Integrated Agricultural Monitoring and Information System (AGRIMONIS - TARBiL)

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You can not control what you cannot measure
In order to Manage Agricultural Economy

Monitor Agriculture
AGRIMONIS provides you with an integrated management tool for Agricultural Economy Management
TARBIL - AGRIMONIS

- A pilot project combining Earth observations, field operations and administrative processes on a common layered structure in a modular way in real-time. (2007-2011)

- Countrywide implementantion ESTABLISHMENT has begun by 2012.

- The most comprehensive integration platform ever implemented with its own terrestrial observation network
  - more than 42,000 sensor, cameras etc.
  - satellite remote sensing station
  - real-time data fusion system and services

for wide range of users including
- Farmers
- Traders
- policy makers.
TARBİL
ANKARA

TARBİL
İSTANBUL

Field Observation Network
Satellite/Air Observation Network

Agri. Inf. Sys. Administration for Registration
Mobile Field Information System

Administrative Decision Making Support System
Producer Decision Making Support System
Within TARBİL there is a fleet of 0.5m, 1.5m, 2.5m, 5m high-resolution satellites for remote sensing.

1200 robot-stations form an agricultural ground-based network.

The most advanced data fusion system for the agricultural purpose:

TARBİL CENTER

UGİP

Large area coverage satellite earth station among top 5 in the world: İTÜ UHUZAM (SCRS)

Turkish first national UA satellite management and archive system: UGİP

GPU and multi-core data processing system

TARBİL Command Control Center

Ministry of Food, Agriculture and Livestock and related units use TARBİL monitoring and decision support systems together with TBS in determining the rational agricultural policies for the efficient management of agricultural economy and dissemination of good agricultural practices.

Most comprehensive and profitable advanced technology application for development in Agriculture:

TARBİL

Agricultural experts can access field and plant measurement data with TARBİL tablets. Through their observations, experts provide most effective and healthy prescriptions to farmers about fertilizers/pesticides usage as well as other agricultural activities.

Farmers access TARBİL and Agricultural Information System (TBS) through their mobile devices using TAKAS ID number. With TBS and Tavlamatix information support farmers can follow the official (Ministry) procedures and carry out their agricultural activities.

With reaper and combine harvesters working on the field, data maps are created and calibrated through the remote sensing models. Immediately after the sowing phase, farmers can track the expected yield of their crops.

Using tablets: Ministry of Agriculture experts (TARBİL), carry out the livestock registration and provide support to the farmers.

Irrigation systems use TARBİL information for the water usage optimization with respect to the plant current conditions.

Agricultural machinery and equipment, fertilizers and pesticide usage, planting and maintenance information are taken from TARBİL network.

For trade in agricultural products and agricultural finance management, observations of harvest forecasting, production-region yield distribution and risk assessment are used.

Calculating indices:

Spatial resolution agricultural data mining/optimization models
TARBIL - AGRIMONIS

Scale

- 1200 robo-stations
- 2500+ phenological CT sampling fields
- 16,000+ mobile field samplings/seasons
- 250mx250m grid resolution
- 10 minutes sampling time for agro-meteo data
- 30 minutes sampling time for agro-pheno data
- 120+ computed parameters
- Official data from 2 Million+ farmers
- 28 Million Framing parcels
TARBIL - AGRIMONIS
Scale

- 28 joint research projects
- 84 development projects
- 1000+ field staff, cooperation of 10,000+ ministry staff
- 200Tflops processing capability over GPUs and multicore CPUs
- 12,000m2 new building for operations and research center
Layered Structure of Agricultural Information Processing
Fusion of periodic and non-periodic spatio-temporal data from land and space

Interpolation of more than 100 parameters at 16 points per 1km² countrywide

Ministry of Agriculture and units at towns, cities

Traders, brokers and operators

Farms

Subscribed Farmers with TARBİL tablets

Any farmers with mobile devices

Ground Satellite Station Center + Agro-meteo-pheno Observation network + Data aggregation and national crop models + TARBİL data processing and operations center
İTÜ UHUZAM
Satellite Communication and Remote Sensing Center

• one of the five biggest tracking antenna systems
• having high performance data-acquisition ability

SPOT 4, SPOT 5, Radarsat I, II
SPOT 6, SPOT 7 (2014), PLEAIDES 1a / 1b
Protection
1st Precipitation1/Wind/temperature set (2nd set is at 2m)
Tarla net – RF link
(4Mp 10x remotely controlled HD IP camera)
LED illumination
Turk-sat Comm.Dish
Speakers
Movement detection and analysis
Human detection and counting
Intrusion type classification
Terminal mode communication
Automated responses and alerts
Self diagnostics and alerts
Central content play controls

Scheduled content play
Event based content play
Remote operations
Station operating system
AdHoc/Inter-station communication
Direct mode sensor network
Sensor/protocol hosting
TARBIL AGRIMONIS
Research and implementation on

- Integration level issues for economy and make system extensions manageable
- Importance of automated monitoring of phenological stages in agricultural data fusion
- Quality of Service (QoS) based data classification and resource/service planning in TARBİL
- Forecasting and nowcasting on a unified track for yield, prices, resource and economic parameters
- Layered and modular information system structure enabling rapid development but how to establish standards...
- Mobility has increasing role in Agriculture
  - Sustainable application scenarios on a common platform
- Controlling optimal crop pattern by using the integrated platform
  - Exchange rate approach between the economic and financial feasibilities in agriculture
- M2M service design considerations for applicability in precision farming
R&D in AGRIMONIS

A few research, development and implementation area of AGRIMONIS
Real-Time Information System Services

- Vital agricultural production process information based on country-wide real time measurements.
  - Prediction of seasonal and early harvest crop yield
  - Crop type and field based mobile info. to subscribers
  - Precision Farming
  - Reduction of chemical usage
  - Adaptive land model Decision and Support systems.
  - Agricultural Insurance: reliable pre-event risk and impact assessment ability
  - Early warning system
  - Fair insurance payback by after-event damage reports Financial and Economic Savings by reducing the telemetry data and satellite remote sensing costs.
  - Protection of farmers by on-time preharvest national & intl. market forecast
Phenological Stage Monitoring
Agro-Information Systems

Plants have different transfer functions at each phenological stage.

A finite-state automata is a reasonable representation method.

Yield forecast related parameters, indices are highly correlated to phenological stage.

Parcel based or high resolution information extraction requires phenological stage coupled information
Automated Phenologic Stage Detection

\[ I = \frac{1}{3} (R + G + B) \]

\[ S = 1 - \frac{3 \times \text{min}(R, G, B)}{R + G + B} \]

\[ H = \cos^{-1}\left[ \frac{(R - G) + (R - B)}{2\sqrt{(R - G)^2 + (R - B)(G - B)}} \right] \]
Vegetation marking: RED, Before germination
Vegetation marking: RED, After germination
Height and Grain Intensity Measurement
Farmer Tablet Application

Buğday - Cumhuriyet 99

Ekim Tarihi: 01/06/2013
Geçen Süre: 149 gün
Tahmini Hasat Tarihi: 10/01/2014
Kalan Süre: 75 gün var

Referanslı Bitki Su Kaybı: 121,8 mm
Su Kaybı Toplamı: 135,3 mm
Kalan Su İhtiyacı: 506,9 mm
Tahmini Hasat Miktarı: 254 kg/da
Rekolte: 39 Ton ± %15

(Tavsiye edilen uygulama koşullarına göre)

Diğer Bilgileri

GDD: 3017 gün-derece
HTU: 27155 derece-gün-saat
PTU: 45258 derece-gün-saat
VPD: 327 mbar

Rüzgar Yönü: Kuzey
24 Saat Max. Rüzgar Hızı: 0 km/saat
Günlük Yağış: 0 mm
Haftalık Yağış Miktarı: 0 mm
Aylık Yağış: 0 mm
Yıllık Yağış: 480 mm
Yaprak Islaklık İndisi: 0
Hava Basıncı: 1016 hPa
Güneş Radyasyon Şiddeti: 606 W/m²
Yağış İhtimalı (3 Saat): 70 %
Yağış İhtimalı (1 Saat): 20 %
Farmer Tablet Application

Ekim Planlama

Bitki Seçimi
- Arpa
- Esterel

Çeşit Seçimi
- Barbaros

Tarih Seçimi
- Mayıs
- Haziran
- Temmuz
- Ağustos
- Eylül
- Ekim
- Kasım
- Aralık

Planlanan Toplam Sulama
- 230 mm = 12000
- 260 mm = 13000
- 270 mm = 13500
- 280 mm = 14000
- 290 mm = 14500
- 300 mm = 15000
- 310 mm = 15500
- 320 mm = 16000
- 330 mm = 16500
- 340 mm = 17000
- 350 mm = 17500

Tahmini Hasata Kalan Süre: 180 Gün ± 15 gün
Tahmini Hasat Tarihi: 27 Mayıs 2014 ± 15 gün
Beklenen Yağış: 466 mm ± 20 mm
Bitki Su Tüketimi (ETc): 285 mm ± 40 mm
Çiçeklenmede Don Riski: %15
Referans Koşullarda Tahmini Verim: 769 kg/da ± 50 kg/da

Tavsiye edilen ekonomik tarım uygulama koşullarına göre seçilen değerler ve uzun yıl istatistiklerine göre planlama tahmini
Farmer Tablet Application
AGROWORLD

AGROWORLD - AN AGRICULTURE ECONOMY GAME IN VIRTUAL REALITY

- Real data
- Real life decisions
- Faster than real-time!
- High quality animation and graphics
- Role defined players
  - Farmers
  - Private Sector (farming device)
  - Agriculture Experts
  - Traders
  - Economists (playing their own roles)
  - Decision makers
  - etc.
- Convertible to cash! (like bitcoin)

Would you play?
AGROWORLD

AGROWORLD - A GAME IN VIRTUAL REALITY

- Finding the optimal solution through concurrent simulations
- Motivation not only fame but also cash
- Monitoring pattern of players

if you play
We would like to share our experience and outcomes. We also benefit from your experience and outcomes in a wide range of research and application areas. These include:

- Such as infrastructure policy in EU/NAF/AL.
- Application specific projects:
  - Trade nature locally/regionally/globally
  - Data fusion at information level
  - Decision making mechanism
  - EU/NAF/AL versions of AGRIMONIS
TARBIL - AGRIMONIS

- We encourage you
  - to share your experience and outcomes with us
  - benefit from our experience and outcomes
  - In a wide range of research and application area
    that you may suggest
- We believe that an integrated solution requires a wide support
  from all related disciplines.
Thank you for your attention!

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