# Training

## Introduction

According to a study by Esalq (Escola Superior de Agricultura “Luiz de Queiroz”), the concept of agriculture 4.0 began to be thought of as a reflection of a modernization project started in Germany in 2011. At that time, the term Industry 4.0 was coined for designate production more linked to technologies such as IoT (internet of things), M2M (machine-to-machine) and others.

With the use of such technologies, different productive sectors began to realize the strength of the 4.0 concept and agriculture embarked on the novelty to solve problems such as productivity, assertiveness, sustainability and connection. Current agriculture is marked by the presence and development of machines with artificial intelligence, tools with 5G connection, decision-making software, sensors and even autonomous robots.

## Evolution in Agriculture

- Agriculture 1.0: This denomination is for the most common agriculture, with low productivity and energy use. It is marked by subsistence and few technological resources.
- Agriculture 2.0: From the 1950s onwards, agriculture became recognized as 2.0, as agricultural science advanced rapidly and several machines began to arrive in the fields.
- Agriculture 3.0: Used to define the sector between the years 1990 and 2010, agriculture 3.0 marks the beginning of automation and data collection as ways to improve productivity and bring more assertive decisions. The period also marks a greater concern with the sustainability of the planet.
- Agriculture 4.0: After the 2010s, agriculture reached its 4.0 stage, marked by a digital revolution and the constant creation of new software and technological tools capable of making agriculture more productive and sustainable.

**Part 1 – My First Automation**

To get started, we'll start with a step-by-step walkthrough of more conventional irrigation automation using solar energy. Of course, the model that we are showing here is something you can do at home, but if you want to move it to production level, some adaptations are necessary.

**Time**: Approximately 15 hours.

**Requirements**: Basic knowledge of soldering.

**Necessary Material**

150 Ice Cream Sticks
Hot glue
2 6v Solar Boards
1 Mini Submerged Water Pump 3v – 6v
1 meter of hose
2 2 liter plastic bottles
3 450 ml plastic bottles
1 Step Down Voltage Regulator LM2596
1 2 pole seesaw wrench
Tow
Lithium battery 3.7V and 950mAh

**Step 1**

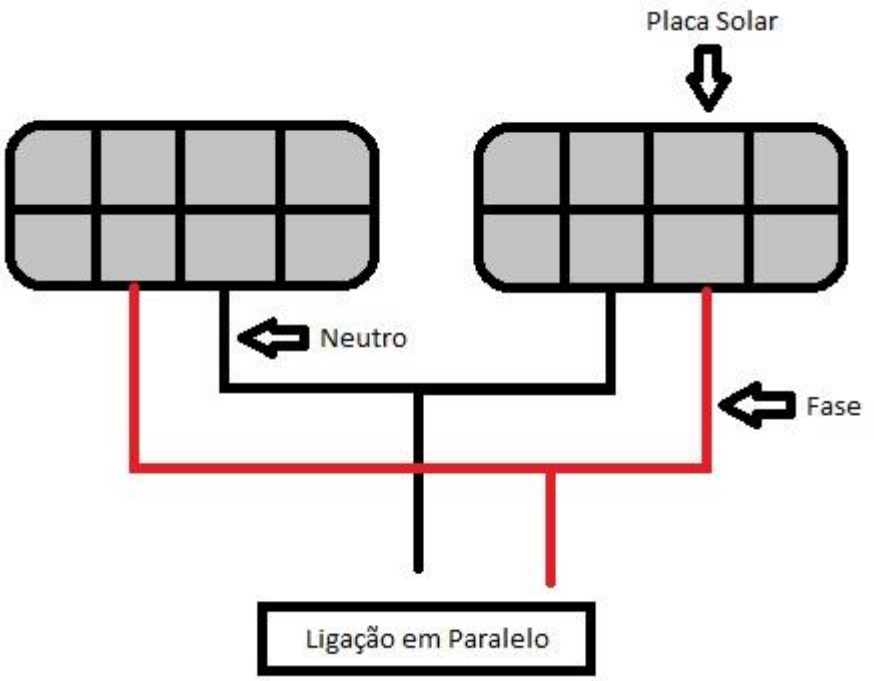
First step is to build our Control Center where all our equipment will be. In the photos above I glued two stick houses glued together without a wall dividing them. You can create your hub however you like. Link example video: https://youtu.be/Y8Wv2PlGz1o

**Step 2**

Now we will start to equip our Control Center.

Glue the two solar panels to the ceiling of the Control Center pulling the wires inside;

Solder the wires so that the two plates are connected in parallel. Note: Although the solar plate specification is marked that it reaches 200 mA, it was not able to reach the necessary current to activate the water pump.




- After connecting in parallel, the two wires will be connected to the 3.7v battery and then to the step down voltage regulator to prevent the voltage from exceeding 6v. Note: Even if the solar panel is 6v, in some tests it reached 6.8v.
- The wire (+) that comes out of the voltage regulator is connected to the 2-pole seesaw switch and then the wire goes to the water pump. The (-) wire comes out of the voltage regulator and goes straight to the water pump.

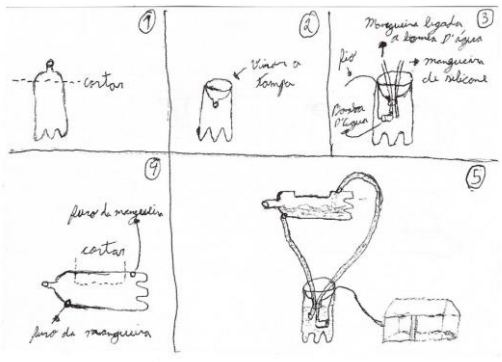
## Step 3

Now take the 450 ml bottles and cut them and pierce them at the bottom as shown in the photos below

- Now put burlap at the bottom of the bottles and then put soil and the seed you want to plant.

## Step 4

Finally, follow the steps in the image below.




**Result**
Video link: https://youtu.be/p3IFxXe8SXk

**Analyzing the Project**
During the tests, this irrigation method achieved its goals by consuming little electricity and water, since in this case the water pump only needs to be on for approximately 30 seconds per day and all the water that was left was returned to the reservoir to be reused. We can also mention that by using battery, irrigation occurred normally, even on cloudy days.

**Part 2 – IoT – Internet of Things**
To update this automation using IoT, it is necessary to change the 2-pole seesaw switch for an Arduino so that it can collect information through the soil moisture sensor and decide when to turn on the water pump. In this training part we will use Tinkercad to prototype this solution. Below we have a solution created in Tinkercad to use IoT in the irrigation system that you should do it and if possible improve it.

For this prototype you will need:

- 1 DC Motor
- 1 Solar Cell
- 1 NPN transistor (BJT)
- 1 Arduino Uno R3
- 1 Soil Moisture Sensor

**Below are some links with more information:**
Getting Started with TinkerCad
How to connect the humidity sensor in Arduino
How to connect a DC Motor or a Water Pump
Template: Proposed prototype ready