Water consumption reduction: electronically controlled drip irrigation systems

PAPER PRESENTATION

Universidad Tecnológica Nacional – Facultad Regional Paraná

Electronics Engineering

Ingles II - 2020

Ledesma, Luciano

Politi Livoni, Jerónimo

Introduction

- Water crisis and its impact on health and the environment
- An engineering contribution

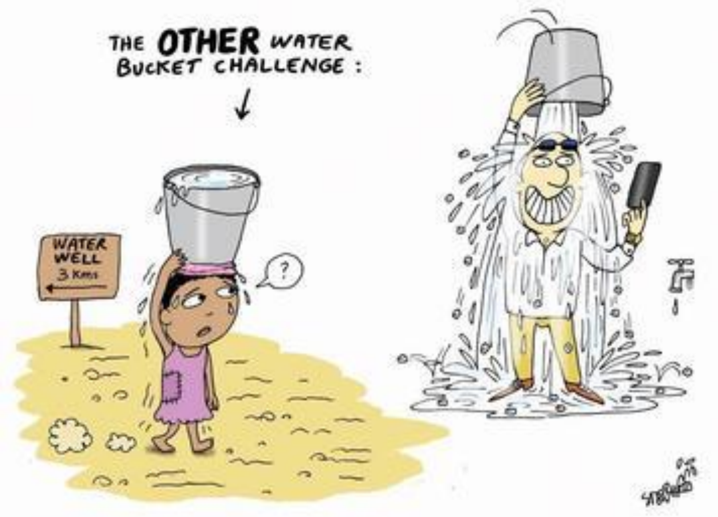
Basic aspects

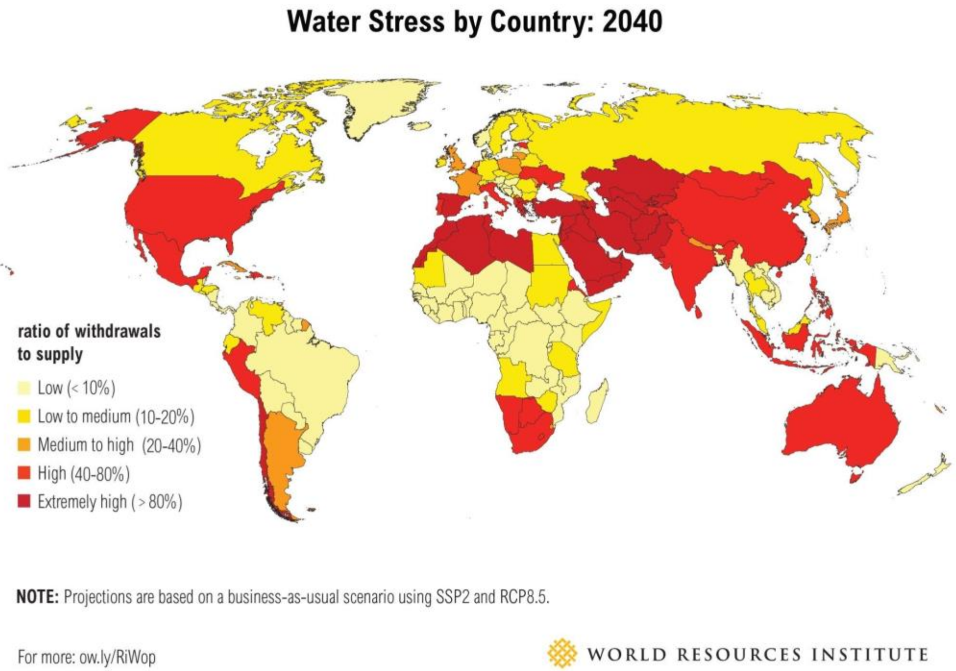
People's limited access to clean drinking water.

Stressed water systems.

The right to water.

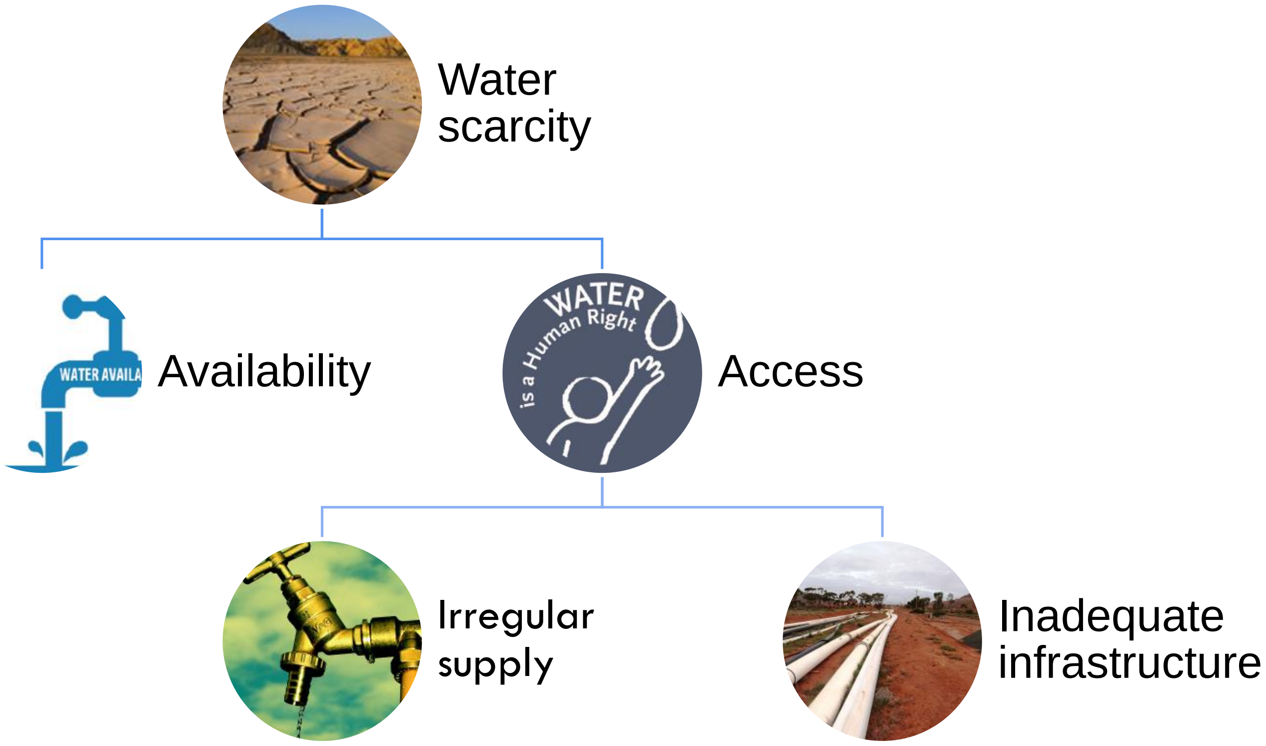
HUMAN RIGHTS TO WATER AND SANITATION

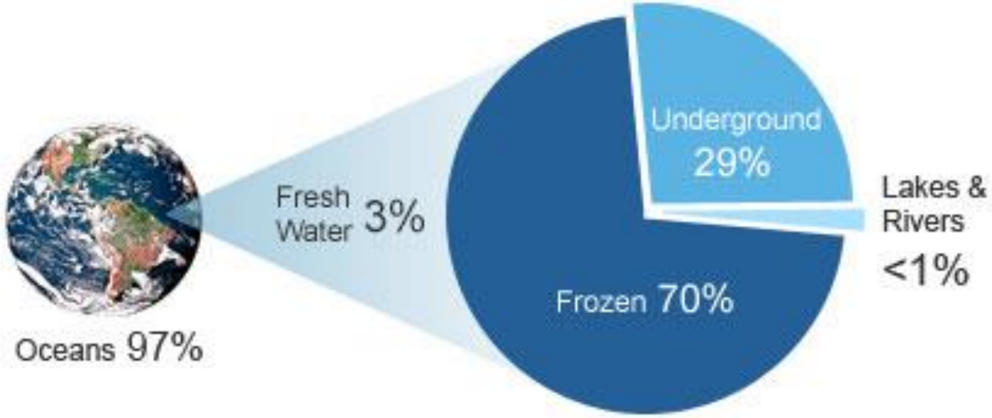


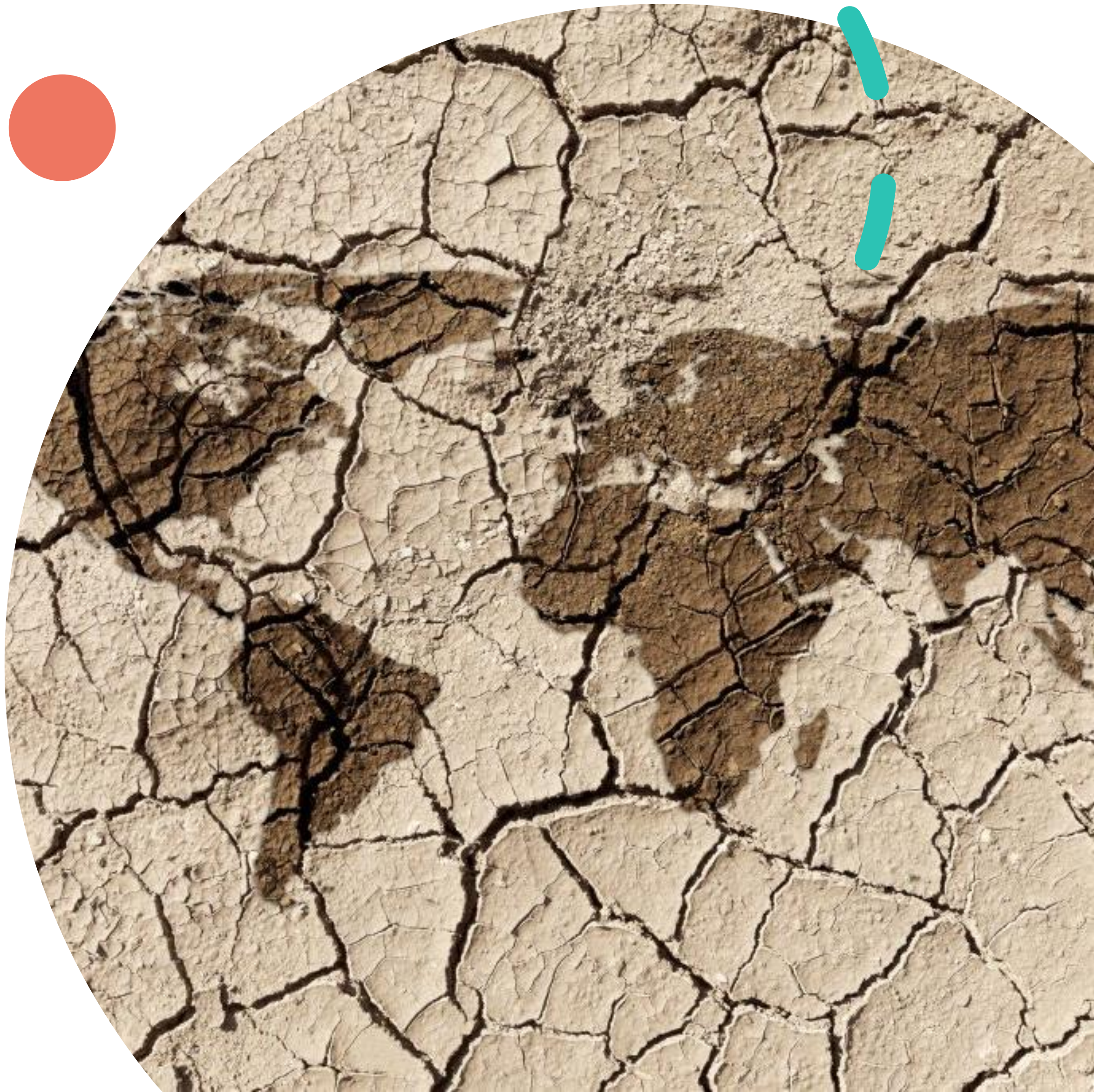


Basic aspects

- Water scarcity







An engineering contribution: automated drip irrigation system

Map of the presentation

Definition

Basic aspects

Differences with traditional systems

Advantages

Water and soil issues

Cropping and cultural practices

System infrastructure

Disadvantages

Water and soil issues

Cropping and cultural practices

System infrastructure

Soil and Environmental Parameters Involved

System design considerations

Electronic characteristics

Automation platform

Sensors

System Architecture

Automation system assembly

General system assembly

Definition

- Subsurface drip irrigation system
- Composition
- Development

Advantages

- More efficient water use
- Less water quality hazards
- Enhanced plant growth
- Improved fertilizer
- Better weed control

Disadvantages

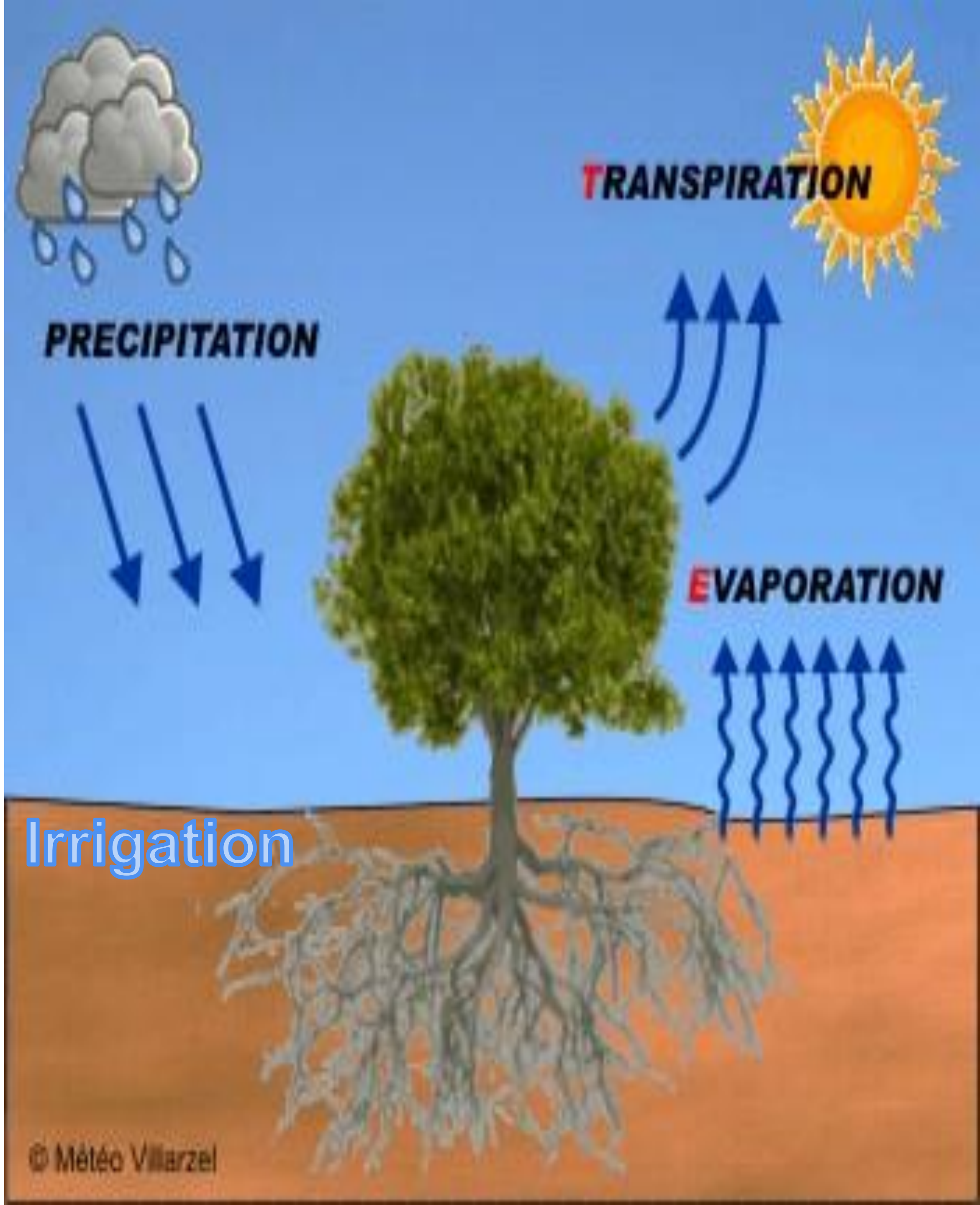
- Small wetting pattern on coarse-textured soils.
- Monitoring and evaluating irrigation events
- Emitter discharge rates
- Location and positioning of the driplines
- Restricted plant root development
- Infrastructure costs.

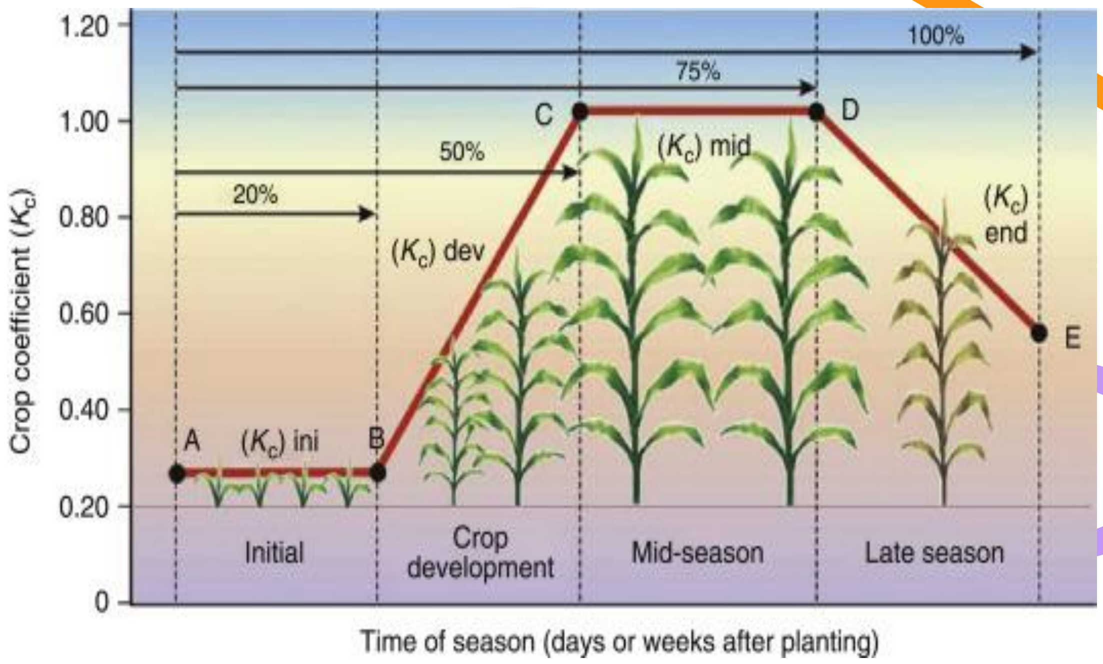
Soil and Environmental parameters involved

- Water balance method

$$Water\ inputs = water\ outputs$$

- Process called "evapotranspiration"
  - Transpiration
  - Evaporation
- Parameters that can affect ET





Crops at different locations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Haldia												
Kharif rice							*1.15	1.05	1.1	0.95	1.0	
Boro rice	1.2	1.4	1.3	1.0								
Potato	1.05	0.7										*0.7
Sunflower	0.6	1.2	0.8									
Lathyrus	0.3										*0.5	1.05
Paradip												
Brinjal	*0.35	0.6	0.8	0.95	0.8							
Chilli	0.8									*0.6	0.95	0.9
Ladies finger	*0.5	0.95	0.9	0.8								
Tomato	0.6									*0.4	0.6	1.05
Potato	0.6	1.05	0.7									*0.4
Onion	0.55	0.95	0.75									*0.35
Green gram	1.05	0.3										*0.4
Visakhapatnam												
Sugarcane	*0.4	0.5	0.6	0.7	1.0	1.0	1.3	1.3	1.3	0.7	0.8	
Chilli	0.95	0.8	0.5							*0.3	0.5	0.7
Sesame	*0.8	1.05	0.25									
Horse gram	1.05	0.3										*0.8

*Initial crop period

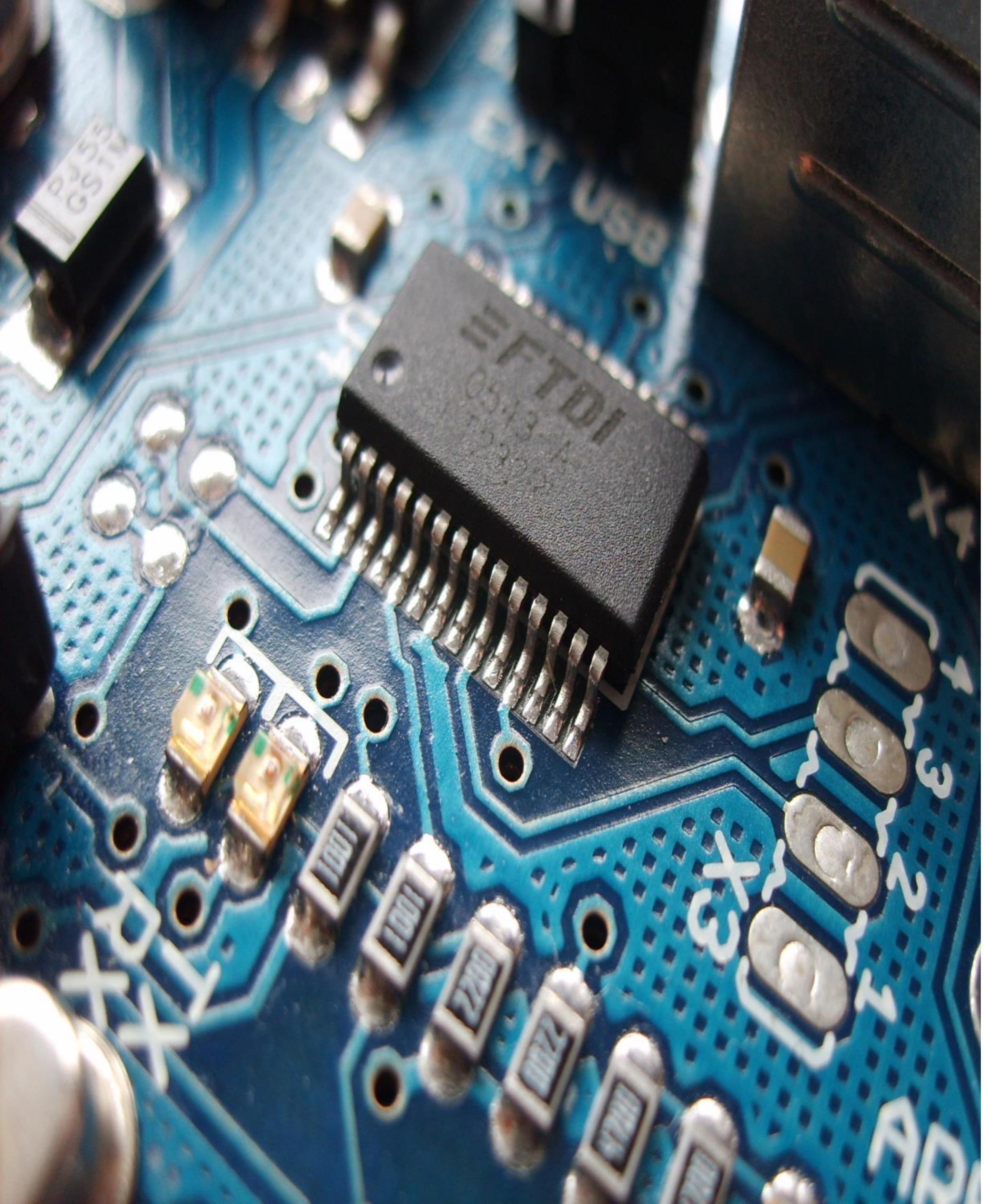
- Evapotranspiration:

$$ET_c = K_c \cdot ET_0$$

Solar radiation, wind speed, altitude, air temperature and relative humidity

Crop coefficient

Reference evapotranspiration



Electronic characteristics and system architecture

- Types of microcontrollers
- Components and sensors
- System description
- Functions

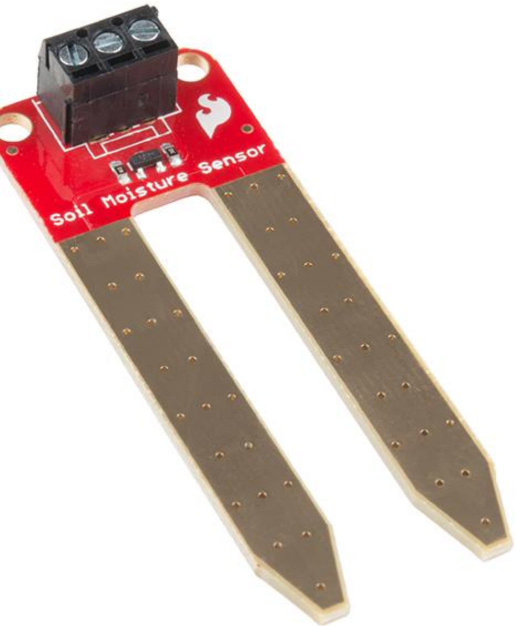
ARDUINO **NANO**

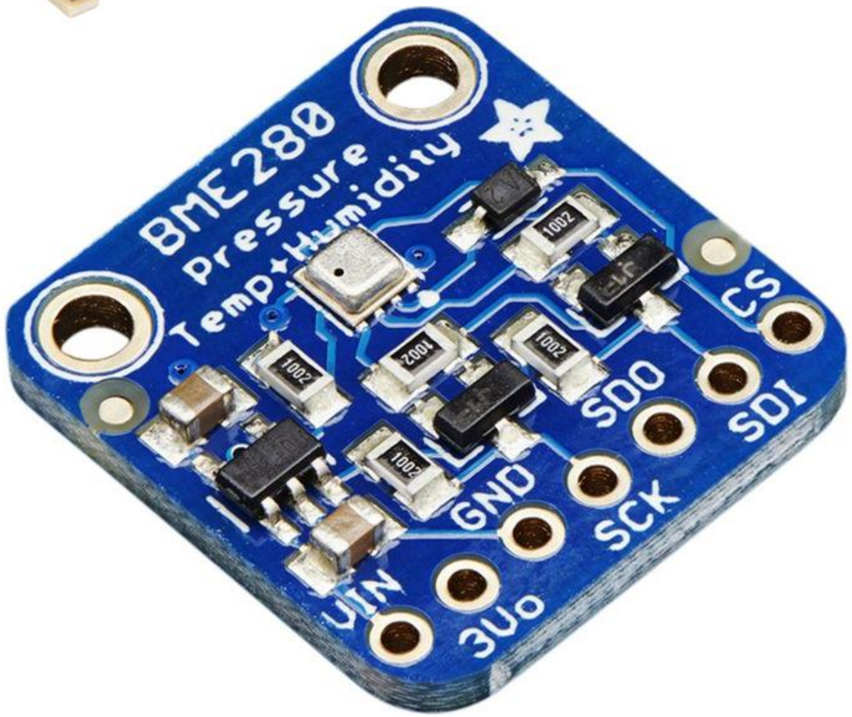
ARDUINO **MEGA**

ARDUINO **LEONARDO**

ARDUINO **UNO**

ARDUINO **YUN**



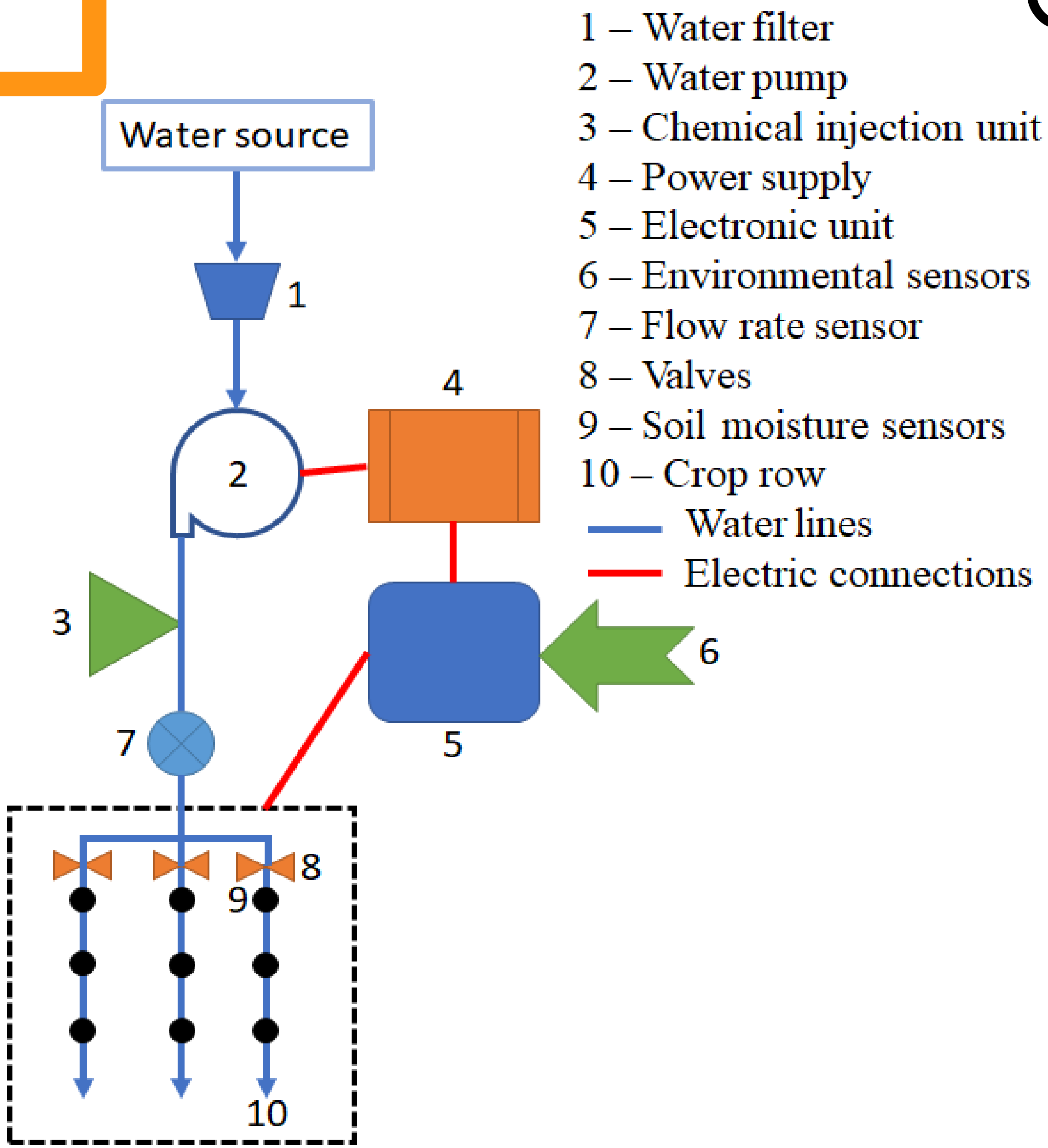


Sensors

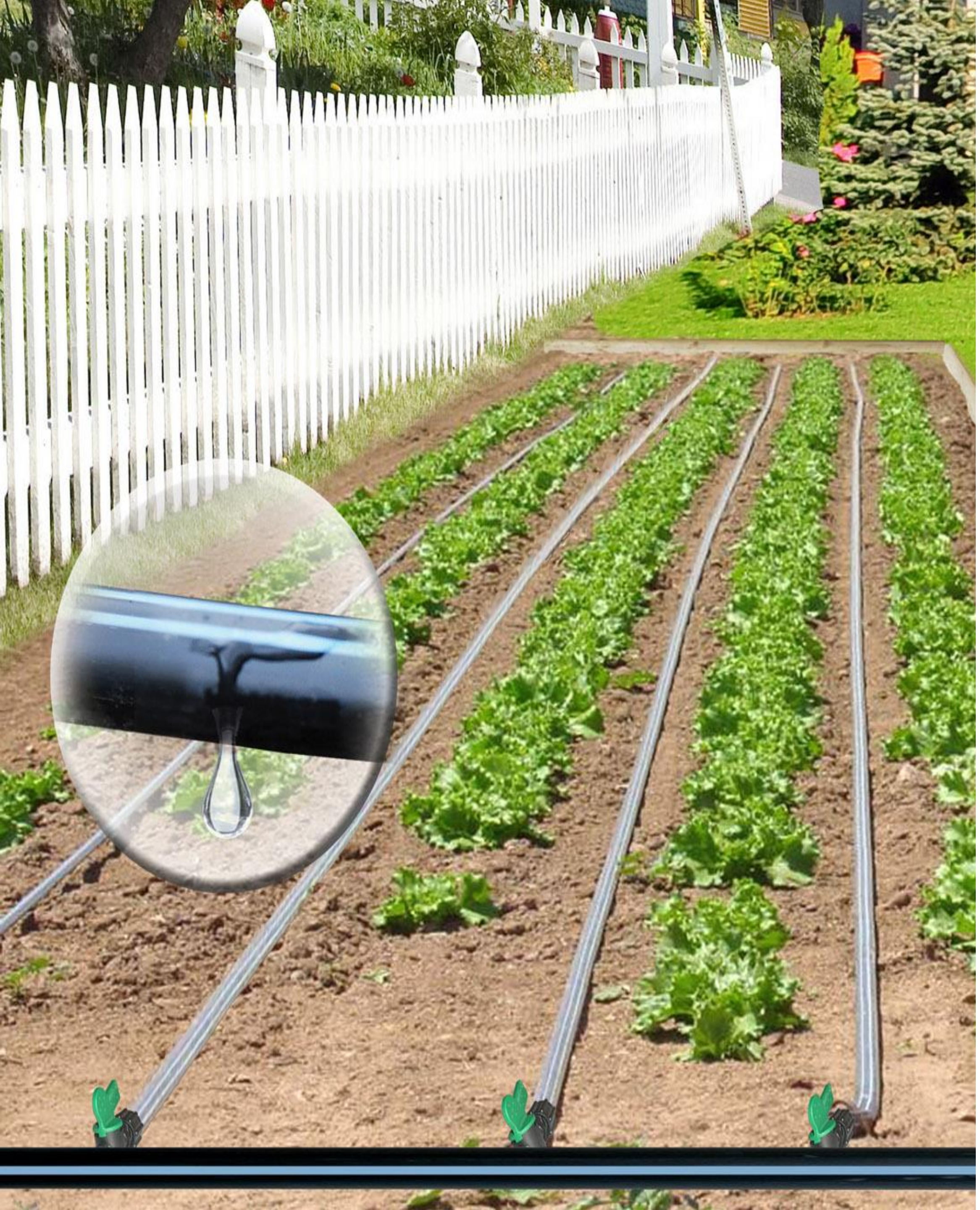
- Soil moisture sensors:
  - SparkFun Soil Moisture Sensor
  - FC-28 soil moisture sensor
  - Grove - Capacitive Soil Moisture Sensor
- Temperature and relative humidity sensors:
  - Adafruit BME280
  - DHT11 and DHT22
- Water flow sensors:
  - YF-S201

Automation system assembly

General system assembly



System architecture includes the water management devices and previously described electronic unit.



Conclusions

Real time feedback control system.

Effective model for modernizing small and large-scale industries

Effective water and resources saving.

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Thank you for your attention!

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