Smart Agriculture Revolution: Topraq's IoT Solutions for Precision Farming

Name of the Organisations Involved

- Topraq, Turkey

Challenges Identified

- Climate change and mismanagement of existing water resources cause water depletion and a decrease in precipitation.
- Limited access to agricultural data: Old habits about agriculture cause inefficent usage of technology and production based upon only observation.
- High technological investment cost: Farmers can't invest as much as they need because of high investment cost of agricultural technology.
- Water resources are no longer sufficient for old-style irrigation activities: Farmers need to see the impact of their irrigation activities on the ground to plan their next irrigations with right amount at the right time.
- Limited qualified human resources in agriculture: In addition to the difficulty of finding human resources capable of using technology in farms, operations performed in traditional ways also create situations open to human error.

Short description of the technology

Sensors:

- **Soil Moisture & Temperature**
  Sensors applied to different depths provide data need for the right amount of irrigation at the right time by measuring humidity and temperature.
    - Data and science-based irrigation decisions
    - Subsoil effects of irrigation activities
    - Optimization of water consumption
    - Saving on your electricity bills
    - Crop quality increase

- **Soil Moisture & Temperature & EC**
  It measures the salt level of the soil in addition to humidity and temperature for fertilizing sufficiently. High soil salinity causes slowdown in plant growth, decrease in yield and crop failure. High water level brings the loss of nutritions and low level of water may harm crop quality.
    - Right fertilization decisions
    - Saving on fertilization cost
- **Weather**
  The weather sensor provides data of air temperature, humidity and barometric pressure in order to be able to interfere quickly and accurately.
    - The system monitors the temperature on a daily basis and monitors the cooldown & warm-up times. It feeds the system for the calculations of chilling hours.

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- Provides data for detecting potential frost hazard. It helps to prevent the risk of frost by working with wind fans.
- Air temperature data has an important role in determining the amount of irrigation requirement of the garden.

- **Rainfall**
  Local weather forecasts may not provide accurate and reliable data for the location of your garden or field. Rainfall data is vital for determining irrigation and harvest time. Our sensor precisely measures the amount of rainfall in the applied field. It measures and collects the most accurate data for our services in order to make smartest decisions.
- **Wind Speed & Direction**
  The sensor provides important data for the decision process of critical field applications such as pesticide applications and determination of planting direction.
- **Pyranometer**
  It measures the intensity of sunlight effective in each period to predict and plan water needs from planting to harvest. The data obtained from this sensor is used in the calculations of ET0 – evapotranspiration rate.
- **Leaf Wetness & Canopy Temperature**
  Leaf Leaf Wetness & Canopy Temperature is placed on the leaves and acts like a leaf to measure leaf surface wetness generated by dew, rain, or spray irrigation. In addition, it measures the canopy temperature of the tree its positioned on. These measurements are essential when it comes to the imminent prediction of diseases and the calculation of diagnostic models.
- **Flowmeter**
  It provides information about the flow rate of the water passing through the irrigation line and the irrigation start & stop times.

Products:

- **Agro Station**
  T-Weather is a smart meteorological station where you can remotely access your local weather data in real-time.
  - Weather
  - Rainfall
  - Leaf Wetness & Canopy Temperature
  - Pyranometer
  - Wind Speed & Direction
- **Irrigation Optimization Station**
  T-Irrigate is an AI based irrigation optimization solution that enables farmers to manage their irrigation with the right amount at the right time.
  - Soil Moisture & Temperature
  - Soil Moisture & Temperature & EC
  - Water Pressure
  - Flowmeter
  - Rainfall
  - Weather
  - Wind Speed & Direction
  - Leaf Wetness & Canopy Temperature
  - Pyranometer
- **Digital Pheromone Trap**

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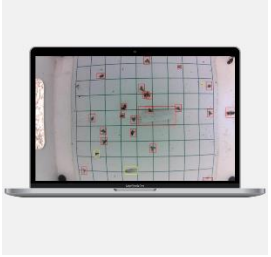
T-Trap is an automated AI based pest detection technology that enables real time pest control.

T-Brain: T-Brain is an intelligent engine that provides bidirectional communication between the field and AI Platform. It works with GSM or Lora technology depending on implementation.

AI Platform:
We obtain the Big Data from our stations in your fields and then we present it as reports, graphics and services using AI to enable farmers to take your daily decisions easily.



- **T-Weather User Screens:** We collect all meteorological data needed for harvesting from the sensors at frequent intervals and present them to our users as a summary. Air Temperature, Rainfall, Wind Speed, Humidity, Air Pressure, Leaf Wetness & Canopy Temperature and Solar Radiation data in your fields are presented to our T-Weather: Agro Station users.
- **T-Irrigate User Screens:** It is so easy to have detailed information about your irrigation with user screens! Our farmers have opportunity to control and monitor irrigation information such as Irrigation Start Level, Irrigation Stop Level, Humidity Index, Soil Temperature, Soil Moisture, Flow Rate, Irrigation Time etc. which are specifically determined for their fields and crops by AI.
- **T-Trap User Screens:** Real time images from the AI camera and the Digital Pheromone Trap are securely processed, stored in the Cloud and analyzed. Our users can access the images via the AI Platform, follow the change in the pest population and plan their pest control operations.

Smart Assistant: TOPRAQ Smart Assistant is an AI based BOT software built within Telegram to help users communicate with their systems on a real-time basis. You can set alarms, monitor all irrigation activities, and get real-time data and reports by simply messaging with the system.

Goals and Solution

Topraq was planted in 2019 with the vision of building smart digital agro services and improve farmers' lives. Topraq's dream is to provide clear visibility to farmers in regards to what's going in their fields along with giving them the capability to take science-based decisions.

Topraq's desire is not to sell pure hardware but to bundle IoT products with digital smart services and focus on Sensor as a Service concept. This is why they introduced a unique sales strategy which is Agricultural Technology as a Service, i.e., an annual subscription based model to make farming technology accessible and affordable.

Actions Taken

- Design & manufacture own IoT products. They develop purpose-built mobile software enabling farmers to manage their farms to collect further farming data.
- Use Statistical Machine Learning & Artificial Intelligence within own AI platform to process, store, analyze and correlate.

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- Convert big data into algorithms and make it relevant.
- Transform these algorithms into simple, user-friendly services for farmers.

Benefits and Impact

- Better measurements - better management
- Minimized technology investment with annual subscription model
- Saving from electricity bills with optimisation in water consumption
- Improving the quality and efficiency of crops
- Controlling input costs & increasing profitability
- Identifying the needs for each field & harvest
- Creating and tracking ideal growing conditions for products
- Disease prediction with data analysis

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Application Area

☒ Soil ☒ Weather

Digital Technology in the Value Chain

☒ Supply Chain Management ☒ Agronomic Services

Digital Technologies

☒ IoT ☒ Sensor Technology ☒ Artificial Intelligence (AI)

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