Designing an in situ Soil Conductivity Monitoring System for Precision Agriculture and Water Management

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Soil Conductivity [soil EC], the measure of soil salinity, offers farmers invaluable information to predict crop yields, manage field sustainability, and create a decision support system [DSS] for proper water management. However, as most soil EC sensors and measurement tools are time-consuming, expensive, and risk crop damage, full field soil EC testing becomes an infeasible precision agriculture technique. The goal of this project was to design a non-invasive low-cost in-situ array of sensors for full field soil EC measurements and to support an irrigation DSS for year round usage. Novel multi-anode microbial fuel cell [MFC] modules functioned as individual in-situ sensors in the array, and an algorithm was developed to relate the voltage-time curve of the multi-anode sensors to a local soil EC. Each sensor is able to estimate soil EC within + 1 mS/dm and four sensor grids showed accurate recordings of soil EC over multiple locations. In addition, the sensor system was able to accurately measure soil moisture content and conductivity over a variety of soil conditions. In application, each sensor is planted in a unique location, and raw soil EC data is measured and interpreted to create field maps of ideal watering levels, soil salinity, and plant sustainability. This sensor system offers the user a DSS for irrigation, field sustainability, and soil EC related field treatment. As each sensor costs under $5 to produce, the overall system offers affordable, accurate, and year-round soil EC testing that can revolutionize worldwide farming practices.

Awards Won:

Fourth Award of $500

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