

**Objective:**

To build a multi-land robot capable of locating, manipulating and carrying objects in order to later place them at certain point.

**History:**

During XII century, in Mexico there was a very powerful Prehispanic culture: the Mexicas (*Figure 1*). The emperors had several treaties with other minor cultures and these often had to give tributes to the Mexicas.



*Figure 1 – Mexicas*  
[<http://es.wikipedia.org/wiki/Aztecas>]

In those days, the Emperor Moctezuma Ilhuicamina has implemented a very performing delivering-message-system that covers all his Empire. For example, messengers from Veracruz had to go from the jungle, cross the plains in Puebla, climb the Popocatépetl volcano and also cross the Texcoco Lake just to hand to the Emperor Moctezuma the towns' tributes (*Figure 3*).

**Challenge Description:**

To design a robot that solves this challenge in an efficient way and as faster as it can be done.

The robot will go from point A (*Figure 2*) from a zone called Veracruz jungle where there will be the first object at point I.

Then, the robot will have to go to the plains in Puebla, pick up objects II and III in order to climb the Popocatepetl volcano where there will be the IV and last object at the top. The robot will have to be capable of crossing a little pool of 15cm of depth (10cm of water depth) so that it can later step into firm land again to leave the objects at the established area (Moctezuma's House).

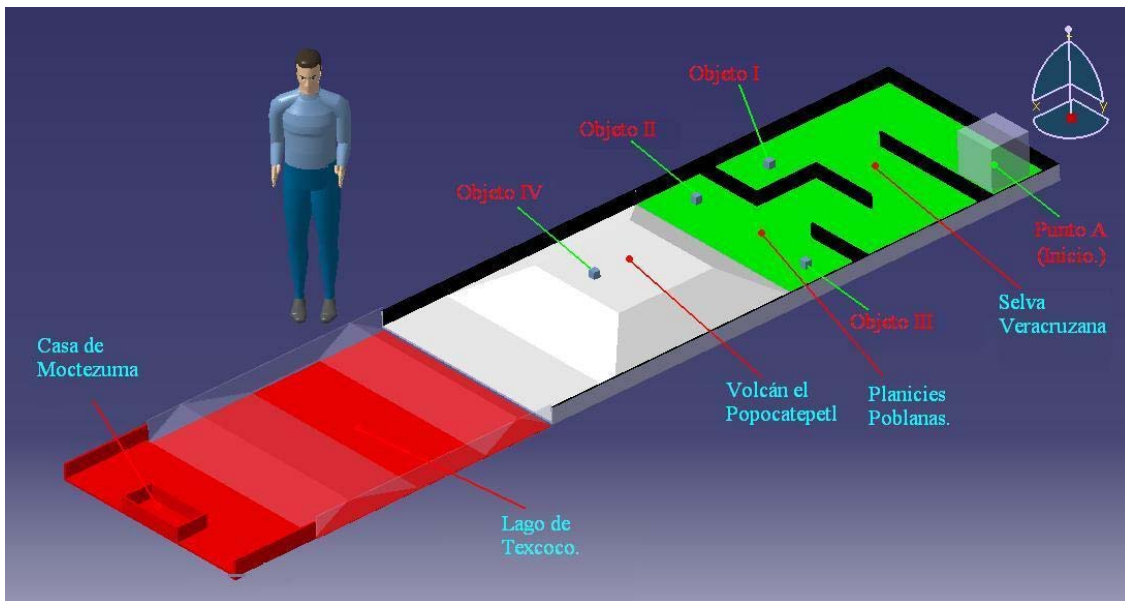


Figure 2 – Arena's Sections.



Figure 3 – Mexica's Empire  
[\[http://es.wikipedia.org/wiki/Aztecas\]](http://es.wikipedia.org/wiki/Aztecas)

## **Stage Description:**

- **General Dimensions:**

- The stage will be 6.5m long to 1.5m wide.
- Material: the stage, except the pool area, will be made of wood with possible discontinuities of even +/- 2mm.
- The pool will be made of acrylic (polymethyl methacrylate, thickness not yet determined) with perhaps 8mm.

- **Veracruz jungle:**

- Measures: 1.5m wide and 1.5m long.
- Color: Light Matte Green.

- **Puebla Plains:**

- Measures: 1.5m wide and 0.5m long.
- Color: Light Matte Green.

- **Popocatépetl Volcano:**

- Measures: 1.5m wide and 1.5m long.
- Inclination: 30°
- Color: White.

- **Texcoco Lake:**

- Measures: 1.5m wide, 2m long and 0.15m deep.
- Water level: 0.10m deep.
- Color: Transparent with red bottom (see *figure 2*)

- **Moctezuma's House (Tenochtitlán):**

- Measures: 1.5m long and 64cm long.
- Color: Matte Red.

## **Robot Specifications:**

### **Top Measures at the beginning of the Challenge:**

Width: 30cm

Length: 30cm

Tall: 30cm

The robot must enter in a wood cube of 30cm before the round takes place.

No manipulating device of any type, such as conveyors, cranes, telescopic or articulated arms may exceed the maximum body size (0.3x0.3x0.3m) before the robot is turned on. However, robots with protractible/retractable parts are allowed if in their contracted state they do not exceed the maximum dimensions.

Sensors: Any type of commercial or custom-made sensors are allowed.

Actuators: Any type of commercial or custom made actuators are allowed.

Processors: Any type of commercial and on board computers are allowed.

Platform: Any type of commercial or custom-made platform is allowed.

Other specifications:

The robots must be fully autonomous. No remotely controlled robots will be accepted.

The robot must work alone. No cooperative swarms will be accepted.

### ***Objects that must be Picked Up:***

There will be four objects that will be placed in a predefined way and its measures will be:

Width: 5cm

Length: 5cm

Tall: 5cm

Average Weight: Between 50g and 100g.

Material: Wood.

Its color will be: Light Matte Blue.

### ***Lighting conditions***

The local organizing committee should provide uniform, indoor, diffuse lighting conditions at least of 500 LUX. Nevertheless, teams must come prepared to calibrate their robots based on the lighting conditions at the venue. Every effort will be made to keep ambient shadows, incandescent lamps and natural lighting as low as possible. However this may not be totally eliminated. Therefore it is highly recommended that teams design their robots to cope with variations in lighting and magnetic conditions, as these vary from venue to venue. Once competitions have begun, teams will play under existing lighting conditions without further discussions or requests.

## Grading Criteria:

- The winning robot will be the one that gains more points (**First Criterion**) at the least possible time (**Second Criterion**).
- The maximum time to complete the challenge will be of 10 minutes.
- The robot will have permission of 2 restarts.
- The restarts are allowed only if the robot is in Veracruz, Puebla or Popocatépetl Area. If the robot is in the Texcoco Lake it is not allowed restart the challenge.

## Punctuation:

- Object I gathered: +1 point.
- Object II gathered: +2 points.
- Object III gathered: +3 points.
- Object IV gathered: +4 points.
- For every object delivered: +5 points.
- Penalization for every restart: -1 point.

**DEFINITION:** A gathered object is the one that the robot was capable of carrying until the next stage.

- *Example:* Object I is carried until the beginning of the plains.

## Arena Specifications:

- **Veracruz and Puebla Areas:**

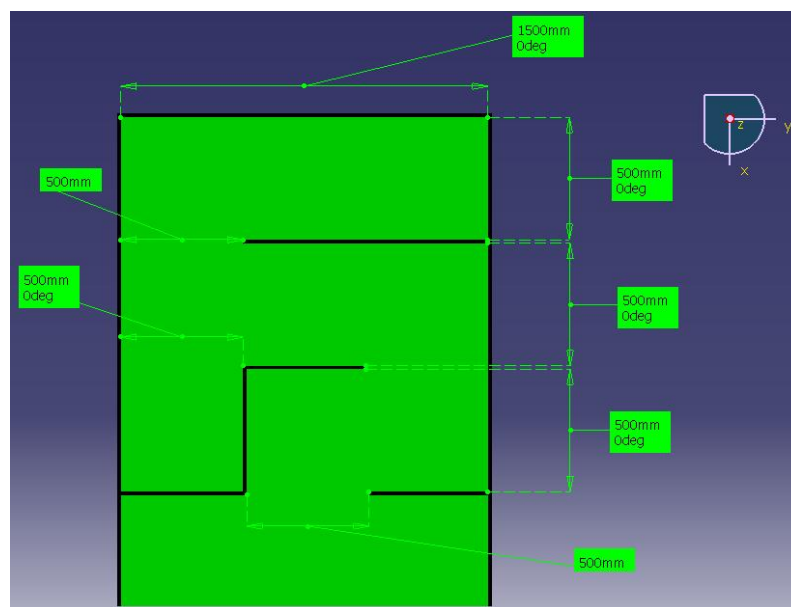


Figure 4 – Veracruz and Puebla Areas (Top View).

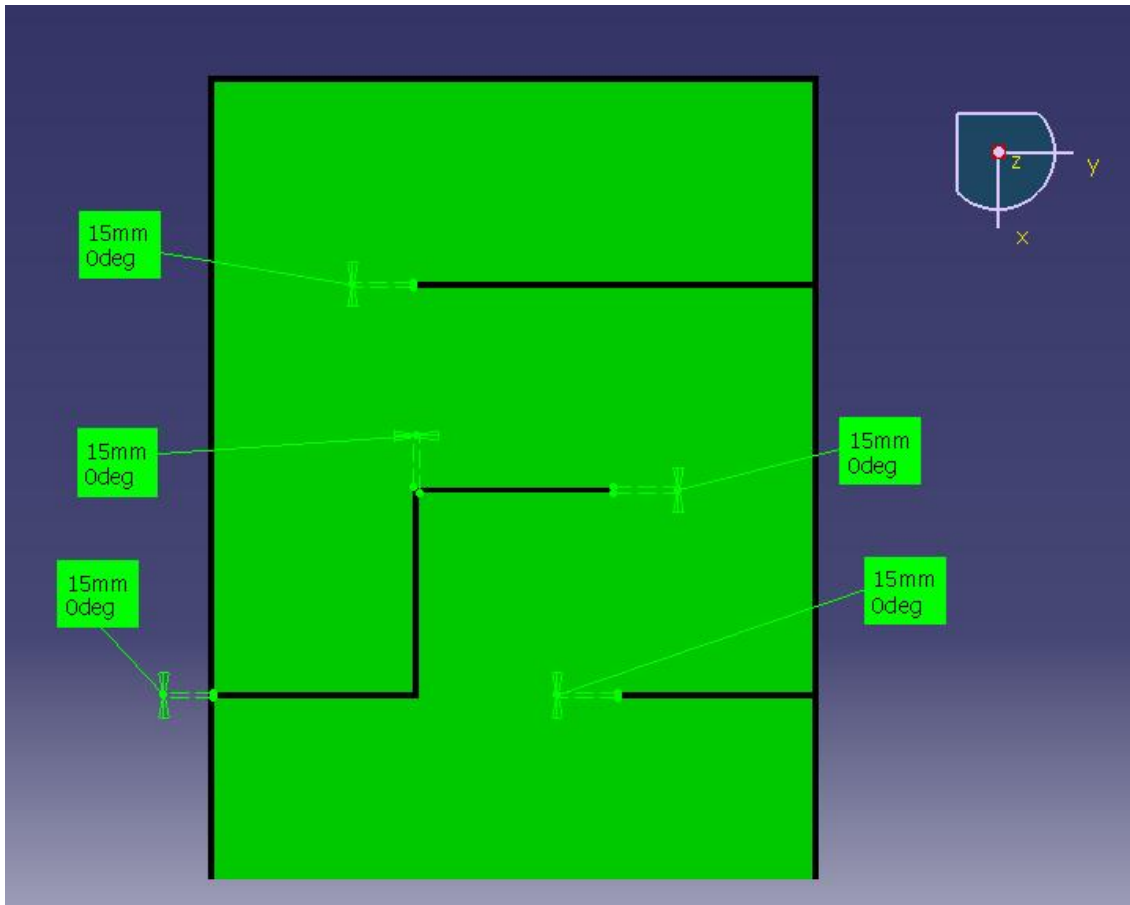


Figure 5 – Veracruz and Puebla Areas (Top View).

○ **Popocatépetl Volcano:**

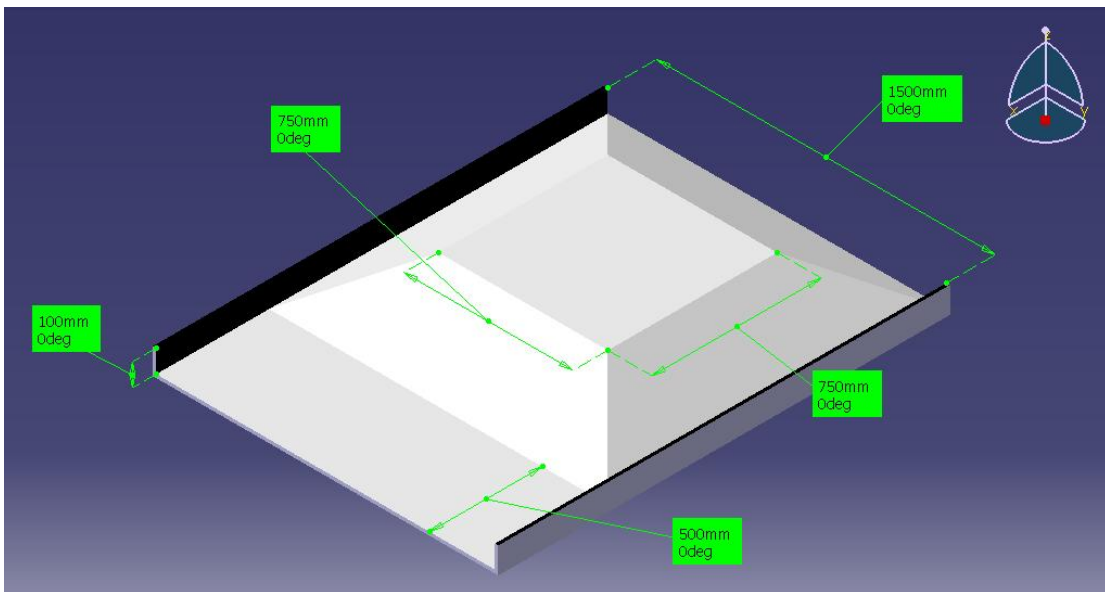


Figure 6 – Popocatépetl Volcano (Top View).





Figure 7 – Popocatepetl Volcano (Lateral View).

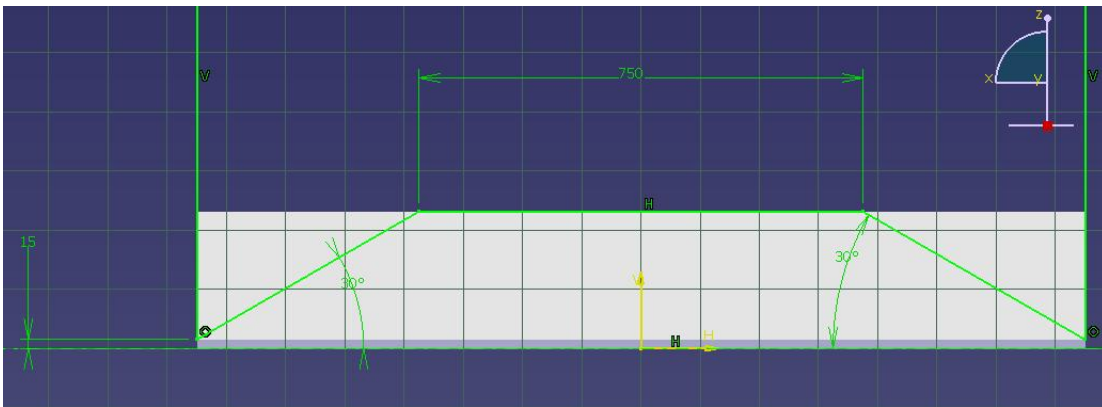


Figure 8 – Popocatepetl Volcano (Lateral View).

○ **Lake: (Without the red floor)**

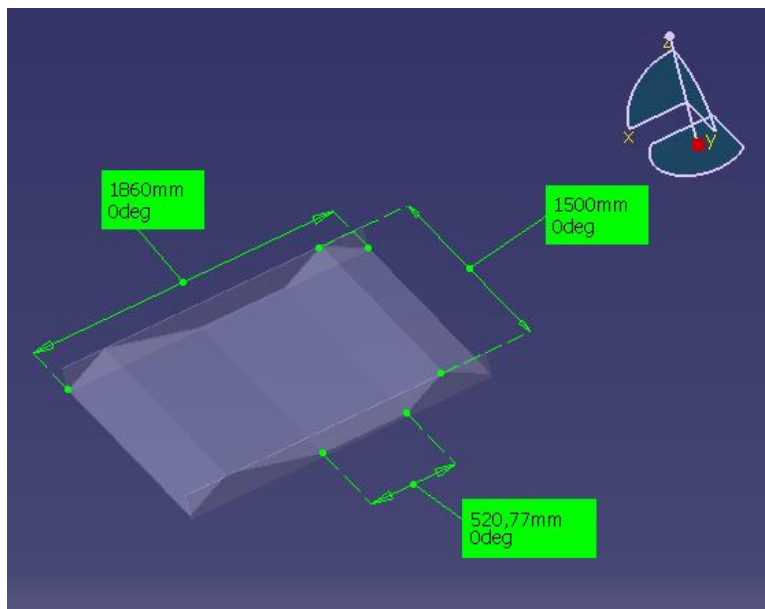


Figure 9 – Texcoco Lake (Top View).

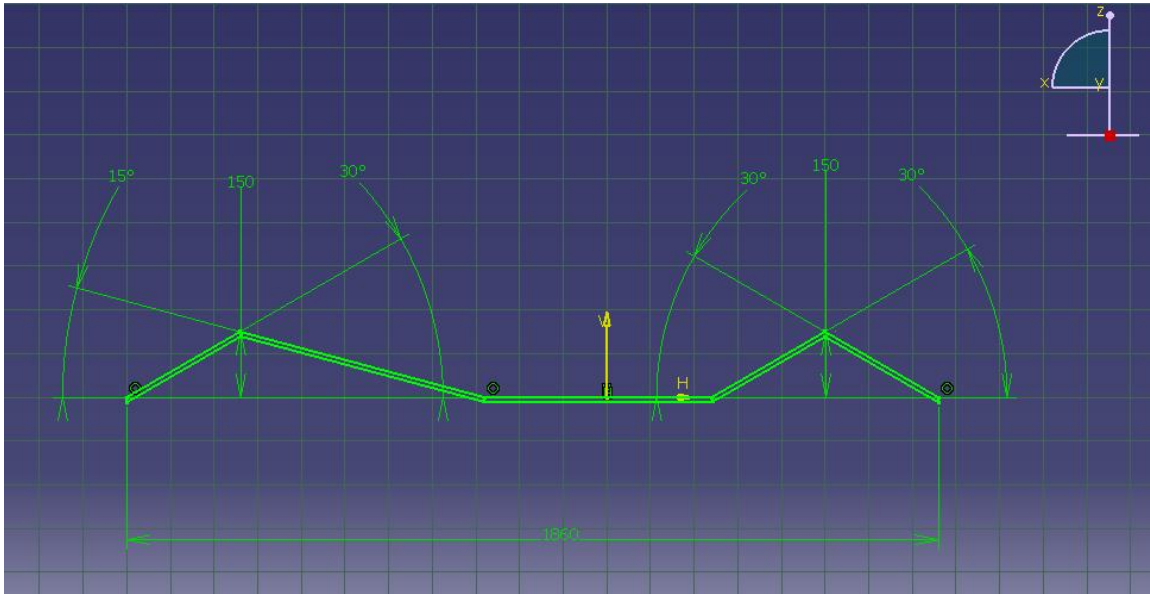


Figure 10 – Texcoco Lake (Lateral View).

○ **Moctezuma's House:**

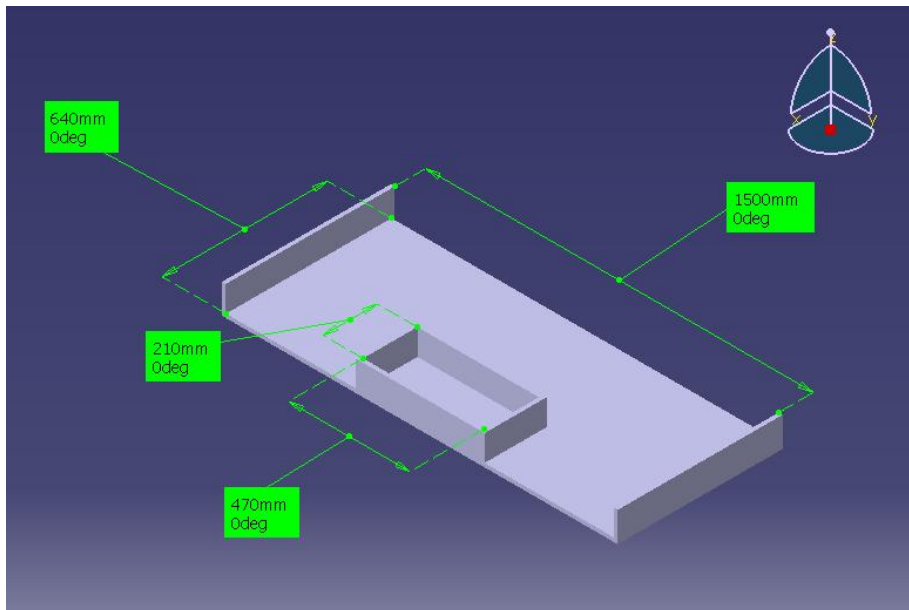


Figure 11 – Moctezuma's House (Top View).