement at OP (Observation Post) requires additional communication facility paying high extra cost for that. However the remote measurement achieved in this way will be limited in service except to transmit simple & short SNS message at emergency but not to provide real time status information taken and stored data by the data logger. The data logger can not be controlled remotely by the operator at the OP. Even with the communication, it still will not work for the use at blocked area such as deep mount creek, drainage, under ground location, under water location etc.

Now overcoming all the limitation of the electronic devices, we proudly present Fiber Optic Water Depth Monitoring System '**Water Guard**' as a new true measure for monitoring water depth and alarming at emergency in the most convenient and powerful way as described in detail below;

- The WDS(Water Depth Sensor) consisted with passive elements only (Stainless spring, Optical fiber sensor, rubber ball) which do not require any electricity and will not get affected by environment but shall perform half-permanently being free from any failure.
- The WDS which may be placed at any wanted location such as mountain creek, river, seabed, drainage or under ground location can be connected via FOC (to MoU at OP (Observation Post) for real time measurement of water depth and alarming/reporting at emergency.
- The MoU is easy to manage and control by the operator and perform all the functions to measure, display, store, transmit etc.
- The system is suitable to monitor water depth and watch any water disaster over a wide area by placing the MoU at the fork of river, mountain top, Safety Control Center etc.
- The system must be also useful for measurement of wave height and tidal difference at sea and for sensing and alarming at avalanche of mountain surface, dam, wall etc.

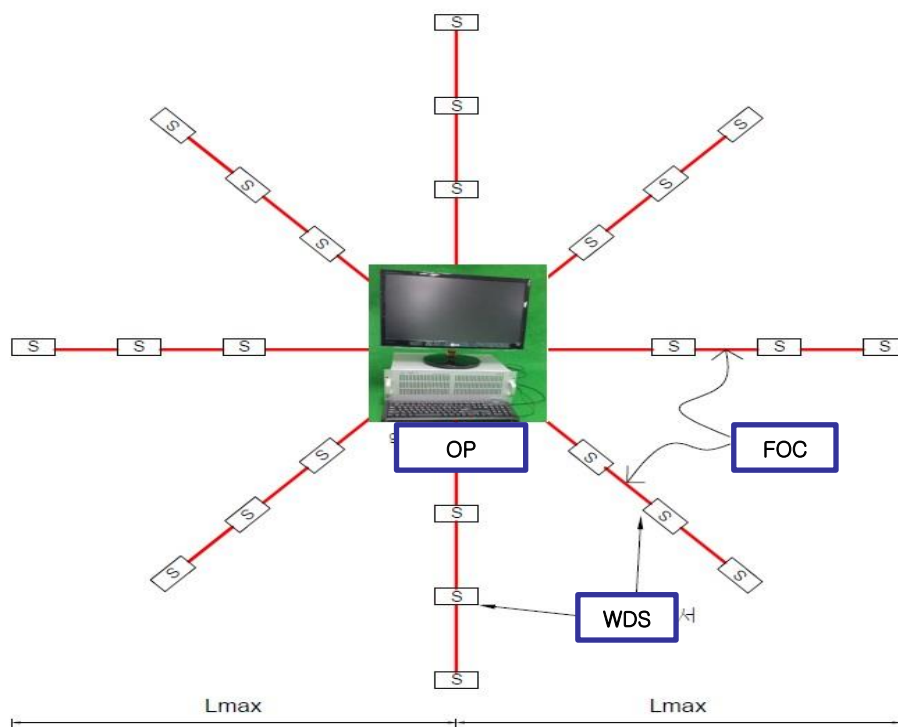


Fig.4 Coverage by a Water Guard

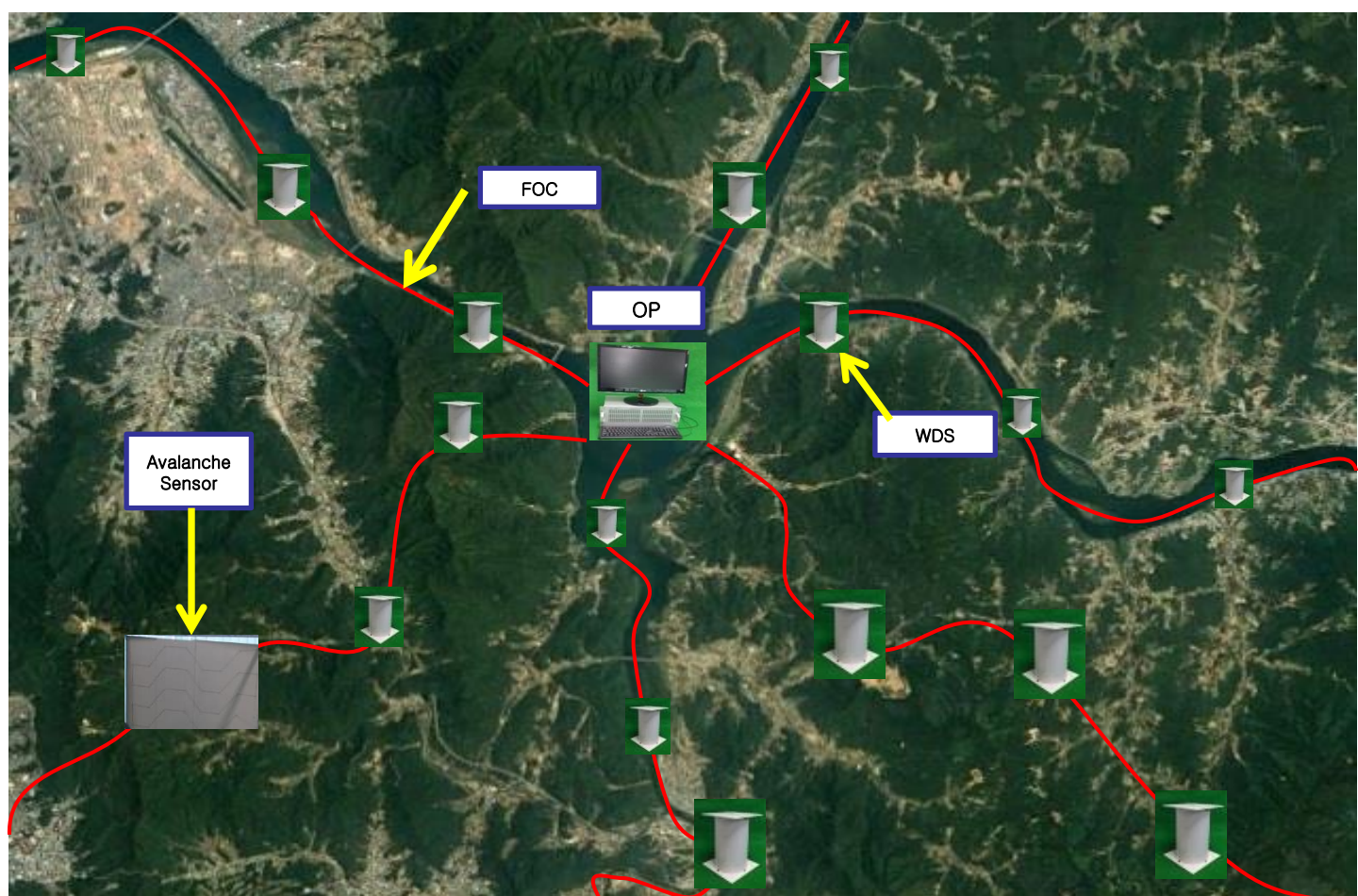


Fig.5 Water Guard monitoring a entire mountain water & avalanche

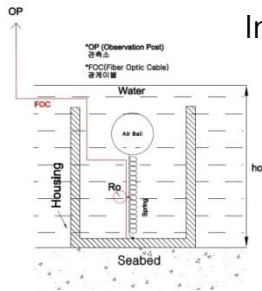
System Performance and Specification

System Components	MoU – FOC – WDS
Measurement Range	10KM current, 300KM future
number of channels	8 ch
Measurement Range	5M, 10M, 30M, 50M, 100M (depending on site condition)
Accuracy	±5%, ±1%, ±0.1%

Water Depth Sensor Specification



Shape



Inside

Model : WDS-500M

- PVC Housing Dimension : 300Φx500 (depending on site condition)
- Contents : FO Sensor, Spring, Rubber Ball
- Operation condition : under water
- Weather proof
- Weight : 15kg Approx

Avalanche Sensor Specification (depending on site condition)

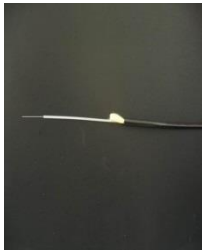


Both ends of a tension wire zig - zag in an array form covering any dangerous surface are connected via FOC to MoU for triggering alarm at the surface movement over pre-determined level.

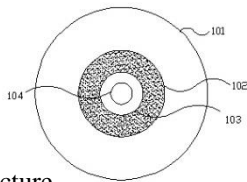
Model : TWS – H x L

- Dimension : H meters x L meters
- Stainless Wire : 1.2Φx50kg
- Pin size: 20Φx500 typical
- Cell size : 1000 x 1000 (depending on site condition)
- Weather proof
- Op condition : outdoors

Fiber Optic Cable (depending on site condition)



shape



Structure

Model : FOC-1C

- Component : 125Fiber/900Hytryl/3ΦPU
- Kevlar : 1,000denier
- Fiber Grade : 50/125MMF
- Allowable strength : 50kg Approx
- Allowable radius : 5mm
- Weight : 10kg/km
- Environmental characteristic : all weathered

MoU (Monitoring Unit) Specification



front



rear

Model : MoU-nP

- OP mode : Normal, Input, Test, Halt
- Sensing origin : Optical loss
- Number of channels : n (Max 8ch)
- Location accuracy : ±15m, ±25m Optional
- Measurement range : 10KM current, 300KM futuer
- Storage : Alarm time, Sensor ID, Measured value, Threshold etc.
- Monitor : 17" LCD
- O/S : Windows XP
- Interface with CCTV or RTU or SNS : Dry Contacts or Serial Data (RS232, RS422, RS485 etc) Optional
- Warning light : 12V1A Siren : 12V0.3A
- Dimension: 19" 4U (177×483×300 mm)
- Power consumption : 220 VAC / 200Watt
- Operation condition : indoors