The I-Tube Project

In the drilling industry, acquisition of real-time information on all relevant data during a drilling operation is a desired attribute. Hence various complex Measurement While Drilling (MWD) techniques of borehole telemetry were employed in the past to affect the actual drilling (drilling, completion, intervention and process control) and to provide the operator with a sight field to control his task in the desired manner. For this to be achieved, a flexible, robust, fast and reliable communication structure needs to be put in place.

The Center for Sensor Systems has developed an innovative borehole telemetry system where the objective is to obtain the latest information in real-time on all relevant data during a drilling operation using an innovative ad hoc network structure and design. This is motivated by but not limited to the in situ soil mixing drilling process where quality and accurate vertical drilling is essential to save time and effort.

Using underground wireless communication models, the feasibility of achieving a reliable connectivity for real-time data acquisition has been analyzed. Concerning this a pre-determined distance between node transceivers and microwave frequencies up to 868 MHz were assumed. Several on-field tests have also been conducted to verify the feasibility of sustaining such wireless connectivity over a variety of soil types and conditions. For transporting sensor data from sensors mainly embedded in the drilling head to the base station located above ground, a prototype routing protocol/algorithm has been developed. We choose a derivative of the AODV routing protocol where each node participates in routing by forwarding data for other nodes (wireless ad-hoc network). This routing algorithm currently runs on the MSP430 processor modules equipped with CC1101 RF devices.

Further research work on antenna design techniques and signal propagation issues is needed taking into consideration the unique characteristics of the encasement structure of the modules. We want to improve the overall signal strength as well as the effectiveness of the underground data transmission. Furthermore, work is being done on the application of sensor and data fusion algorithm to interpret prevailing drilling and underground conditions from data received/generated from the sensors embedded in the drill head or along the drill tubes.

I Project Management and Execution

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