Safety Roots: Soil Monitoring System for Disaster Prevention and Strengthening Family Farming

Lidoni dos Santos, Julia Maria (School: Instituto Nacional Leva Ciencia)

The increase in climate catastrophes in the Brazilian state of Rio Grande do Sul, such as landslides, floods, and other disasters, represents a challenge for family farmers in the affected region of Caxias do Sul, a municipality in Rio Grande do Sul, Brazil. This study presents an intelligent and accessible solar climate monitoring system, designed to detect abnormal ground movements and meteorological data in real time and provide early warnings to protect crops and homes. Using a qualitative methodology that includes semi-structured interviews with four farmers and rural leaders, the research identifies the multigenerational effects of climate change, rural exodus, and technological challenges, along with an experimental proof of concept (PoC). In the initial phase of the PoC, the BBC micro:bit V2 microcontroller and the CreateAI tool were used to process accelerometer data, identify "normal" and "oscillation" patterns, and train an embedded model to detect anomalies that simulate solar instability. An improved prototype was used, combining an ESP32, DHT22 sensors (temperature and humidity), an anemometer, and an MPU9250 (position and vibration), which collects field data for a neural feedback loop on a server. The micro:bit achieves an 80% confidence level in classifying six simulations. These results demonstrate the technical and economic viability of the system, which can be replicated in rural communities to mitigate agricultural losses and boost research on climate risks in southern Brazil.

Awards Won: