Advanced Soil Sensor Technology for Sustainable Agriculture Management

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Soil chemical analysis is essential and fundamental, It provides farmers with benefits such as ensuring crop success, supplying appropriate quantities of fertilizers and water to the soil, thus guaranteeing higher productivity and avoiding crop loss. In many developing countries, farmers are unable to test their soil and receive scientifically-based recommendations. This leads to a decrease in the productivity of their lands. In the study, the Soil Multi Parameter Sensor 7-in-1 was integrated with an Arduino Uno to transmit data to a specially developed mobile application. This app uses the sensor data to provide agricultural recommendations, including suitable crops, irrigation, and fertilizer needs. The processing of data within the application is based on mathematical algorithms and agricultural equations, taking into account plant values from a database containing information on 50 plants. An embedded system has been invented to replace the presence of agricultural experts and costly chemical laboratories with an affordable device. After assessing the accuracy of the device, its readings were validated by comparing them to standard solutions with specific pH and electrical conductivity values. The coefficient of determination, r2, was 0.92 for pH and electrical conductivity, and 0.8 for nitrogen, phosphorus, and potassium. This makes it excellent for salinity, acidity, moisture, and temperature, and somewhat acceptable for NPK levels. The project offers a creative solution to a significant problem in the agricultural sector, empowering farmers to make informed agricultural decisions based on scientific background at a low cost. This will greatly support the agricultural sector economically.